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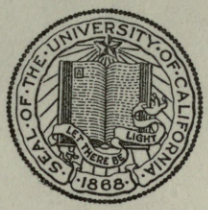

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PROF. CHARLES A. KOFOID AND
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THE

BRITISH CYCLOPÆDIA

OF

NATURAL HISTORY:

COMBINING

A SCIENTIFIC CLASSIFICATION OF ANIMALS, PLANTS, AND MINERALS;

WITH

A POPULAR VIEW OF THEIR HABITS, ECONOMY, AND STRUCTURE.

THE VARIOUS ARTICLES ARE WRITTEN EXPRESSLY FOR THIS WORK

BY AUTHORS EMINENT IN THEIR PARTICULAR DEPARTMENT.

THE WHOLE ARRANGED AND EDITED

BY CHARLES F. PARTINGTON,

PROFESSOR OF MECHANICAL PHILOSOPHY, AUTHOR OF VARIOUS WORKS ON NATURAL AND EXPERIMENTAL PHILOSOPHY, &c. &c.

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JACARANDA (Jussieu). A genus of tropical trees belonging to the natural order *Bignoniaceæ*. Generic character: calyx bell-shaped, five-toothed; corolla funnel-shaped, limb five-cleft spreading; stamens, anthers two-celled; rudiments of five filaments; style with a two-plated stigma; capsule roundish, compressed, woody, and two-celled; seeds in a double series, with membranous wings. This plant flowers freely in our stoves, potted in any kind of light soil; and it should be kept very dry in winter to cause it to flower more readily. Young plants may be raised from cuttings. The full sized tree forms a beautiful kind of rose-wood. The jacaranda of commerce is said to be the timber of a Brazilian mimosa.

JACQUINIA (Linnæus). A genus of tropical trees and shrubs belonging to the fifth class of Linnæus, and to the natural order *Myrsineæ*. Generic character: calyx five-cleft, persisting; corolla somewhat bell-shaped, limb ten-lobed, in two series, the lobes of the inner one smallest; stamens fixed in the base of the corolla; anthers behind; style short, bearing an obtuse stigma; berry globular and five-seeded; albumen fleshy. The jacquinias are beautiful plants, and thrive in loam mixed with moor-earth. They may be increased by cuttings, but require much care.

JALAP is a medicinal juice extracted from the *Ipomœa jalapa*, a South American plant nearly allied to *Convolvulus*. The *Mirabilis jalapa*, a species of the marvel of Peru, is also known by this name.

JAMBOSA (Decandolle). A genus of fruit trees natives of India, formerly called *Eugenia jambos*, and belonging to the beautiful order *Myrtaceæ*. This plant, with many of its near alliances, have long been cultivated in our stoves, and grow readily in good loam and moor-earth. They are readily propagated by cuttings in moist heat, or placed under a small bell-glass.

JANIPHA (Kunth). A genus of useful shrubs natives of South America, belonging to the natural order *Euphorbiaceæ*. It has been separated from the genus *Jatropha* of Linnæus.

JASMINEÆ. A small natural order containing only two genera, of which there are already described forty-two species. They are elegant and generally fragrant shrubs. From their flowers, some of the most delicious perfumes are extracted, such as the essential oil of jasmin which is distilled from the flowers of *J. grandiflorum*, *officionale*, and *odoratissimum*, as well as from the *Jasminum*, or, as it is now called, *Mogorium sambac*, which is the *Ysmyn* of the Arabs, whence our common European name. The flowers of *M. undulatum* and *trifoliatum* are also sweet scented; and their leaves, which have a bitter taste, have been recommended as slightly stomachic, and agreeable cephalic medicines. The powdered root of *J. angustifolium* is extremely bitter, and it is said by Ainslie to be an effectual application to ringworms. *Nyctanthes arbor tristis* has likewise a very fragrant blossom, and to its expanding only towards night, and diffusing its odours chiefly during the dark, its generic and specific names allude.

Of the jasmine there are above thirty species; and of the *Officinale* there are several varieties, two of them with variegated leaves. These variegated ones present a curious physiological circumstance, which is, if a common green one be budded with a variegated sort, not only will the future head rising from the bud be variegated, but the suckers also which rise from the root.

JASPER. There are five varieties of this mineral commonly found in the cabinets of collectors. Egyptian jasper, striped jasper, porcelain jasper, common jasper, and agate jasper. The first kind is found in several parts of Africa, and whatever may have been its original formation, it is now frequently discovered in detached masses embedded in sand.

There are some fine specimens of the second kind in the Pentland Hills, near Edinburgh, and also in Germany, which is also the case with the remaining varieties; but the last is more generally found in the agates of the Lothians.

The jaspers vary considerably in their colour, and also in their value, as the latter depends very much on the beauty of their tints. The red Egyptian jasper frequently passes into flint, from which, however, it may be distinguished by its opacity and inferior degree of hardness. Some of the largest and most beautiful snuff-boxes are formed of this mineral; so that it is common in Egypt for the political expectants of the Pacha to calculate the value of an appointment by the size of the jasper box, which are its first fruits. There are some very fine specimens of jasper in the mineralogical gallery of the British Museum.

JATROPHA (Linnæus). Tropical shrubs, commonly called the physic-nut tree in the West Indies. The genus belongs to *Euphorbiaceæ*, and some of the species now called *Janipha* are important both as medicine and food. The physic-nuts are the seeds of the *J. curcas*, but those of *multifida* are cathartic likewise. One species, *J. manihot*, affords the celebrated manioc of the negroes; known, however, better by the name of cassava in the West Indies, and tapioca of Brazil.

This very mild, innoxious, and nutritious food, is remarkable for being the produce of the root of the *Manihot*, which, when in its fresh state, is highly poisonous; the juice with which it abounds would form a deadly draught, and is even used by the savages to envenom their spears and darts. The deleterious principle is very volatile, passing off from the roots after they have been kept for thirty-six hours, and is immediately dissipated by heat. Two ounces of cassava will suffice for a meal, and a pound will support a man for twenty-four hours.

JERUSALEM ARTICHOKE is the *Helianthus tuberosus* of Linnæus, a well known culinary plant. They are cultivated in the manner of potatoes, but usually in some out of the way part of the garden, as they grow tall, and when once planted are difficult to eradicate.

JIGGER. See CHIGOE.

JONQUIL is the *Narcissus jonquilla* of Linnæus, one of the sweetest and most elegant of its family.

JUGLANDEÆ. A small natural order of trees comprising only two genera, viz., *Juglans* and *Carya*—the walnut and the hickory nut. Their flowers are monœcious; those bearing stamens are collected into aments or catkins, and the pistilline flowers are single, or in twos or threes together on short footstalks. The fruit is drupaceous, globular, or sub-ovate. The embryo is large, with two wrinkled, oily, and fleshy cotyledons, the radicle short and superior, and the plumula with two pennate leaves.

The *Juglandeæ* are much esteemed both for their timber and fruit. Before the introduction of mahogany and other modern fancy woods, the walnut was much prized and greatly employed in the construction of ornamental furniture; its chief use now is for gun-stocks, and during the late war fetched a high price.

The fleshy cotyledons of the nuts abound in oil, which is in some places expressed. It is one of the oils which do not congeal by cold, and which, drying on exposure to the air, are valuable in the art of painting. It is also used instead of olive and almond oils in cookery. The *mark* or *nut-bread*, as it is called, which is left after the expressure of the oil, is very nutritious, and is used to fatten poultry and other domestic animals.

An opinion has long prevailed that the exhalations of the common walnut-tree are deleterious, producing stupor, &c., in those who sit under its shade. These accounts are, doubtless, exaggerated; but it is well known that the strong odour of the leaves produces headach in many persons.

The different species of hickory yield nuts less grateful than the true walnuts, but still wholesome and nutritious. The best are those of the *Carya olivæformis* and *sulcata;* the first named is the Pekea nut, and its flavour is delicious. The bark of *C. alba* is acrid, and used as a caustic; its wood is of a light colour, and valuable for its elasticity and toughness.

JULUS (Linnæus). A genus of apterous insects belonging to the order *Chilognatha* of MacLeay, and to the class *Myriapoda* of Latreille. The body is very long and cylindric, and the insects, when disturbed, roll themselves into a spiral coil. For further details relative to these insects, see the article CHILOGNATHA; and for an account of the imperfect species of metamorphoses which they undergo, see the article INSECT, where the common English species, *Julus terrestris*, is figured at three periods of its existence.

JUNCAGINEÆ. A small natural order of insignificant bog plants containing only two genera; viz. *Scheuchzeria* and *Triglochin*. These plants are not floaters, but grow more like rushes; their exalbuminous seeds, however, easily distinguish them from the *Junceæ*. They are all innoxious, but none of them have been applied to any useful purpose; they contain very little nutritious matter, and form poor fodder, which but few animals will eat.

JUNCEÆ. A small natural order comprising some of the lowest grades of vascular plants. They are generally herbaceous, rarely suffruticose; the underground stems or rhizomata are scaly, with long subterranean divisions. Hence they are often planted to strengthen sea and river walls, and various embankments. In Holland the *Juncus acutus* and *J. maritimus* vie with the mat-grasses and sand-sedges in protecting the low lands from the encroachments of the sea, by the strength their long interlacing roots give to the soil. The *Juncinæ* are none of them poisonous plants, but they are now applied to few domestic purposes, save the making mats, chair-bottoms, and brooms; their chief occupation being gone, since the advance of luxury has spread the apartments of our citizens with carpets, although, as late as the time of the last Henry, the king's chamber was only strewed with rushes, and one of the charges against cardinal Wolsey for extravagance was having his room restrewed so often as once a week.

JUNIPERUS (Linnæus). A genus of hardy trees and shrubs, chiefly natives of the northern parts of the world. The flowers are diœcious, and the genus belongs to the extensive order *Coniferæ*. The *J. excelsa* is a timber tree in Siberia; and so are those indigenous to Bermuda, Barbadoes, and Virginia. Many are only low bushes, as the common British one which covers large tracts of waste ground. The wood of the juniper is hard and durable, and its bark may be twisted into cables; but the chief use of the plant is to flavour ardent spirits. Hollands owe their taste to the berries of the juniper, and English gin is commonly believed to be flavoured with them also; but it is generally unconscious of their presence, the British manufacturers of that "cordial" poison being mostly content with the substitution of oil of turpentine! Juniper berries are stimulating and diuretic, their properties depending on an essential oil which they contain. From six to eight hundred tons are annually imported into this country, but the oppressive duty to which they are subject, full 100 per cent., limits their consumption.

JUSSIEUA (Linnæus). A genus of water-plants, mostly biennials, belonging to the natural order *Onagrariæ*. Generic order: calyx tubular, somewhat three-sided, the limb of four persisting divisions; petals inserted into the calyx, and spreading, commonly four, though sometimes five or six; stamens eight, nine, or ten filaments inserted into the calyx short, anthers oval and erect; style cylindrical; stigma peltate; seed-vessel four-celled, four-valved, and many seeded; seeds naked, smooth, and minute. Some of the species are kept in our aquariums, and propagated by seeds.

KÆMPFERIA (Linnæus). A genus of East Indian herbs, having thick tuberous roots. The plants belong to the first class of Linnæus, and to the order *Scitamineæ*. The *K. galanga* is cultivated in India for its roots, which are used as an ingredient in curric,

but chiefly as a dye-stuff. They are managed in the stove by growing them in light sandy loam, sparingly watered when dormant, but plentifully when in growth: and are propagated by division.

KALMIA (Linnæus). A genus of beautiful North American plants belonging to the tenth class of sexual botany, and to the natural order *Rhodoraceæ*. The handsome figure of the shrub, the beauty of its foliage, and the exquisite form and delicate tints of the flowers, introduces these shrubs among the choicest ornaments of the flower garden. They are always grown in moor earth along with rhododendrons and the like, and as they ripen seeds plentifully, they are easily propagated.

KANGUROO (*Kangurus*). A genus of marsupial mammalia, peculiar to Australia; and in some respects one of the most extraordinary productions of the animal kingdom. They are so, from the fact of being the largest animals having a double gestation, the first uterine or internal, and performed through the medium of a placenta, and the second marsupial, or carried on in a pouch or appendage to the abdomen of the female, without the intervention of any thing like a regular placenta, unless it is considered that the teat to which the young is for some time attached, though it afterwards can attach and detach itself at pleasure, and even quit the pouch in order to browse the grass, may perhaps be considered as performing a similar office to that of a placenta, at least for some part of the period during which the young one inhabits the pouch. That there is a closer connexion between the teat of the marsupial animal and the young one which is to be nursed upon that teat, than there is between the teats of ordinary mammalia and the young which they nourish, is a point which must be admitted; for the individual teat which nurses the young one is a temporary part; and so perhaps, at least in many of the species, is the glandular apparatus, by which the nourishment of the young one is secreted. This point is indeed an obscure one; for up to a period comparatively very recent, we know little or nothing of the curious physiology of marsupial animals; and there was a strong, perhaps a too strong, disposition to consider the whole gestation of the animals as uterine, and the abdominal pouch as little else than a simple sack in which the young were carried about. Now, that the young are, in many of the species, carried in the pouch is perfectly true; but it is equally true, that the pouch performs other and far more important functions in their economy; and as there is perhaps no species in which the pouch, with all its apparatus, is more perfect than in the kanguroo, and as that animal, from its size and habits, and its ability to bear the climate of Europe, is the best subject by the observation of which to work out the general truths, it is desirable that as much attention should be paid to it as possible.

We know from actual observation, conducted at the London Zoological Gardens, under circumstances the most favourable and by parties the most competent, what portion of the whole time of development of the fœtus, from the pairing to the time that it is able to shift for itself, is uterine, and what part is marsupial. We know also that, preparatory to the lodgment of the embryo (for it is still very rudimental or unformed), and also for some time after it has been lodged there, there is an action of the marsupium, which, though we cannot say that it is similar to the action of a conceiving uterus, yet bears no inconsiderable resemblance to it in many respects; and one of the most remarkable of these is the production of the teat to which the young one is to adhere.

What may be the purpose in the economy of those animals which is answered by this very extraordinary kind of gestation, we are not in a condition for determining; for all our speculations respecting the adaptation of the structure and physiology of animals to their habits and nature, and the part which they are to perform, and the purpose which they are to answer by them, have been so framed, and are still so worked out, exclusively from the examples of the placental mammalia, that they fail us whenever we attempt to give a reason for the very different formation and functions of these most extraordinary creatures.

The kanguroos are interesting in another point of view, besides this singular mode of production, which they possess, in great part at least, in common with all the marsupial animals. They are the only animals, of any considerable size, in Australia, which bear the least analogy to the ruminantia, or grazing animals of other parts of the world; and though this analogy is an exceedingly loose one, inasmuch as it applies only to the kind of food, but not to the furnishing of the mouth, by which that food is taken, or to the stomach, in which it is digested. If in these respects we consider the kanguroos, the common mammalia to which they have the nearest relation are the rodentia, or gnawing animals; and in the case of them, the analogy is also very partial, so much so indeed, that, in order to express it correctly, we ought to take it upon the negative statement, and say that the kanguroos are less unlike the rodentia than most of the other mammalia; but this is a species of saying which is calculated to convey very little information; and in the present state of our knowledge we must be contented with little more than a simple description of these animals, leaving their relations to the rest of the animal creation, and to the physical circumstances of that portion of the globe in which alone they are to be found, to be more fully illustrated when further observation shall have furnished the means.

The name kanguroo is that given to the animal by at least some of the many hordes or packs of savage inhabitants which were found in Australia at the time when it was first visited by Europeans; and probably the retaining of this name, both as the common English and the scientific one, is the wisest plan which can be adopted. That disposition to call names, by which systematic naturalists are often too much beset, has led to the application of one or two to the animals of this genus. The late Dr. Shaw, who was very laborious in compilations respecting the natural history of animals, though perhaps far from the most philosophic and discriminating that ever undertook such a task, applied the name *Macropus*, or large foot, and that name is accordingly to be met with in many of the books. Others have given different names descriptive of various parts of the structure or action of the animal; but there is none of them that reaches the real character; so that there does not appear to be any necessity for changing the native name, which, if it has no other advantage, at least possesses this one—that it does not mix up the subject for which it stands with any other genus of animals.

Altogether the kanguroos are animals of singular

appearance; and when one contrasts the anterior and the posterior parts of the body, it seems singular that they should belong to the same animal, the former are so slight and slender as compared with the latter. We have, no doubt, approaches to this in some other animals, and it is worthy of remark that those approaches are found in the rodentia, such as the hare and the jerboa; and we have mentioned that the rodentia are the least different from kanguroos of all the common mammalia. When we have stated this, however, our parallel is at an end, and we must content ourselves with noticing kanguroos as a separate genus, which cannot be explained, or the peculiarities of its structure accounted for, upon any principle of connexion.

In brief, the generic characters may be stated as follows: six incisive teeth in the upper jaw, and two in the under; five cheek teeth in each side of both jaws, but no canines in either. The head long and slender; the ears of large size and pointed; and the eyes also large. The fore legs very short, furnished with five toes on each, and armed with large claws. The hind legs very long and strong, both in their bones and their muscles; the hind feet furnished with four toes upon each; but the two inner ones are very small, and united together, so as to have the appearance of only one; the outer toe of moderate size; but the middle one very large, and armed with a claw, or, more strictly speaking, a hoof of great size, firmness, and strength. The tail very strong, often very long, and capable of much and rapid motion, but not prehensile, though the animals can make use of it as a sort of third foot in their progressive motions, and especially when standing nearly upright.

There is something very remarkable in the hind foot of the kanguroo, as differing from that of every other known species of animal, whether marsupial or not. It no doubt preserves the general structure of toes much developed and divided, and furnished with pointed claws, which render the feet of most, if not all, marsupial animals a very characteristic feature; so that one who has been in the habit of paying even a moderate degree of attention to the connexion between the developments of certain parts of animals and their general physiology, would have no hesitation in deciding whether an animal were or were not marsupial by carefully inspecting its foot; for there is something slightly approaching to the foot of a bird, in at least the greater part of them. The most remarkable structural feature of the kanguroo's hind foot is the peculiar way in which the toes are developed. The external toe is not very long, but it is thick in proportion to its length; and the claw, though not very large, is firm and powerful. The two internal toes, which, as we have said, are united, form together a sort of balance to this external one. The middle one is, however, the most remarkable portion of the foot; for the bones of it extend beyond the others in a manner unknown in any other animal; they are thick and strong in proportion to their great length; and they are terminated by perhaps the most formidable claw, taken singly and without reference to the other parts, which is to be met with among the whole of the mammalia. This claw is not a nail, placed on the upper end of the member, for the mere purpose of strengthening that as a grasping instrument; it is not crooked, like the clutching claws of those carnivorous animals which use the feet in seizing their prey; it is not in any way adapted for climbing, or for burrowing in the ground; neither is it brought habitually into action in the locomotion of the animal. Still it is one of the most powerful appendages to an animal which we meet with, and therefore analogy leads us to conclude that it has a function to perform as important as itself is powerful.

From its combining the properties of a claw and a hoof, we may suppose that this armature of the middle toe of the kanguroo performs in part the functions of both—that is, it is both an instrument of walking, and one of hostile operations; but in the latter respect it is a defensive weapon rather than an offensive one. Still, however, as it is a general habit with very many of the grazing animals to make what may be called an active defence—that is, to anticipate the attack of a supposed enemy by making a counter attack—the kanguroo is sometimes apt to use this powerful weapon in cases where no injury is done to it, or even intended. The protecting instincts of these animals, which feed exclusively upon vegetable matter, are often very singular and apparently inexplicable; and when an enemy appears, they very frequently attack that enemy, though it has shown no disposition to attack them. This is an instinct, too, which, in a very remarkable manner, improves by being exercised, or perhaps we may say cultivated; for nothing is more common than to find an animal belonging to a species naturally mild and even timid, becoming bold in its attack both upon other animals and upon human beings, in proportion as these attacks are more frequently and more successfully repeated. This, of which the natural course is very easily seen, is what we are accustomed to call a vicious disposition in an animal. There is, however, no vice in a moral point of view in this, any more than there is moral virtue in its opposite; for it is merely the instinct of the animal excited and kept alive by exercise; and it does not differ in principle from the analogous instinct by which all animals find their proper pasture and their proper food, or by which wild ones return to their lairs or forms, or tame ones to their stalls and other habitations.

The usual mode of using the claw as a weapon, is striking out with the foot, in the same manner as other kicking animals use their hoofs; and from the great length of the leg, and the powerful muscles of the hinder part of the animal, the blow which it gives is rapid and very powerful; so that when the Australians course kanguroos with dogs, they require to train those dogs in the same manner as they are trained for coursing the emu, which also strikes out against its pursuer with great force and effect. The dog is trained to run, not on the direct line of the game, but a little to one side; and he continues until he can go in upon the fore part of the animal, in which part it is comparatively weak and defenceless. If, however, the enemy, or that which the instinct points out as being an enemy, appear suddenly in front, or in a situation where there is no means of escape by flight, the kanguroo does not tamely abandon itself to its fate. It adopts a new system of tactics, and this system is even more dangerous than the other, unless against an animal of considerable strength and weight. The kanguroo stands something like a tripod, upon the entire length of the very long soles of the hind feet and the point of the tail; which latter organ, from its stiffness and power of muscles, is scarcely less efficient than the other two. Thus posted on its tripod, and having some-

thing of the stability of a pyramid from the thickness of the hind parts and the slenderness of the fore, the kangaroo is really more stable and difficult to be thrown down than an ordinary animal of greater size and weight, when that animal rears on its hind legs. The bear, and such other plantigrade animals as have the habit of rearing their anterior part while they rest with the tarsi of both hind feet upon the ground, partake in great part of this stability; but as none of them have equal strength or efficiency in the tail, none of them are so stable as the kanguroo. It has often been remarked, however, how very firmly a bear can stand, and how large a weight it can carry clasped in its fore paws, when it is in an erect position; and it will readily be understood that the kangaroo will derive the full benefit of its superior conformation in this respect.

And it is worthy of remark, that though the kangaroo has none of the carnivorous propensity of the bear, its action at close quarters is not very dissimilar. Its fore feet are very short and feeble as compared with the hind ones; but they are so free in their articulations, that the fore arm can perform almost a complete rotation. They are furnished with five toes of unequal length, and each one provided with a strong and sharp claw, so that the animal can use them very effectively both in striking short blows at close quarters, and in hugging. In performing this last operation, the toe of the hind foot is sometimes brought into use, and used in ripping open the abdomen of of the animal hugged; and as the great length of the hind foot, and the mobility of the tail, can give a firm base, though one hind foot is off the ground, this lacerating operation can be performed very certainly and very rapidly, and both the half savage dogs of the natives, and the better trained ones of the European settlers, are apt to be killed by kanguroos in this way.

These animals have still another mode of defensive warfare. When pursued, they betake themselves to the water, where they stand upon their tripod with only the body as far as the fore legs raised above the surface. In this situation they can very readily turn round as if on a pivot, and this facility of turning, together with their large and prominent eyes, enables them to command the horizon on every side, so as to front any danger that may present itself. If the enemy takes to the water and attempts to go in, the ready paws of the kanguroo seize it by the head; and, from the advantage of the structure and position, the animal is able to keep a large dog under water till he is drowned.

In the ordinary locomotion of the kanguroo, when undisturbed by danger, it leaps about rather than walks, generally using the tail to assist in the leaping. This leaping in its tranquil and unalarmed state is performed upon the entire soles of the hind feet; and the fore feet are not brought to the ground, except when the animal feeds upon grass, which it cannot do constantly, as there is little or no grass at any time in some of its haunts, and all of them are subject to have the grass burned up at some seasons of the year. On these occasions the fore feet are not brought to the ground at all, but employed like hands in bringing toward the mouth the branches of those shrubs and bushes upon which the animal feeds, when subsistence upon the ground fails it. Where, however, a more expeditious rate of locomotion is necessary, either for the safety or the pleasure of the animal, it can proceed by immense leaps, in the taking of which it delivers its body from the points of the great claws of the middle hind toes; and as these are very strong, stiff, and sharp pointed, it gets so powerful a hold on any surface, however hard, that it can leap to a great distance, and recover itself and leap again with so much agility, that its march bears some resemblance to a rapid succession of short flights.

Altogether it is a most singular animal, both in the style of its action and in the instruments by means of which that action is performed. The region which alone it inhabits is, perhaps, in its physical character the most singular on the face of the earth, for the uncertainty of its climate and the singularity of its vegetation. For long periods of time, the atmosphere is without a cloud, and does not let fall a single drop of rain, so that the streams become dry, the larger rivers are in many places evaporated to a few pools in which the fish are huddled together, and a great breadth of the surface is plantless and covered with a saline efflorescence. From the extreme of this state of things, and without any other warning than that dismal murkiness which is the harbinger of great atmospheric changes in such places, the winds are let loose in tornadoes, and the rain descends as though the clouds had been pitchers shivered to pieces by the burning of the lightning, the bellowing of the thunder, and the fitful fury of the gusty storm. The winds themselves in such countries assume much of the majesty of thunder, for they sound upon the mountains as if the heavens were sown with hammers, and wrench and twist the trees, till even those species of eucalyptus, which are as hard as iron and as heavy as stone, are torn to shreds by internal shakes and fissures in their stems.

Amid this direful conflict of the elements, the earth upon every summit and every slope gives way; and mingling with the "torrent flood," it descends into the levels, or more generally floats onward in the swollen river to where that river meets the sea. At such times, the majesty of the main is in motion, as well as that of the atmosphere; and the yeasting surge flings back toward the shore those spoils of the land which would stain the beryl tint of its own waters. But the red-rolling flood of the swollen river presses onward on the other side, and the contending waters work the earthy deposit into a bulwark near the shore, behind which a certain quantity of the land flood is imprisoned; and this speedily converts the accumulated mud into a nursery for mangroves and other trees and plants which grow in the water; and thus at every violent storm there is formed near each outlet of the water a portion of new land totally unfit for the subsistence of ordinary land animals. In places a little more inland, the older surface of the earth is covered by a new stratum of stones, earth, and vegetable and animal remains, miscellaneously blended together, and often to the depth of several feet. Along with the remains of dead vegetables, there is a very considerable admixture of the seeds of living vegetation; and as those seeds are brought from grounds of different elevation and physical character from that on which the seeds are deposited, the same effect is produced as cultivation brings about when the seeds and germs of plants are conveyed to a more genial climate, and more abundantly watered soil, a vegetation entirely new springs up, and attains a most luxuriant growth in the course of a very short time.

While those violent changes and contests between the sea and the land flood are going on in the vicinity of the shores, there are other circumstances of a different character, but equally calculated for producing changes in the condition of the country, taking place in the interior. Though there are hills of considerable height in the island of New Holland, no mountains have hitherto been discovered, bearing any such proportion to the breadth of the country, as are to be met with in most other parts of the world. So far as it has been explored, the principal elevations are at no great distance from the shores; and thus, though it is probable that the quantity of of rain in the interior of the country is not very great, yet a portion must reach the depressions in the interior. In as far as that interior has been explored, the rain which thus falls is accumulated in marshes or swamps, which are extensive pools of water immediately after the rain has fallen, but which gradually become dried up after the drought again returns. In warm countries, alternating waters of this kind do not produce even seasonal vegetation, for the drought burns up the marsh plants; and when this takes place, the volatile part of the vegetable matter evaporates, the salts are in great part left behind, and the soil is changed into dry sand or indurated clay, neither of which is well adapted for the growth of sea plants or land plants. In consequence of this, the soil gets worse and worse after every flood, and in a short time becomes wholly unproductive of any species of vegetation adapted for the food of an animal of even moderate size. Consequently the larger species of kanguroos are at all times confined to particular spots of the country—namely, the flats of considerable elevation, which are liable to be burned up at some seasons of the year, but never to be flooded. It becomes necessary that animals which have to find food on the vegetation of such places, should have a power of changing from place to place with considerable rapidity; and as, even when they are in the best condition, few of those places have that continual herbage which characterises our meadows, and adds so much to their beauty, they are totally unfit for animals which graze the breadth of the surface while they are in slow progressive motion. But the kangaroo, which, from its structure, can bound rapidly from tuft to tuft, and live upon vegetation of considerable height, as well as upon that which is immediately upon the surface, is exactly the animal adapted for such regions; whereas any of the ruminants would be incapable of subsisting upon them for any length of time. No doubt there are, to the south-westward of Sidney, pastures of considerable extent which have been found not ill adapted for cattle; but those pastures are situated on a part of the country which, in its geological structure, and its physical character, generally differs very considerably from what may be considered as the average character of the country.

The leaping motion of the kanguroos suits well with the nature of this kind of country, and though we are not so well acquainted with all the relations as to be able to judge with so much precision as to the advantages which they derive from the marsupial gestation, there can be no doubt that that also serves to fit them for the locality wherein they are situated, otherwise they would not have it, upon the principle in nature to which there is not one known exception—that there is not an organisation or modification of an organisation, for which there is not an adequate use. There can be no question that the carrying of the young in the abdominal pouch, or marsupium, enables the female to move about and carry her young ones with much more ease than if any of her limbs were concerned in the performance of that office. The fact of the internal uterus and the marsupium admitting of a more rapid succession of generations than can take place in animals which perfect the young in the internal uterus, and afterwards suckle them on the teats, is also calculated to assist in keeping up the breed of the animals in situations where, without such a provision, they would be often exposed to the peril of extinction. Common placental mammalia, with single uteri, rarely have a case of superfætation in the uterus, and an impregnation during the time that the young are most exclusively nourished by the lactiferous secretion of the mammæ, is scarcely less rare. Placental mammalia are therefore adapted only to countries in which they have irregular successions of seasons, unless in those animals that are not absolutely dependent on the production of green or recent vegetable matter for their food. The placental animals that occasionally furnish instances of superfætation, and also become gravid pretty frequently while they suckle, are almost, if not altogether, rodent animals, which eat bark and other dry vegetable matters, as well as the green produce of the earth. Perhaps the best and most circumstantial account which we have of the economy of the female kangaroos, is that which was read to the committee of science of the Zoological Society of London, by Mr. Owen, on the 26th of November, 1833; we shall therefore quote it for the information of such of our readers as have not access to the Reports of that most excellent and efficient committee. "Perhaps," says Mr. Owen, "there is no question in animal physiology that has given rise to more numerous and contradictory theories, and in which fewer facts have been well ascertained, than that which relates to the generation of the *marsupial animals*.

"In the present communication I propose to limit myself to the narration of some circumstances that have occurred in elucidation of this subject during a series of observations which I have made at the gardens in Regent's Park during the past summer.

"All the kanguroos at the farm were for this purpose transferred from the farm to the gardens at the latter end of June. The whole stock consisted of two males and six females, all full grown. The animals of different sexes were kept apart until they had in some measure become accustomed to the gaze of visiters, and reconciled to their new abode.

"It was to be expected that some accidents would occur in exposing so timid an animal, and one whose locomotion is of so violent a kind, to this change; and shortly after their arrival one of the females died in consequence of leaping against the wire fence. It is, however, probable, from the appearances observed on the post mortem examination of subsequent cases, that this, like the other individuals, were rendered highly excitable by great determination of blood to the brain. When the remainder had become more habituated to their new circumstances, the experiments were commenced, and the first step taken was to examine the pouches of all the females.

" The first female had previously been kept at the gardens, and had a young one, which measured about one foot two inches from the nose to the root of the tail: this, of course, had quitted the nipple and the pouch. The right superior nipple was the one in use; it was nearly two inches long and one-third of an inch in diameter, the gland forming a swelling on the base. The three nipples were everted, and about half an inch in length.

" A second female, from the farm, had a young one attached to the lower nipple on the right side. It measured about seven inches from the nose to the vent, was naked, with the skin of a bright pink colour, being still, in the language of M. de Blainville, a mammary fœtus. The nipple in use was one inch and a half long from the gland to the mouth of the fœtus; the rest were everted, and about the size of those in the first-mentioned female.

" The third female had a mammary fœtus about four inches long from the nose to the vent, adhering to the left lower nipple, covered like the preceding, with a naked vascular integument, which probably assists in oxygenating the blood. The eyes in this as well as in the preceding were closed. The other nipples were everted, but were not all of the same length, the right lower nipple being shorter than the right upper one. I could not ascertain when the female had been impregnated.

" The fourth and fifth females had no young in the pouch; all the nipples were everted.

" From this examination two facts were ascertained; first, that the kanguroo, at least in a state of captivity, has no particular period or season for breeding; and second, that the upper as well as the lower nipples are both used during the period of mammary gestation, and for the young animals subsequent supplies of nourishment.

" With respect to the second female, the following facts relative to her gestation were obtained from Joseph Fuller, head keeper at the farm. She received the male on the 14th of September, 1832. On the 14th of October, the same year, Fuller observed her looking sickly, and when the male approached her she scratched and repulsed him. This was about three P. M., when he was unfortunately called away on some business. In the evening, at eight o'clock, suspecting that parturition had taken place, he examined her pouch, and found a young one attached to a teat: on being touched the young one dropped off to the bottom of the pouch. Next day he again examined her, and found the young one adhering to the nipple. It fell off a second time on being handled, and both Joseph and Devereaux Fuller had the little one in their hands out of the pouch, and both assert that it was not more than one inch in length. It was again put in the pouch, and the mother was meddled with no more till the 3rd of November following. On that day Mr. Yarrell and myself visited the farm, and on hearing this account, we examined the female, and found the young one now three inches long, adhering strongly to the nipple. On further questioning Fuller on the subject, he said, that when first he saw the young one it was covered with blood-clot or coagulum; but on the following day it was quite clean and dry, and moved in body vigorously. The mother still suckles one of the previous year.

" From Mr. Morgan's experiments, it would appear, that when the mammary fœtus has arrived at nearly the size of a fully grown Norway rat, it will bear a separation from the nipple for two hours, and regain its hold. According to Fuller's statement, it will bear a separation from the nipple and again become joined to it, at what is now proved to have been a very short time after uterine gestation; and Mr. Collie's observations, in the eighteenth number of the 'Zoological Journal,' are in confirmation of the same opinion. It is uncertain in what manner it regained the nipple, although in a subsequent experiment, where a similar fœtus was detached, the mother made many, but, as it appears, unsuccessful attempts to replace it.

" In order to ascertain precisely the period of gestation, as an essential guide to future experiments, the first female was selected, she being still suckling the young one of the previous year, and being known to be impregnated. She was placed with the male only at such times as they could be watched.

" The union was observed on the 27th of August at one P. M. She was separated from the male the same day, and was kept in a distinct shed and paddock until parturition took place. In order to enure her to the examinations of the pouch when they should become indispensable, they were repeated every morning and evening by James Hunt, the intelligent keeper, whose services were allotted to me by the council during these investigations. At many of these examinations I was present, and the following are among my notes made on those occasions.

" September 6th, tenth day of gestation. Pouch tolerably free from secretion; the right upper nipple about two inches long, and one-third of an inch in diameter; the young one, which has left the pouch, still sucking occasionally; the other nipples as when first examined.

" September 11th, fifteenth day. No alteration in the pouch or nipples; the young one still sucking occasionally.

" September 30th, thirty-fourth day. The young one that was sucking is dead. The nipple in use by it is begun to shrivel, and the brown secretion to form.

" October 4th, thirty-eighth day. Hunt observed the female in the afternoon putting her nose into the pouch and licking the entry. He examined her at six in the evening, but a slight increase of the secretion was the only perceptible change, and there was no appearance in the nipples indicative of approaching parturition.

" October 5th, thirty-ninth day. Hunt examined the female at seven A. M., and found the young one attached to the nipple. No blood or albuminous discharge could be detected on the litter, nor any trace of it on the fur between the vagina and orifice of the pouch. As the birth took place in the night, the mother had probably had time to clear away all traces of it.

" I repaired to the gardens the same day, and examined the pouch. The young one was attached to the left superior nipple; it resembled an earth-worm in the colour and semitransparent colour of its integument, and adhered firmly to the point of the nipple. It breathed strongly but slowly, and moved its fore legs when disturbed. Its body was bent upon the abdomen, its short tail tucked in between the hind legs, which were about one-third shorter than the fore legs; but the three divisions of the toes were distinct. The whole length, from the nose to the end

of the tail, would not exceed one inch two lines. A linear longitudinal mark of the umbilicus was apparent.

"It has been ascertained by Barton that the young of the opossum, immediately after birth, are in a much more imperfect condition than that above described in the kangaroo, being merely gelatinous corpuscles, comparable to a *Medusa;* but the observations of Dr. Rengger on an opossum (*Didelphis azaræ*, Temminck), nearly allied to the Virginian species (*D. Virginiana*, Cuvier), accord, as to the condition of the new-born fœtus, with what we have now been able to ascertain with accuracy is the condition of the new-born kanguroo.

"Oct. 9.—I again examined the pouch; the young one was evidently grown, and respired vigorously. I determined to detach it from the nipple for the following reasons: 1st, to decide the nature of the connexion between the fœtus and nipple; 2nd, to ascertain, if possible, the nature of the mammary secretion at that period; 3rd, to try whether so small a fœtus would manifest any thing like voluntary action to regain the nipple; and lastly, to observe the actions of the parent herself to effect the same purpose, as we might presume they would be instinctively analogous to those by means of which the fœtus was originally applied to the nipple, supposing that to take place through the agency of the mother.

"An organic connexion by vessels between the mammary fœtus and the nipple being a necessary consequence of the truth of Dr. Barton's assertion, as to the condition of the product of generation at uterine birth, this has been much insisted upon; a discharge of blood has been described as a concomitant of marsupial birth; and even the anastomoses of the maternal vessels, with those of the fœtus, have been speculated upon (see Mém. de Museum, tom. ix., p. 393).

"The dissection of the mammary fœtus of the kanguroo by Mr. Hunter, showing the relation of the nipple to its tongue and mouth, the passage of the larynx into the posterior nares, the absence of the uracus and umbilical vessels, &c., tended indeed to disprove the theory of the vascular connexion; and the observations of Mr. Morgan and Mr. Collie, with the testimony of Joseph Fuller, were completely subversive of it. Nevertheless it was desirable to have ocular demonstration of the real state of the facts at this early period of the young animal's existence.

"It was removed from the nipple without the slightest trace of laceration of continuous vessels, or of any kind of connecting substance; but it adhered more firmly than I had been led to expect from Fuller. After it was detached, a minute drop of serous milk appeared on pressure at the point of the nipple; this was the smallest part of the nipple, and was not swollen or clavate; about half a line had entered the mouth of the fœtus.

"The young one moved its extremities vigorously after being detached, but made no effort to apply its legs to the fur or skin of the mother so as to creep along; it seemed perfectly helpless. It was deposited at the bottom of the pouch, and the mother was liberated and carefully watched. She immediately showed symptoms of uneasiness, stooping down to lick the orifice of the vagina, which she could easily reach, and scratching the exterior of the pouch with her fore paws. At length she grasped the sides of the opening of the marsupium with her fore paws, and drawing them apart, just as one would open a bag, she thrust her head into the cavity as far as her eyes, and could be seen moving it about in different directions. During this act she rested on her tripod, formed by the tarsi and tail. She occasionally lay down, but in that posture never meddled with the pouch; when stimulated to do so, she immediately rose, and repeated the process of drawing open her pouch and inserting therein her muzzle, which she sometimes kept in for half a minute at a time. I never observed her put her fore legs, or either of them, into the pouch; these were invariably employed to widen the orifice, or in scratching the exterior. When she withdrew her head, she generally concluded by licking the orifice of the pouch and swallowing the secretion.

"After repeating the above act of insertion at least a dozen times, she lay down, and seemed at ease. When she had rested quietly about a quarter of an hour, we examined her again, and found the young one at the bottom of the pouch, but within two inches of the nipple. It was moving its extremities, and respiring as vigorously as before. I attempted to replace it on the nipple, but without success; it was therefore left in the pouch, and the mother was released.

"My engagements prevented me from visiting the gardens the day but one after this examination, when at ten A. M. I examined the marsupium, but the fœtus was gone. We searched very carefully every portion of the litter, &c., in the hope of finding it, but without success. I concluded, therefore, that the fœtus had died, and that the mother had probably eaten it.

"From what I observed of the mother after the separation of the fœtus, I should conclude that parturition takes place in the erect and not in the recumbent posture; and on perceiving the ease with which she can reach with her mouth the orifices of the vagina and pouch, a means adequate to the removal of the young from the one to the other became obvious. I should suppose the fore paws not to be used for the transmission of the fœtus, but to keep open the pouch ready for its reception, while the mouth would be the means by which it would be deposited therein, and perhaps held over a nipple till the mother felt the sensitive extremity grasped by the young one.

"This mode of removal is consistent with analogy. Cats, dogs, and mice transport their young by the mouth.

"I ought perhaps to have forborne this hypothesis when an opportunity of actually observing the process may so soon be afforded; but it was suggested by observing the actions of the mother after an artificial separation of the fœtus from the nipple, and accords with the phenomena better, I think, than any that have been previously proposed. There is no internal passage; there is no power of bringing the mouth of the vagina in contact with that of the pouch, either in the living or dead kangaroo, without lesion of the parts; the fore paws could not so effectually protect the embryo from the external hair on the lips, nor so safely ensure its passage; and the young one itself did not by any of its actions give the idea of its having the power of creeping up the fur along the pouch to the nipple.

"Where, however, the structure of the pouch, as in *Perameles*, and some South American opossums, is different, the mother's aid may be less necessary; but

the period of gestation being now ascertained, every endeavour will be made to clear up this part of the problem *ex visu*."

Various species of kanguroo have been mentioned by different naturalists, but the distinctions between them are chiefly those of size and colour; and as there are several of them which have been described from an occasional sight of a single specimen, it is not easy to determine whether some of them may not be accidental varieties, and others variations of appearance arising from age, sex, or pasture. Under these uncertainties, we shall make our notices of the species very brief.

Great Kanguroo (*K. labiatus*). This is the most interesting species, the typical one, and the one on which the general descriptions are founded. Its proper native country is New Holland, where it is the largest native animal, and by no means rare in those parts of the country where there is a supply of food for it. Besides being the largest native animal, it is the favourite game both of the natives and of the European settlers; and the superior means of destruction possessed by the latter have thinned its numbers in all parts of the country which are even moderately peopled. In more remote places, the straggling settlers, whose cultivated patches are insignificant spots in the wilds around them, derive a good deal of their subsistence from the flesh of the kangaroo. We believe that the flesh of this, and indeed of all marsupial animals, is much inferior to that of placental mammalia living upon similar food; but the supply of human subsistence in the Australian wilds is so scanty and of such inferior quality, that the flesh of the kanguroo is considered as a dainty. The greater part of the flesh is accumulated on the hind quarters, so that when the hunter has a long distance to return home, he sometimes leaves the fore part of the animal to the carrion birds, and takes with him only the hind quarters and the skin, which is made into leather and used for various other domestic purposes. The favourite mode of dressing the flesh is by making it into a sort of stew, which is provincially termed a "steamer;" and those who have partaken of it, seasoned by the sauce of a thirty miles' scramble in the woods and wilds, describe it as being by no means unpalatable.

This species varies a little in the colour, but in general it is of a reddish ash grey on the upper part, white on the under, with a grey streak across the chin; and the legs and upper side of the tail blackish. It is an animal of considerable size, sometimes attaining a height of six feet, which, however, is to be understood of it not as standing on all fours, but as erect, or resting on the soles of the feet and the extremity of the tail. It was discovered by Captain Cook in 1789, and it has been introduced, and is bred readily, in Britain and in other parts of Europe; and it has also been introduced into the grounds of several of the more wealthy settlers in the neighbourhood of Sydney. Its singular appearance and habits attract some attention, and it no doubt forms a variety in a park; but it is neither a pleasant nor a profitable animal. It appears to be almost, if not altogether, destitute of that sensibility to kindly treatment and gratitude to those who treat it well, of which not even the most ferocious, or separated from man in their habits, of the placental mammalia are not altogether destitute. There are instances mentioned of the lion yielding his ferocious disposition, and not only playing with those who fed and attended him, but even making pets of small animals; we have also some recorded instances of the delight expressed by the hyæna on recognising one who had formerly been kind to it, even after a separation of many months; nor are there wanting instances in which the seal has voluntarily left its native element to visit the abode, sleep on the couch, and watch, with all the vigilance of a dog, those who have treated it with kindness. No such affection, and indeed nothing that can be called affection at all, has ever been displayed by the kanguroos. It is perfectly indifferent to every species of treatment, and will attack just as readily those by whom it is fed and attended as those who treat it harshly. This appears to be a general character of marsupial animals. They evidently belong to a lower order of animalisation, if the term may be allowed, than those animals which mature their young by internal gestation. None of them have much courage, or apparently many resources; and those which approach the nearest to the carnivorous animals in their dispositions are scavengers rather than hunters. Some of them tear sheep in a most unscientific manner, so to speak; for instead of first killing and then eating the animal, as is done by the members of the dog or cat family, they set about tearing and eating it alive, at any one part they happen first to get hold of; and we believe it is not unusual for some of the genus *Dasyurus* to gnaw off the tails of sheep and young cattle, on their nightly prowlings, without daring to assail any other part of the body. One might perhaps expect this conduct from the marsupial animals, for there is unquestionably a physiognomy of animals as well as of human beings. It is difficult to reduce this physiognomy to system, and to point out the specific disposition which the eye and the air of an animal indicate; but still there is not the least doubt that if there is spirit in the animal there is always speculation in its eye, and if there is energy in the action of the animal, that energy will tell in its attitude, even when it is in a state of repose. In so far as one can judge analogically of this indication of the disposition of animals from their expression, it may be said that the susceptibility of the animal is always in proportion to the extent of change which the expression of its eyes can undergo; and in the case of the kangaroo, and indeed of all marsupial animals, so far as is known, there is little, if any, change of this kind. One might address the whole race of them in the same terms as Macbeth addresses the ghost of Banquo:—

> Thou hast no speculation in those eyes
> Which thou dost glare with.

For under the most kindly and the most cruel treatment, they have the same blank and vacant expression; and though kanguroos are very prone to do mischief, they do it without any previous sign of excitement, much in the same manner as if they were passive engines. Some of the marsupial animals, it is true, never offer any violence to human beings; and the wumbat and the koala may be beaten without showing the least diposition to retaliate, and hardly any even to escape. They are thus usually denominated gentle creatures; but their gentleness is something analogous to the gentleness of a stone, which breaks no one's toes unless it be run against, and the injury be the act of the sufferer. It is in fact the passiveness of stupidity, and a very strong evidence

that the animal is susceptible of scarcely any cultivation.

This is exactly the case with the kanguroo; so that after the first wonder at its strange shape and unique style of motion is over, there is no more interest about it; for there is no disposition in it which can be drawn out as the basis of that sort of attachment, which can be formed with almost any placental animal, by a careful study of its disposition, and due attention to its comfort. The kanguroo is, therefore, in its very nature, an animal of savage climes; and it is not a little singular that, in a large portion of the earth's surface, which is as peculiar in most of its productions as it is large, the principal four-footed animal and the aboriginal human being should be at the very bottom of their respective races. Such, however, is the fact; and it appears to be just as hopeless to attempt civilising the native New Hollander, as to attempt taming the kanguroo. Some of those natives have been educated, some of them have been treated with kindness, some have been employed in various offices; but in almost every case the result has been only an increase of cunning, and a deepening of vice; so that the parties were in the end no more to be trusted than their naked brethren, who lie in wait in the bush for the purpose of spearing every living creature, human or not human, which happens to pass by. This is a very curious point in physiology; but it is one, upon the discussion of which, we, for obvious reasons, cannot in the meantime enter. But still we may remark, that no people have ever been civilised by intercourse with other people, except such as had previously shown some disposition to civilise themselves. So, also, among the other animals, there is no hope of taming, into anything like attachment, any animal which does not show some resource and stratagem in a state of nature; but if the human being, or the other animal, evinces the requisite capacity, there is always a way of turning that capacity to the very best advantage, how much soever it may be misused, or turned to vice, before the treatment is applied to it. If, however, there is no capacity, mere brute placidity is no recommendation; and it is from its total want of this capacity, together with its indiscriminate disposition to do mischief without any apparent cause, that we have described the kanguroo as an unpleasant animal to be kept in parks or pleasure grounds. Indeed, we have direct evidence of this fact; for some which were in the royal parks in this country were so very vicious, without any obvious cause, that it became necessary to remove them; and we believe that some of those in the menagerie of the museum at Paris were very prone to attack and lacerate the keepers; and the wounds which are inflicted by their claws, are far more formidable than single cuts given by almost any other animal.

In addition to this, we mentioned the inutility of the kanguroo as a domestic animal. From its structure, it cannot be employed in any species of work; and the useful products which it furnishes are few in number. Its skin is of some value, though perhaps not equal to that of most ruminant animals, and certainly not at all to be compared with the skin of the horse. From its peculiarity of structure, and the mode in which it rears its young, it can be of no use whatever as a milk animal; and its hair is neither fit for spinning nor for felting into a fabric of any consistency; so that the only part of it which has value, is its body in substance. The principal part of that is the flesh of the hind quarters, as already stated; and this flesh is wholly unmixed with fat. There is, indeed, a sort of soft fat which accumulates in the rump and the upper part of the tail, to which Australian epicures give some praise; but it is almost, if not entirely, destitute of stearine, and thus unfit for those purposes in the arts, to which the surplus fat of our domestic animals is applied. The portion of the carcass, too, which is fit for food, is so small that, in a country where land and its produce are of much value, the kanguroo could not be bred so as to anything like repay the expense of its keep. These circumstances put the use of it, in an economical point of view, entirely out of the question; and from what we have already stated, it is not more desirable considered as an ornament; and, therefore, the only purpose which it can answer with us, or in any other European country, is that of being kept in zoological collections of living animals, as an object of science or simply of curiosity; and certainly, in both of these respects, it is highly interesting, and deserving of its place.

It is a singular fact, and one which, while noticing this animal, we can hardly pass over, that, in every country where the inhabitants have been found in a low state of savageism, there is hardly any animal available for domestic purposes. When America was discovered, there was not, with the exception of the lama and alpaca, in the central mountains, any animal calculated to be of service to man; and in Mexico, and more especially in Peru, where those animals were kept in a state of domestication, and partially, at least, used as beasts of burden, there was an incipient civilisation, rude indeed, but still forming a wonderful contrast with the condition of the people in other, and naturally far richer, parts of the American continent. In all the points of their character, the native inhabitants of many of those districts in which, when first visited by Europeans, there were no domestic animals, were not only superior to the Peruvians, and especially to the Mexicans, by whom civilisation had been begun, but many of them, those of the north especially, and also some of those of Paraguay and Bolivia, are superior to the average of European peasantry, both in energy and in mental recourses. Yet they had not become civilised even when people of less natural endowments had made some advances; and we can account for this apparent anomaly only in the fact of those superior people having no animals which they could tame and turn to account in their domestic economy.

This is a very important fact, as showing the dependence which the development of the human powers has upon the situation in which human beings happen to be placed, and from this we may, without impropriety, infer, that the people of the east owe their advances in civilisation more to the possession of the ox, the sheep, the horse, the ass, and the camel, than to any mental superiority on their part. The coincidence of elevated character with the possession of those animals, and of the absence of that character with the want of them, are too general, we may say too universal, for admitting us to suppose that they are owing to accidental circumstances; and this consideration should teach us not only not to be wantonly cruel to those animals, but to look upon them with kindness, and pay every attention to their comforts, as they are unquestionably our benefactors. This is a subject upon which little has been said, though

much might be said, and even requires to be said; but we must leave it in order briefly to notice the other species or varieties of kanguroos which are mentioned by writers on zoology.

Great Kanguroo.

The great kanguroo, to which the above observations apply, appears to have been multiplied into two species; one more inland and northerly, to which the description of colour which we have given applies, and one more southerly and near the shores, which has been called the sooty kanguroo, but which differs from the former only in being rather larger in the size and deeper in the colour. It is described as being sooty brown on the upper part and reddish grey on the under, with red on the flanks; and the feet, the point of the muzzle, and the legs, blackish brown. It is probable, however, that these distinctions are nothing more than those between a mature animal in a favourable pasture, and a young animal in a pasture less favourable.

Grey Kanguroo (*K. griseus*). This species, if distinct species it be, is considerably smaller than those which have been mentioned, for it has not been observed of greater height than three feet and a half. Its general colour is reddish grey, with white points to the hairs, the colour becoming paler towards the under part, and passing into white on the middle of the belly, while it gradually deepens toward the mesial line of the back. The legs are brownish grey, and the terminal part of the tail is reddish brown. The ears are not so pointed as in either of the two species, or varieties, which have been mentioned. Like them it is a native of New Holland, and nothing is known of its manners as distinguished from those of the others.

Red-necked Kanguroo (*K. ruficollis*). This is still smaller than the former species. It is grey, with more or less of a reddish tinge on the upper parts and the flanks; but the lower part of the neck is deep red. The insides of the limbs are white, and so is the middle of the under part of the body, but the white on the latter is of limited extent, of not more than a mere line. One of its most remarkable characters, in as far as mere colour can be considered a character, is the colouring of the tail, which is russet grey on the under part and whitish on the upper. The ears are of the same colour as in the great kangaroo, but of the same shape as in the grey one, so that it is possible that this may be merely a hybrid between the two. Hybridation, in kanguroos particularly, and in marsupial animals generally, is a subject to which little or no attention has hitherto been paid, and yet it is one of very great interest, in coming to a proper knowledge of the physiology of those singular animals. The male kanguroos have not that bifurcation of the organs which is possessed by many of the marsupial animals; but the females have the compound uterus, and are capable of impregnation while enceinte of a previous fœtus, not only in the marsupium, but in the internal matrix. The fact has not been ascertained, but those circumstances would lead us to conclude that there is not a regular animal season of heat in the female kangaroo, but that the animal is as passive in the matter of reproduction, as it is indifferent to kindly treatment. If such is the case we might conclude that hybridation would be very common among such animals, and that they would break down into very many varieties; and until these points are settled, the distinction and description of species must remain very vague and unsatisfactory. It indeed appears that, in the natural history of marsupial animals, error has all along been committed, in consequence of our judging of them by the standards which had been previously formed from the examination of placental animals; and unless we get rid of this false analogy, and study the marsupial animals upon data furnished by themselves, we shall never be able rightly to understand their nature, or to form a proper judgment of their economy. For the reasons now stated, we shall omit several of the species which have been enumerated by writers on the subjects.

Woolly Kanguroo (*K. laniger*). This is mentioned by the French naturalists Quay and Gaimerd, and was found by them in Australia, but if it exists as a species it is very rare. It is described as being about the same size as the great kanguroo. The head, the neck, the back, the flanks, the outsides of the legs, and the upper side of the basal part of the tail, are bright red; and all the rest of the body is white, with the exception of the ears, which are grey, and the toes, which are russet brown. The hair on the body is described as being very long and woolly, resembling that of some of the American members of the camel family; but so little is known of the animal that it is impossible to speak with precision concerning it. It is described as being found in the western part of Van Diemen's Land, where the country is very mountainous, covered with woods, and subject to violent falls of rain; and it is by no means impossible that those circumstances of the country and climate might induce as great a change in the covering as appears between this and the kangaroos with short hair; for we find that similar changes are induced in the mountain cattle of our own country, more especially in those districts which are subject to heavy falls of rain. Indeed, the effect of difference of situation and climate upon them is one of the points upon which we need additional information before we can come to any positive decision as to what is or what is not a species of kangaroo.

Brush-tailed Kanguroo (*K. pensillatus*). This is another species which is but little known, though there is no doubt that it exists. It is found beyond the Blue Mountains in the interior of Australia, where it does not appear to be common, and we are not aware that it has been met with near any of the shores. The upper part is grey, of different shades,

and the under part reddish brown. The head dark grey, with a mesial line of deeper colour; the cheeks and throat marked by spots of a pale tint, the feet dark coloured, and the tail as long as the body, and furnished with a thick brush or tuft of hair at the extremity. The muzzle is much more slender than in those kanguroos which are more abundant, and the corners of the mouth are furnished with whiskers consisting of a few long and stiff hairs. The animal has, however, been so seldom seen, that the accounts of it are very imperfect, though we believe that the museum of the Linnæan Society contains at least one specimen.

Banded Kanguroo (*K. fasciatus*). This species is of a grey colour, with a brown band across the back and loins. It was known as early as the time of Dampier, and it has been repeatedly observed since. It has many peculiarities both of form and of structure, which appear to entitle it to rank as a species. The muzzle is much shorter and the head rounder than in most of the others, and altogether it has a more elegant appearance. Though we have stated the general colour as being grey with brown on the back and loins, yet there is so much effect in the markings and contrasts of the colours, that it has sometimes been styled the elegant kanguroo. The hinder part of the body is very generally marked with transverse streaks of grey, red, and black, which contrast boldly with each other in some places, and are blended in others so as to give it a very rich appearance. The outsides of the legs and the muzzle are deep red, and the under parts and the tail grey, with the exception of the tips of the latter, which is black. This species has been met with only on the east coast of New Holland, near the sea shore, or on some of the small islands which are found on that coast; but, as is the case with all the rest, it is scarcely possible to study its habits in a state of nature; and the few specimens which have been obtained were shot, so that little or nothing is known of it except as a dead animal. It is described as being rather smaller than the common kangaroos, which are often met with living, and with whose manners we are, at least, a little acquainted; but still, as there appear to be climatal varieties in other parts of Australia, and as we are uncertain what changes may result from crosses between the varieties of different regions, which may frequently meet in a country so much burnt up during the long droughts, and where animals are necessarily so much put to their shifts, we can come to no positive conclusion concerning it.

There are several other species named by the French naturalists that visited Australia and the islands in the adjoining seas; but as, on some occasions at least, they appear to have gone more for the purpose of naming, than for that of discovering and discriminating, the accounts which they published, and which have been repeated again and again, cannot be depended on; neither can we be certain that the different specimens of animals which they brought, on very casual visits to a most extensive country, of which they saw only limited portions of the shores, are distinct species, or even varieties, or merely the same identical species in different stages of their growth and different states of their colouring. That the scientific men who went out on these occasions were talented and zealous in their vocations we have not the least reason to doubt; but it so happened that while France was politically at war with this country, some of those expeditions went out for the express and avowed purpose of taking by storm every English name which had been given to a place, an animal, or a thing within the limits of the territory, and substituting a French name in its stead. Accordingly we find some of the most ludicrous geographical puzzles in the translations which have been made from the reports of those visiters, into compilations on natural history published in this country. Those translators and compilers are, generally speaking, marvellously unencumbered with knowledge, and especially with geographical knowledge; and as the English answering to those French names is not to be found in the dictionary, and as the names themselves are now forgotten even in France, we often find an animal set down as an inhabitant of some place which has no existence.

In as far as the British residents within the colony are concerned, the natural history of Australia was, till within these few years, vague and imperfect enough; for the chief persons that ranged into the fastnesses of the country were those expatriated outcasts of Britain, at whose hands a taste for anything but the gratification of their animal passions at the least possible expense of labour could not be expected.

Of late years, however, there has been much improvement; and those who are interested in the knowledge of nature—and who, being capable of thought, can fail in being so interested—are deeply indebted to the Zoological Society of London, which has given concentration and vigour to the science of living nature, has enlisted very many officers of the army and navy among its corresponding members; and they most commendably keep up that energy and enterprise which are at once the province and the glory of their callings, by extending our natural knowledge of the several regions in which they reside. In so far as Australia is concerned, there is still only a beginning in proportion to what we may ultimately expect; but still a beginning is the step, and that being taken, we may feel confident as to the progress. Through their agency, and the investigations of scientific men at home, the perplexing anomaly relating to the ornithorhynchus has been cleared up; and we may confidently hope that ere long the very peculiar zoology of our Australian colony, the most extensive in mere breadth, will be elucidated in a manner honourable to Britons and instructive to the whole human race.

Kanguroo rat (*Patoroo*). A genus of marsupial mammalia, found in New Holland; and though differing in some essential particulars from the kangaroos, properly so called, yet agreeing with them in some respects. There is only one animal of this genus, so far as has been hitherto discovered; but it has had the advantage of many names, if that can be considered an advantage. Dr. Shaw, whose judgment was seldom so praiseworthy as his industry, and who, we believe, was among the first into whose hands it came, called it the little kanguroo (*Macropus minor*). Illiger, we believe, gave it the name of *Hypsiprymnus*, which means "elevated rump," from the great length of its hind legs; and the colonists of New Holland call it the kanguroo rat. The first part of the name being founded chiefly on its form, and the second on its size. It is, however, a distinct and peculiar animal, and perhaps a better name for it cannot be found than *Patoroo*, which it is called by the aborigines of

New Holland, the last syllable being strongly accented and much prolonged. It is from this that the systematic name which we have adopted is derived. The structure of the teeth in this animal is peculiar, and indicates a miscellaneous figure, the same as many of the rats are, though its chief subsistence is understood to be vegetable. It has six incisive teeth, two canines, two false grinders, and eight true ones in the upper jaw; the same number of grinders, true and false, and two incisive teeth, in the lower jaw, but no canine teeth. The upper jaw, therefore, partakes more of the character of a carnivorous, and the lower more of that of a rodent animal. The first incisive tooth in the upper jaw is much longer than the others, and also stronger, and has three rounded protuberances in the front side; the second tooth is small, and resembles the teeth of the carnivorous marsupial animals. The last tooth of the superior incisives is very small; and there is a vacancy between them and the teeth in the rear, by which means it approaches still more to the rodentia. The hind legs are much longer than the fore ones; the feet on them want the thumbs, or fifth toes; and the two inner toes are united nearly in the same manner as in the kanguroos. The tail is long and very stout; and the marsupium in the females is complete, but contains only two mammæ, at least in the specimens which have been examined with sufficient care; but it is possible that, as is the case with various marsupial animals, these appendages may wholly or nearly disappear when not required, and be developed only as they are wanted.

It is understood that, notwithstanding the trace of carnivorous character in the teeth of this animal, its food is wholly vegetable, and it lives indiscriminately upon green herbage and upon dry, the peculiar structure of its incisive teeth enabling it to gnaw the latter in the same manner as a rat. They live concealed among stones, or in the bush, or thick shrubby underwood, which is so common in that part of the world; and the sound or cry which they utter is very similar to that of the rat. From the length and strength of their hind legs, as compared with the fore ones, they are very dexterous and powerful leapers, although in regular motion upon all-fours they are far from being so swift or graceful as the common rats. They are very numerous, especially in the rocky and bushy parts of the south of New Holland; and it is not a little curious that not only the marsupium, but the form of the kangaroo, is preserved in this, which is almost the smallest native quadruped of New Holland. This fact, that the whole of the mammalia of that country which are vegetable feeders, should be leaping animals, and not walking ones, is by no means an unimportant key to the physical geography of the country. When the herbage, or surface of vegetation, is continuous and perennial, as it is in those extensive plains by the banks of the great rivers, the grazing animals are generally of large size and slow in their motions, not given to migration, and having no occasion for it. This was the case with a great extent of North America at the time when it was discovered by Europeans; and it is now the case with many of the planes of Central and Southern America, where cattle from the east have been introduced. Near the borders of the great desert again, which stretches obliquely from south west to north east, over great part of the breadth of Africa, the different regions are periodically burnt up in the drought; but become fertile, and covered with a herbage which is nearly continuous, after the rain sets in, which it does differently in the different latitudes. This is the appropriate pasture for ruminants of lighter make and fleeter limbs; and accordingly we find that it is the grand resort of the numerous and beautiful family of the antelopes. When the pasturage is still continuous, but lies upland, so that its quantity is not so great as in the places to which we have alluded, it becomes the proper pasturage of the sheep; and when we get to a still higher elevation, or more broken ground, where rocks and precipices alternate with patches of verdure, we come to the natural locality of the goat, which is the last ruminant animal on the cliff, in like manner as the antelope is the last one on the margin of the desert; but all these animals belong to one class, and form a regular succession from the ox to the goat on the mountain, or the antelope in the desert; and there is no resemblance among them to any of the marsupial animals which graze. The characteristic ones of these are found only in Australia, where they leap from patch to patch, and can partially use their fore paws in the eating of their food. In countries where there are browsing animals which consume the green leaf of the ground vegetation, there are ground animals of the rat family, which, in great part, live upon the fallen seeds; and just as we find the kangaroo taking the place of the ruminants in Australia, we find the kanguroo-rat partly occupying the place of the common rat, and other rodentia represented by species of marsupial animals which, like the kangaroo-rat, are not so decidedly herbivorous as the typical kanguroos, and yet not, strictly speaking, carnivorous animals, but miscellaneous in their feeding.

The kanguroo-rat is about the size of a small rabbit. The body rather exceeds a foot in length, and the tail is fully a foot. The fore legs are only between three and four inches long; but the hind ones measure as much as ten inches. It is a very gentle and timid animal, very easily tamed, but not particularly interesting in its manners. It is eaten by the aborigines, who are not very choice in their feeding; but its flesh is small in quantity, and inferior in quality.

KENNEDIA (Ventenat). A genus of climbing plants, natives of Australia, belonging to *Leguminosæ*. Generic character: calyx two-lipped, upper lip two-toothed, lower one three-cleft; standard reflexed; pod linear, compressed, contracted between each seed. This genus are favourite green-house plants, grow freely in a mixture of loam and peat, and are propagated by cuttings.

KERRIA (Decandolle). An ornamental deciduous shrub, said to be a native of Japan, belonging to *Rosaceæ*. It is of the easiest culture, and has lately emerged from the green-house into the open air. When first introduced it was called *Corchorus Japonicus*.

KIDNEY BEAN. Is the *Phaseolus vulgaris* of Linnæus, a well known culinary vegetable. There are two principal species in our gardens viz., annual dwarfs and runners, the pods of which are used when green and tender. Those of the dwarfs are also a favourite pickle. The runners, both scarlet and white flowered, are at once ornamental and most useful plants, being very productive, and continuing to yield pods till killed by frost: for, being tropical plants, they are extremely impatient of the least degree of frost. The runners are, properly speaking,

perennials, but as such they are of no use in this country, as they do best when raised every year from seeds. The *Haricots* of the south of Europe, and the *Caracallas* and *Callavances* of tropical countries, all belong to this genus.

KIGGELARIA (Linnæus). A genus of ornamental trees, natives of the Cape of Good Hope, belonging to the natural order *Flacourtianeæ*. They are treated as green-house plants, and propagated by cuttings.

KITE (*Milvus*). A genus of diurnal birds of prey, not very numerous in species, but very generally distributed over the world, plentiful in those places of the country which are favourable to its habits, and resorting more frequently to the vicinity of human abodes than most birds of prey, and therefore better known. In some countries, kites are objects of persecution, from the depredations which they commit on the young of the poultry yard and the duck pond; while in other parts of the world they are protected on account of the great number of offensive small animals, of which they clear the neighbourhoods of houses.

Kites form a very distinct section of diurnal preyers both in their appearance and in their habits. Their tarsi are slender, but at the same time short; and, therefore, though they exceed the sparrow-hawks in size, they are not nearly so powerful with the foot, neither are they so courageous. The bill also is smaller and weaker in proportion to the size of the birds, than in any of the hawks or eagles; and altogether they indicate a feebler power of action, and smaller prey. At the same time, however, they are very ravenous, as well as very miscellaneous feeders; and when a hungry kite meets with an abundant meal, it feeds so eagerly that it may be knocked down with a stick, or even seized with the hand, in which respect it bears some resemblance to several of the vultures. But notwithstanding its comparative feebleness and its voracity, a kite is by no means an unhandsome or uninteresting bird. On the contrary, its motions in the air are so light and graceful, and its style in hovering about is so easy, and performed with apparently so little effort, that it is assumed as a sort of typical motion. Kite-flying is a cant term for the putting of light or doubtful things afloat in the world; and there is not a schoolboy who is not acquainted with the paper imitation of this light and graceful hoverer in the sky; and though, in the case of the paper kite, the string is the resistance which enables the expansion of the kite to rise and ride obliquely in the air, it is the weight of the living kite, balanced against the ample expansion of its wings and tail, which enables it to float, occasionally at least with little more apparent muscular effort than its paper namesake. We shall best describe its manners, however, in adverting briefly to the species.

The Common Kite (*M. vulgaris*) is the only species which is found in the British islands, or indeed in Europe. But, as is the case with most birds of prey, the young are different from the mature birds in the markings of their colour; and, on this account, they have sometimes been brought from foreign countries, and described as species inhabiting there.

The kite is rather an extended bird. The female measuring more than five feet in the extent of the wings, and about half as much in the length of the body and tail, the latter of which is very much forked, and pointed in the branches of the fork, so that while beating about, the bird can wheel and turn on the points of the forks as on centres. The exterior feathers of the tail are upwards of a foot in length. The wings are not so pointed as the tail, but they are pretty strong in proportion to their other dimensions. The third and fourth quills are the longest in the wing, the fourth being a little longer than the third. Of the others, the second is a little shorter than the fifth, and the first much shorter than the sixth. This arrangement of the feathers gives a balance to the middle part of the wing, by making it, though really a pointed wing, take a strong hold on the air, by means of which it performs the double offices of wheeling and floating much better than if it had been wholly adapted for either of them. The kite is a light bird in proportion to its extent, being usually in the female not much more than two pounds and a half, while the male is smaller and less heavy.

In the full grown bird, the head is dull white, streaked with dusky lines; and the feathers on the neck are pointed, and capable of being partially erected. The upper parts are brown in the centre of the feathers, and reddish orange on the margins; the under parts are reddish orange, with stripes of dusky brown on the thighs and belly. The female is not so brown as the male bird, and there is often a tinge of greyish ash in her general plumage. The young, before arriving at maturity, is much redder, the male bird especially, than the full grown; and it is in this state that it has been described as a different species; though there is often so much difference of tint in the male and female when full grown, as to have procured for the one the name of the red kite, and for the other that of the grey kite; but they are the same species notwithstanding this, and we have no certain evidence that there is any specific difference of kite in Europe; and the same species with which we are familiar in this country is found in many parts of Asia and Africa.

The kite is indeed a ranging bird, not only in its ordinary feeding, but, as is generally understood, in seasonal migration. In winter it is but rarely seen, and seldom if ever in the neighbourhood of farmyards and houses; for as it has not sufficient courage for attacking full-grown fowls, it does not pay its visits until the spring broods are hatched. All birds of prey are comparatively little seen abroad over the fields during the winter. The resident ones are then chiefly in the fastnesses of the woods and wilds, which are much more productive in the winter season than the open grounds, both for the preyers and the animals on which those preyers feed. On this account it is often supposed that species quit the country during the time when they live in concealment in it; but notwithstanding this, it is probable that, in some parts of Europe at least, kites may migrate during the winter, and resort to Egypt, which is then the general retreat of very many birds. This opinion was maintained by the ancients, and the kite is enumerated among those birds which appeared in numbers in Greece during the spring; and Greece is known to be a great resting place for birds, both in their northward and southward migrations. It is not understood that the same constancy of attachment is found in the kites which characterises, in so remarkable a manner, those diurnal birds of prey which are known to be permanent residents, and which form an interesting feature in their character. Male kites, though not the most warlike of birds, yet sometimes exhibit con-

siderable symptoms of pugnacity during the early part of the pairing season. Their strifes have not the dashing style about them of those of the gallinaceous birds, nor even of the ruff, but still they do contrive to pull and scratch at each other; and as this is certainly not done in order that the victor may eat the vanquished, we can assign no natural cause for those battles except that they are affairs of honour connected with the females; and as it rarely happens that there is any battling of this kind between animals which are constant in their pairing, the most rational conjecture is, that the pairing of the kite continues for only one brood.

Considerable labour is bestowed in forming the nest, and no little of instinctiveness in the placing of it. It is usually in the fork of a thick tree, where it is concealed by the natural branches; and it is more elaborate than the nests of birds of prey generally. The external part is formed of twigs, thickly wattled together, and the interior is lined with wool, hair, or other soft and warm matter. The eggs are generally three in number, fully larger than those of the domestic hen; they have sometimes a few dark blotches near the thick end, but at other times they are all over of a dull white colour. The young remain a long time in the nest, and as they feed greedily, the old birds, more especially the female, have severe labour in finding food for them; and it is during this time that they invade the farm-yards with the greatest audacity, though even then they do not venture to attack a bird capable of showing any resistance.

The kite, though its motions in the air are free and graceful, is not in the habit of preying there, even for any sort of creature. It feeds on the ground, or sometimes even on the surface of the water, from which it can twitch up a floating animal substance with great dexterity. It is on the young of the most timid animals that the kite chiefly feeds, the young of all descriptions of game birds, and also the young of hares and rabbits, and on lambs in the very early state, more especially if they are sickly. Mice, insects, worms, and snails, it attacks and destroys in vast numbers; and no kind of carrion comes amiss to it. This last property recommends it to the protection of the inhabitants of those towns which are in warm countries, where putrefaction comes on rapidly. In Turkey, and also in some parts of Egypt, it enjoys a sort of domestic life in this way. The birds are numerous, hovering about, or resting on the houses, and they are instructed so that they answer to a whistle, which is the signal for them to descend and clear the ground. Kites are seldom seen in or over towns in any part of Britain at the present day, but the case was different formerly, when less attention was paid to cleanliness. Not longer ago than the time of Henry VIII. numerous kites supplied the trade of scavengers in London; which trade was found a nourishing one for them, and a necessary one for the people. Indeed, in all countries where cleanliness is neglected in towns there is a necessity for scavenger birds, and for kites among the rest, which ceases when there is a better system of management; and in those towns of the east and south which are still subject to infectious diseases, there is no doubt that those diseases are rendered less frequent than they would be by the labour of those birds; and the rapid motion, the quick eye, and the ravenous appetite of the kite, conspire to render it one of the most serviceable of the whole.

But it is in the free air where it has scope, and its necessities require the complete exercise of its powers, that the kite appears to the greatest advantage; and therefore we shall quote a short description of it from Mudie's "Feathered Tribes of the British Islands." "The kite," says Mr. Mudie, "has, from the extent of its wings and tail, very great command of the atmosphere and possession of itself in that element. It does not beat along in straight lines, but wheels in curves, which it is constantly opening and closing, and always in a smooth and graceful manner, without any jerks; and if it were possible to trace a day's path of a kite, it would be a very fine specimen of looped curves. The kite can hover a long time over the same spot, with very little exertion of the wings, and though there is a fresh breeze; and there are times (probably when it has lost sight of some prize on the ground, or discovered that the prize over which it was hovering was no prize at all) at which it will 'give itself to the wind,' and drift to leeward in very beautiful style, and apparently with complete self-possession. Crows often do the same, especially upon the elevated moors, where prey is but scanty, and they have been long contending with the wind. Kites will also sometimes turn down the wind to escape the more powerful falcons, which, though they do not attack the kite, often frighten it, and make it lose its prey; and as going down the wind is not a habit of the falcons, the kite gets away from them by the manœuvre. That manœuvre, though held in great contempt by the falcon, is by no means an ungraceful or uninteresting one: the bird rides lightly on the wind, but retains its self-command, so that it can take a new direction whenever it pleases. The axis of its body is placed at an angle to the wind, which is smaller in proportion as that is stronger; and the windward wing is elevated, so that the wind takes the under at an angle, and tends to raise the bird obliquely upward while its weight presses downward and counteracts. When looked at, the bird always has, in these cases, the appearance of descending as it drifts. But that is an optical deception, for all things that are higher than the eye appear to descend as they recede, even though they are rising; and the kite may often be observed to have gained height, while thus appearing to float downwards. If on those occasions an alarm is given, the bird hauls closer to the wind and makes off."

The kite, from its peculiar appearance, and even from its predatory habits, is a bird which has attracted very general attention, and in consequence received no inconsiderable number of provincial names. One of the most common of these, and also one of the most descriptive of the general air of the bird, is the "glead," differently pronounced in different parts of the country; but always having the same name, being formed from the active participle of the verb to glide or slide along smoothly. But in many districts a qualifying epithet is thrown in; and it is styled the "greedy glead," the adjective being as expressive of its general appetite as the substantive is of its air and manner when floating on the wing.

Swallow-tailed Kite (*M. furcatus*). This is an American species, and has been sometimes described as a hawk, and sometimes as a kite. It is chiefly insectivorous; and its gliding habit and power of turning are certainly more rapid, though not so soft as those of the common kite of Europe; unlike that bird, however, it feeds on the wing, seizing in its

flight the larger insects which often crowd the trees in the American forests. In the capture of these, its action is very similar to that of the swallows; but as its size and power are both much greater, it has more dash about it; and a hen, seen on the wing, might perhaps be mistaken for some giant swallow in very different livery from what the rest of the race usually wear; yet the bill, the talons, the feathering of the legs, and the whole appearance of the bird, point clearly at the class to which it belongs. Wilson mentions that its favourite food is a species of lizard, remarkable for the rapid changes of its brilliant colour, and also of the little green snake which feeds upon this lizard. The one pursues the other to the remotest extremities of the twigs; and the kite, which is beating about, captures them both. According to Wilson, "the swallow-tailed hawk measures two feet in length, and upwards of four feet six inches in extent; the bill is black; cere yellow, covered at the base with bristles; iris of the eye silvery cream, surrounded with a blood-red ring; whole head and neck pure white, the shafts fine black hairs; the whole lower parts also pure white; the throat and breast shafted in the same manner; upper parts, or back, black, glossed with green purple; whole lesser coverts very dark purple; wings long, reaching within two inches of the tip of the tail, and black; tail also very long and remarkably forked, consisting of twelve feathers, all black, glossed with green and purple; several of the tertials white, or edged with white, but generally covered with scapulars; inner veins of the secondaries white on the upper half, black towards their points; lining of the wings white; legs yellow, short and thick, and feathered before half way below the knee, claws much curved, whitish; outer claw very small. The greater part of the plumage is white at the base; and, when the scapulars are a little displaced, they appear spotted with white. This was a male of perfect plumage. The colour and markings of the male and female are nearly alike."

There are several other species which have been noticed in different parts of the world, especially in southern Asia, Australia, and America; but they do not appear to differ greatly from the common kite in the more essential parts of their characters, so that very brief notices of them are enough for popular purposes.

Govinda Kite (*M. Govinda*). This species is found in the Deccan, and probably in most other parts of India. It has the head, neck, and under part of the body reddish brown, with dusky lines in the centre of the feathers; and the upper part brown, the tail much forked, and marked with obscure bars. It floats much about in the air, and is fully more daring than the European kite. The length of the body is two feet two, and that of the tail eleven.

The wedge-tailed kite is a native of Australia, and the Riocourt's kite is a species of the Cape.

KNIGHTIA (R. Brown). A genus of plants of which only one species is described, and found in New Zealand. It belongs to the fourth class of Linnæus, and to the natural order *Proteaceæ*.

KNOWLTONIA (Salisbury). A genus of curious herbaceous plants, natives of the Cape of Good Hope, belonging to *Ranunculaceæ*. They are cultivated in the green-house, and increased by seeds or by dividing the roots. They are allied to and resemble the genus *Adonis*.

KOALA. The pouched bear of the Australians (*Phascolarctos*), but more correctly expressed by its native name of koala. It is a marsupial animal, and rather peculiar both in its structure and its habits.

Koala.

It is an animal about the size of a middling dog, of very curious expression and formation in some of its parts. Its head is round, terminating in a distinct muzzle, formed for turning up the earth, and having the nostrils, in the point, with entire margins something resembling those in the hog. The eyes are nearly round, the ears a little pointed, covered with long hair, and having the opening turned toward the front. The body is rather clumsy in form according to the accounts, and by no means fitted for quick motion. The fore legs contain five toes on each, which act two against three, namely, the thumb and next one against the remaining ones. The metacarpal bones in those feet are very small, and thus the toes appear to spread out not very unlike those of a bird, to which they have also some resemblance in the shape of the claws, which are sharp and a good deal crooked, but not retractile. The hind feet have no claw upon the thumb, and those on the other toes are smaller than in the fore feet, while the toes themselves have not the opposite action of the fore ones. There are six incisive teeth in the upper jaw, of which the two in the middle are longer than the rest, and there are two in the under jaw. In some of the specimens which have been examined, there have been no canines in either jaw, whereas in others there have been small ones in the upper. There are four grinders with tuberculated crowns on each side of both jaws, and two false ones on each side of the upper one; but they are wanting in the under. The habits of the animal are obscure; but from the structure of its mouth, and its timid nature, it cannot be regarded as carnivorous. Insects, and probably also vegetable matters, form the chief part of its food. It is expert in climbing trees; for which purpose the particular structure of the fore feet, and the sharpness of the claws with which the toes of these are furnished, adapt it very well. It is also said to burrow in the ground, but its feet are by no means well suited for digging; and the probability is, that it takes up its abode in holes which it finds ready prepared. There is no want of such shelters in the woods of Australia, for most species of trees there are prone to get hollow, and very many of the smaller native animals take up their abodes in those hollows. The koala is, as we have said, an animal of mild manners, and the female is attentive to the young one, which it continues to carry about for a

long time after it is brought forth, the young being seated on the shoulders and neck of its parent, where it holds its place very firmly, and lives and reposes there, except when the mother suckles it, until it is strong enough for finding its own food. Not much is known of its disposition and habits, and it seems so peaceable a creature, that there is probably very little to be known. Indeed, all the native mammalia of New Holland, though they are singular, are inferior in the development of their system of sensation to those of every other part of the world, and their resources are so few, that they will gradually disappear as the country becomes more thickly peopled.

KURTUS. A genus of spinous finned fishes, belonging to the family with scaly fins, and occupying a place in the system intermediate between the dorees and the coryphenes. They are surface fishes, included in the very extensive family of the mackerel, which includes many of the fast swimming and richly coloured fishes of the tropical seas. Of the genus under consideration only one species is known, *Kurtus cornutus*, so called from a small curved horn which stands in front of the dorsal fin. The dorsal fins are not very long, but the ventral and anal fins are well produced. The scales over the whole body are so minute, that they cannot be observed upon the dried skin. They are very richly coloured, being silvery of brilliant lustre, with golden spots on the back. The pectoral fins are gold colour with red margins; and the remaining fins are very brilliant sky blue, bordered with yellow or with white. The body is very much compressed, and its cavity is remarkably short. The fish is rare, however, even in the tropical seas; while in those of the temperate countries there is not a specimen. It is not a large fish, never exceeding a foot in length, and generally not much more than six inches. Still it contributes, along with other nearly allied genera, of which the colours are also very brilliant, to give no small degree of interest to the water in the tropical seas; and as the water there is not only clear in most places, but much better illuminated by the more direct light of the sun, the brilliant colours of the fishes are shown off to great advantage as compared with any thing which we can witness near our own shores.

KYDIA (Roxburgh). A genus of East India trees, belonging to the class *Monadelphia*, and to the natural order *Byttneriaceæ*. It succeeds in our stoves, and is propagated by cuttings.

LABIA (Leach). A genus of dermopterous insects, having for its type the little earwig. See Forficula.

LABIATÆ. A large natural order, containing a portion of *Diandria Monogynia*, and the whole of *Didynamia Gymnospermia* of Linnæus. The plants of this order are characterised by their didynamous stamens, four little nuts or naked seeds, single style, and irregular corolla. They are mostly natives of extra-tropical countries, although under the form of *Hyptis*, *Anisomeles*, *Leucas*, *Ocymum*, &c.; they are found in the hottest zones of the world. Many are extremely odoriferous in the leaves; some bear handsome flowers; but a great number are only weeds.

This order, by some writers, is called *Menthaceæ*, and the strict adherence to the normal characters of this type must be obvious to every one. Indeed, so striking is their similitude, that Jussieu observed they might be considered as forming a vast but single genus; and to this uniformity of structure may perhaps be attributed their equally remarkable similitude in properties. None of the *Labiatæ* are poisonous, nor are any even suspected of being injurious; the betony is the most acrid of the whole. Scarcely any are used as ordinary food, although many form grateful condiments; the stachys and the basil being perhaps the only ones that are esculent as pot herbs. They are all more or less fragrant, most are sweet scented, but some are fetid. Their odours are in general owing to the essential oils which are secreted in abundance, and found in numerous receptacles on their leaves and stalks. M. Fee observes, that odoriferous plants exhibit three remarkable variations. In some the aromatic principle is free, and then it is dissipated by drying; this occurs chiefly in the tuberose and jasmine, and it is not communicable either to water or spirit, and seems to be artificially retained only by the aid of fixed oils; and occasionlly, as in the lily and narcissus, it cannot be retained at all. In some, the aromatic principle is in union with, or is peculiar to, the essential oil, with which the utricles or cryptæ are replete; and in this form it is miscible with water and alcohol, but scarcely with fixed oils. In others again, it is in combination with a resin, or gum-resin, and then it may be collected in concrete masses by wounding the plants, or if by distillation, it deposits camphor after standing for some time. The fragrance of the *Labiatæ* is dependent on an essential oil, or odoriferous principle of the latter kind, and their oil is remarkable for the quantity of camphor it contains.

LABIDURA (Leach). A genus of dermopterous insects, having for its type the gigantic earwig. See Forficula.

LABIO. A genus of molluses established by Ocken, but named by Lamarck Monodonta, under which it will be further described.

LABLAB (Adanson). A genus of plants chiefly tropical, some of which are cultivated for their pods and seeds in China, India, and Egypt. They are climbing annuals, and belong to the natural order *Leguminosæ*. This genus formerly belonged to *Dolichos*.

LABROIDEÆ—the Wrasse family. A family of spinous finned fishes, belonging to the grand division which have labyrinths in the bones of the pharynx. They obtain their name from the great enlargement of the lips, which form a sort of roll on each jaw, beyond which the teeth stand obliquely forward; and so remarkable is this character, that if one of the family has been carefully examined for only once, there is never any difficulty in distinguishing the other members of the family. The body is oblong, scaly, with a single dorsal fin, supported by spinous rays in the anterior part, and generally with a transparent membrane. There are three divisions of the pharynx, the two upper ones close on the bones of cranium, and the lower one larger than any of these; but they are always armed with teeth, which are sometimes placed like pavement, and at other times pointed, and on the margins of the laminæ. Their gill-lids are toothed, and the gills consist of five rays. The teeth in the jaws are conical, and those of the fore part the longest. The stomach is a simple cul-de-sac, but it joins the intestine without any cæcum. The air bladder is simple and very strong.

They are fish of average size, but very active in

their habits, and of that moderately elongated form which we are in the habit of associating with our common notions of a fish. They are found most abundantly on rocky coasts, and are in fact the rock fish properly so called, feeding upon crustacea and mollusca, which the peculiar form of their mouths enables them readily to pull down from the rocks, or otherwise to seize, while their strong teeth enable them to break even hard shells without difficulty.

They are found in the seas of almost every region of the globe, from the Equator to Greenland; but they are far more abundant in the warm seas than even in the temperate; and in the cold seas they are comparatively rare. Their flesh is, generally speaking, agreeable; but their haunts are too peculiar for admitting of their being commonly seen in the fish markets of Britain. They do not frequent the sandy or muddy bays, nor the banks upon which ground fishes congregate, but are confined to the clear water among the rocks; and, therefore, the bold shores of Cornwall are the places of the British seas where they are most frequently met with. The whole of them are dressed in splendid attire; their scales are as splendent as polished metals; and their colours have all the beaming lustre of precious stones when the light falls obliquely upon them. There are many fine species in the Mediterranean; but their grand resort is among the islands which stud the vast expanse of the Pacific; and some of the species which occur there are of extraordinary beauty. They do not all agree in every particular, so that it becomes necessary to divide them into sub-families, or at all events into genera.

We shall briefly mention the distinguishing characters of these genera, as the species are too many for our enumeration; and, having done so, we shall more particularly notice at least the leading ones which frequent the British seas.

First, *Labrus*, properly so called. They have no spines, nor marginal teeth to their gill covers, and no appendages to the tail; the cheeks and gill covers are furnished with scales; the body is oblong, and the lateral line is nearly straight. They are most abundant in the Mediterranean as European fishes; but they are also found as far to the northward as the coast of Norway.

Second, *Julis*, is readily distinguished from the former by having the cheeks and the gill covers with smooth skin, and without any scales; their lateral line is strongly bent upwards, toward the termination of the single dorsal fins. Several species are found in the temperate seas; but there are many more in the Pacific, and there they are remarkable for the richness of their colours. One very beautiful species belonging to this sub-division, occurs in the Mediterranean, the Archipelago, and also the Red Sea, always among the rocks and in clear water, so that the play of their rich colours can be seen to the greatest advantage. The general colour of its body is bright violet, marked along its side by a zig-zag band of brilliant orange, and having the dorsal and anal fins marked with three bands, the first yellow, the second red, and the last blue. It is but a small fish, seldom exceeding six inches in length; but its flesh is excellent, and it is easily taken with hook and line.

Third, *Crenilabrus*. These have the body oblong, with a single dorsal fin, supported anteriorly by very strong spines; and they have the margins of the gill flaps toothed, by which they are distinguished from the first sub-division; and they resemble that sub-division in the sides of the head, being covered with scales. Several of them are found in the Mediterranean, and some are celebrated for the quality of their flesh.

Fourth, *Coricus*. These resemble the third division in many of their characters; but they have the mouth a little protrusile. They are of small size, and some of them are met with in the Mediterranean.

Fifth, *Encilinus*, have the head scaly, and the scales of the tail continued in the basis of the rays. The lateral line is interrupted immediately under the dorsal fin. Some doubts remain as to the perfect correctness of this particular division.

Sixth, *Epibulus*. The character of these, by which they are chiefly distinguished from the others, is the form of the mouth, which is capable of being protruded to some length, in the form of a tube, by means of which they contrive to suck or draw into their mouths those small fishes upon which they feed. Some of these have the body shaped not unlike that of the carp, and they grow to the length of nine or ten inches, or sometimes nearly a foot. The lateral line is interrupted in the same manner as in the last specimen.

Seventh, *Gomphosus*, have the head entirely smooth, or without scales, and the muzzle produced into a tube with a small opening; there are but few species known, and these are inhabitants of the Indian seas.

We shall now notice one or two of the British species; because, from the singularity of their lips, and the beauty of their colours, they are interesting.

Ballam Wrasse (*L. maculatus*). This species, which is not by any means rare on our coasts, is in some places called the old wife, or old woman of the sea, and either the family are of inferior quality in our seas than they are in the Mediterranean, or our taste is different; for the flesh of this wrasse is so soft that the fish is hardly worth taking as a marketable article, the chief demand for it being from collectors and students. It frequents the deep holes among rocks, where it lies in wait among the sea weed, for those crustacea upon which it feeds. It is often a foot and a half in length, and weighs between three and four pounds. The colour varies both seasonally, and as it should seem in different individuals. Generally speaking it is red, passing into yellowish orange on the under part of the body, ornamented with spots of bluish green, and having the fins of the same colour spotted with red. It occurs in many parts of our rocky coasts, both on the east coast of the islands and on the west, but more abundantly on the latter, because it is more rocky. We quote a very accurate description of one, from Yarrell's excellent and accurate Natural History of British Fishes. "The length of the head," says Mr. Yarrell, "compared to the whole length of head, body, and tail, as one to four; the depth of the body alone equal to the length of the head; the lower edge of the scaly portion of the cheek rounded, the scales only half as large as those on the operculum; preoperculum without scales, the horizontal and vertical edges forming an angle somewhat obtuse, the ascending line being oblique, the margin entire; operculum broad, covered with large scales, and ending in a membranous projection over the upper part of the origin of the pectoral fin. The pectoral fin broad and rounded; the membranes connecting the rays of all the fins spotted with verditer, rather inclining to blue than green; the fin rays red-

dish orange, with six or seven scales in succession between each ray of the caudal fin. Back and sides bluish green, paler on the belly; all the scales margined with orange red, the margins varying in breadth in different specimens, and thus producing the prevalence of the blue or orange colour; six rows of scales between the lateral line and the middle portion of the dorsal fin. Head and cheeks bluish green, reticulated with orange red lines; lips flesh colour; about eighteen teeth in each jaw, conical, those in front the longest; the tail slightly rounded at the upper and under corner, the top dusky."

Green-streaked Wrasse (*L. lineatus*). This species sometimes makes its appearance upon the British shores, but very rarely; it is understood, however, to be the same species which is common in the Mediterranean, and known there by the name of the parrot fish. Its ground colour is a fine grass green, deeper on the back than in any other part, and passing into greenish yellow on the belly. There is a stripe of bright blue passing along each side from the head to the tail; but this is said to be a character of the male only, the female being uniformly green in all the upper part. The fins are also green. The body is rather lengthened, and more oval than the former species. The upper jaw is longer than the lower, and both jaws are furnished with teeth, those in the front being largest. It visits our shores, at least the shore of Cornwall, the only one on which it has hitherto been observed in the summer season; but it is little known even to the fishermen, and is a subject of curiosity rather than of use.

The blue-striped Wrasse (*L. variegatus*), is not so rare upon the British shores as the former, and it is pretty common on the south and east of Ireland. The general colour of the body and head is orange, varying from orange red to orange yellow, palest on the belly, and striped with bright blue on the sides. The eyes are orange and blue; the membrane which connects the first twelve rays of the dorsal fin is blue with an orange margin, and the remaining portion of that fin orange with blue spots; the rest of the fins are orange with blue tips. This one grows to the length of a foot, which is considerably more than the species immediately preceding. Different specimens are subject to considerable varieties of colour, but they are all very beautiful; indeed, in so far as colour is concerned, this is one of the most splendid fishes which occurs in any part of the European seas. In the Mediterranean, where its colours are finer than they are when it ranges into colder latitudes, it is sometimes called the peacock fish.

The Sea Wife (*L. vetula*). This species grows to rather more than a foot in length, and it has the caudal fin slightly rounded, though not more so than some of the others. The upper part of the back, the neck, and the sides, are blue of an intense colour, and sometimes passing into blackish purple on the middle of the back. It is marked also with bright orange, and the head has a tinge of flesh colour more or less intense. The irides are blue, and so also are all the fins, with the exception of the tips of the ventrals, which are black. This fish is described by some of the continental naturalists as being common on the coast of France, and ranging as far north as Norway; but if this be correct it must pass round the western side of Britain, as it is exceedingly rare on the British shores; and the opposite shores of the Netherlands and Germany are not suited to its habits.

The red Wrasse (*L. corneus*). This species occurs on many parts of the British coasts, and also on those of Norway and in the Baltic. The usual colours are fine orange red on the upper part, passing into pale orange on the under. A portion of the spinous part of the dorsal fin is rich purple, and two spots on the posterior part of the same fin, and a third one nearer the tail, are very deep purple. Four spots of very delicate rose-colour alternate with those three dark purple ones, and give a very striking character to the upper part of the fish, from the middle of the dorsal fin backwards. Its habits do not appear to differ in any important particular from those of the rest of the genus. Such are a few of those which occasionally occur on the British shores.

LABURNUM, is the *Cytisus laburnum* of Linnæus, one of the most beautiful and conspicuous flowering trees in this or any other country. It is said to be a native of Switzerland, and was introduced into this country as far back as 1596. It is scarcely necessary to add that it belongs to *Leguminosæ*.

LAC INSECT. A small annulose animal, inhabiting the East Indies, belonging to the genus *Chermes*, of which the female is large, unwieldy, and destitute of wings; and the male small, provided with two wings, and a pair of slender filaments arising from the extremity of the abdomen. It derives its specific name, *Chermes Lacca*, from the substance called lac, which is found upon several trees and shrubs in the East Indies, and which is of considerable use in various manufactures, being employed in its manufactured state in the making of sealing wax, varnishes, &c.; it is also the basis of the French polish, and is used in manufacturing waterproof hats. Dr. Roxburgh has published a detailed account of this insect and its production, in the Philosophical Transactions of the Royal Society. "Some pieces of very fresh-looking lac," observes this author, "adhering to small branches of mimosa cinerea, were brought to me from the mountains. I kept them carefully in wide-mouthed bottles, slightly covered; and fourteen days from the time they came from the hills thousands of exceedingly minute red animals were observed crawling about the lac and the branches it adhered to, and still more were issuing from small holes on the surface of the cells. By the assistance of glasses small excrescences were also observed interspersed among these holes, two regularly to each hole, crowned with some very fine white hairs, which being wiped off, two white spots appeared. The animals, when single, ran about pretty briskly; but in general, on opening the cells, they were so numerous as to be crowded over one another. The substance of which the cells were formed cannot be better desribed, with respect to appearance, than by saying that it is like the transparent amber of which beads are made. The external covering of the cells is about the twenty-fourth part of an inch in thickness, it is remarkably strong and able to resist injuries; the partitions are much thinner. The cells are in general irregular squares, pentagons, and hexagons, about an eighth of an inch in diameter, and a quarter of an inch deep; they have no communication with each other. All those opened during the time the animals were issuing from them, contained on one side, which occupied half the cell, a small bag, filled with a thick jelly-like red liquor, replete with what I take to be the eggs. These bags adhere to the bottom of the cells, and have each two necks, which pass through holes in

the outward coat of the cells, forming the excrescences we have mentioned, ending in some fine hairs. The other half of the cells have a distinct opening, and contain a white substance, like a few filaments of cotton rolled together, and a number of the little red insects themselves crawling about ready to make their exit. Their portion of each cell is about one half, and I think must have contained nearly one hundred of these animals. In other cells less forward I found a thick red dark blood-coloured liquor, with numbers of exceedingly minute eggs, many times smaller than those found in the small bags which occupied the other half of the cells." In the preceding account it is evident, from the close relationship existing between the lac insect and the common species of coccus of our own country, that the cells above described were in reality the female insects, whose bodies serve as a covering for the eggs in our species, which are enveloped in a kind of cottony secretion, in the midst of which the young insects just hatched may occasionally be found, and the "minute red animals" were unquestionably the larvæ of the lac insect, of which the development of the males, furnished with wings, &c., is perfectly analogous to that of the coccus adonidum; whilst, on the other hand, the female, as it advances in age, loses its activity, and becomes a shapeless mass. We give this explanation, although Roxburgh has shown the transformations of what he terms the female, but which we do not hesitate to state is the male insect; and this is the more important, because the male insects contribute in no degree to the producing the material called lac.

Lac is known as an article of commerce under three distinct names: stick lac, which is the original state in which it is found adhering to the twigs; seed lac, from which the red colour has been extracted, by immersion in water; and shell lac, which is produced by melting the seed lac, and straining it through cotton bags over a charcoal fire, and then spreading it out into thin plates. The red colour extracted, when the stick lac is made into seed lac, is employed in dyeing; it is less brilliant than cochineal, but more durable.

A curious use is made of this material in India, by forming it into grinding stones, in the following manner: "Take of river sand three parts, and of seed lac washed one part, mix them over a fire, and form the mass into the shape of a grindstone, having a square hole in the centre, cement it to an axis with melted lac, heat the stone moderately, and while revolving rapidly on its axis it can be easily formed into a circle." Polishing grindstones are also formed by mixing two parts of sand, passed through fine muslin, with one of lac; these cut very fast. The same composition is formed upon sticks, for cutting stones, shells, &c. by the hand.

LACHENALIA (Jacquin). A genus of beautiful bulbous plants, natives of the Cape of Good Hope. The flowers are hexandrious, and the genus stands in the order *Asphodeleæ*. Generic character:—calyx of six petals, bell-shaped; exterior petals shorter than the outer, often callous at the point; stamens joined to the base of the petals; filaments awl-shaped; anthers oblong; style awl-shaped; seed-vessel three-sided, three-celled, and full of seeds. The *Lachenaliæ* are green-house plants, thriving in sandy loam and leaf, or moor-earth, requiring no water when dormant, but a due quantity while growing. They may be increased by offsets or seeds.

LACTUCA (Linnæus). A genus of annual and biennial herbs, many of which are eminently useful as salad and culinary plants. They belong to *Compositæ*. The very many varieties of lettuce now cultivated in our gardens, shows the genus has been long in cultivation. Indeed the annals of botany give no certain account either of its introduction into Britain, or of what country the best sort is a native. The *Lactuca* was known to Pliny, and no doubt was brought to this country by that author's countrymen.

Nothing can be easier than the cultivation of this salad herb. There is certainly some skill required in having a constant supply throughout the year, because the summer-sown plants are not hardy enough to stand the frosts of winter, and therefore require to be kept in glass frames; but all the spring sowings come to great perfection, if the ground on which they are sown or planted be moist and rich. It is good management to sow a little seed in every month of the year, whence supplies of plants are drawn for transplanting at every favourable season. For the earliest spring crops, the seed should be sown under glass in the autumn; and when the seedlings are large enough, they are dibbed out on well-prepared ground as soon in the spring as the state of the weather will permit. Successive sowings and transplantings continue the supply throughout the summer and autumn months.

Cabbage lettuce is much required in French cooking; and to obtain this in the winter, it is raised on hot-beds. For this purpose, the seeds of the largest growing white kinds are sown on a warm border in August and September. Substantial hot-beds are made soon after, covered with a frame and lights, and a good thickness of rich compost. On this lettuce plants are put at one foot distance from each other, and as near the glass as possible. Here the plants spread and grow luxuriantly; and by the time the bed gets too cold, the lettuce is all used; other beds being made in the meantime, continue the supply. The upright growing sorts, fit for salads, are called *coss*, and those for stewing are called *cabbage* lettuce.

LADY-BIRD. The common English name for a pretty little coleopterous insect, known systematically under the name of *Coccinella septem-punctata*, Linnæus. See COCCINELLIDÆ.

LÆMODIPODA (Latreille). A singular order of crustaceous animals, belonging to the second subsection *Edriophthalma* (or those with eyes not placed upon foot-stalks) of the hard-shelled section (*Malacostraca*). These curious insects are of small size, and have the body in general narrow, elongated, or linear, composed of eight or nine joints, with the abdomen rudimental and furnished with several small anal appendages. They have four simple setaceous antennæ arising from a three-jointed foot-stalk, the mandibles are not furnished with palpi, the legs terminated by a strong hook, except the third and fourth pairs in some species, which are nearly rudimental. Unlike the other *Edriophthalma*, however, they appear to respire by means of several vesicles placed at the base of the four pairs of legs, commencing with the second or third pair, including those of the head, which latter represent the four anterior foot-jaws greatly developed. No other respiratory organs have been observed. The females, at least in the genus *Cyamus*, carry their eggs beneath the second and third segments of the body, in a kind of pouch formed of approximating scales. They are all marine; according to Savigny, they approach the *Pycnogonides*, and thus lead the way from the *Crustacea* to the *Arachnides*.

The order is divisible into two families :

1. *Cyamidæ* (*Ovalia*, Latreille). Having the body oval, with transverse segments, and containing the single genus CYAMUS, which see ; and
2. *Caprellidæ* (*Filiformia*, Latreille). Having the body long and slender, and the segments longitudinal. See CAPRELLIDÆ.

LAGENARIA (Schreber). A genus of creeping annuals, natives of India, called, from the shape of the fruit, the "bottle gourd." They belong to the natural order *Cucurbitaceæ*, and of course are closely allied to the common gourds, melons, cucumbers, &c. The shells of the fruit are converted into many kinds of vessels for domestic uses. They may be raised on hot-beds, in this country, as a curiosity, if required.

LAGERSTRŒMIA (Linnæus). A genus of beautiful flowering shrubs, natives of India. Class and order *Polyandria Monogynia*, and natural order *Salicariæ*. Generic character :—calyx in six divisions, with two bractea at the base ; lobes distinctly sinuated ; petals six, and clawed, inserted into the throat of the calyx ; stamens inserted into the tube of the calyx ; filaments filiform ; anthers oval and incumbent ; capsule surrounded by the calyx, three to six-valved, three to six-celled, containing winged seeds. This, the *L. Indica*, is one of the most ornamental shrubs of its native country. They flower frequently in our stoves, though but feebly. They, however, flower beautifully if planted in the open air, against a south wall, and securely defended against the frost of winter. They are increased by cuttings.

LAGRIA (Fabricius). A genus of coleopterous insects, belonging to the section *Heteromera*, subsection *Trachelides*, and family *Melandryidæ*, of Leach, but forming, according to Latreille, the type of a distinct tribe, *Lagriariæ*, having the body elongated, narrowed in front, with the thorax sub-cylindric or square, the antennæ simple, filiform, or gradually thickened, and inserted in a notch in the eyes, with the last joint longer than the preceding, especially in the males, the tibiæ narrow, and the fourth joint of the tarsi bilobed ; the body is soft, and the elytra flexible. They reside in hedges and woods, and counterfeit death on being touched. There is only a single British species, *Lagria hirta*, which is very common in the early summer month.

LAMBERTIA (Smith). A genus of New Holland evergreen shrubs, named in honour of A. B. Lambert, Esq., V. P. Lin. Soc. of London. They belong to the fourth class of Linnæus, and to the natural order *Proteaceæ*. Generic character :—involucrum coloured, one to seven-flowered ; receptacle plain and naked ; calyx tubular and four-cleft ; stamens inserted in the clefts ; four scales below the germen, either distinct or united ; stigma awl-shaped ; folliculus one-celled ; seeds margined. The *Lambertias* are treated as green-house plants, potted in light sandy loam and moor-earth, are impatient of too much water, and may be propagated by cuttings planted in sand.

LAMELLIBRANCHIATA. De Blainville's third order of the third class of malacology. The molluscs constituting this order are formed, in many respects, similar to the *Acephalophora ;* but their branchiæ are shaped like large semicircular leaves symmetrically disposed on both sides of the animal's body ; two pairs on either ; their position is between the abdomen and the mantle ; the mouth is large, and transversely placed between two lips, terminated by sub-branchial appendages.

The shell of these animals invariably consists of two parts or valves placed on either side of the body, lying more or less upon each other, and closed or opened by means of a ligament and adductor muscles.

LAMELLICORNES (Latreille). A very extensive tribe or subsection of coleopterous insects, belonging to the section *Pentamera*, and corresponding with the Linnæan genera *Scarabæus* and *Lucanus*. In this group, which was placed by Linnæus and Fabricius at the head of the insect tribes, are comprised some of the most gigantic species, such as the hercules and elephant beetles. The various species figured in our plate of BEETLES, together with the cockchaffer, rosechaffer, shardborne beetle, and a vast number of others to which no ordinary names have been assigned, are also lamellicorn beetles—a term indicating the principal character of the subsection, derived from the structure of the antennæ, which are always short, composed of nine or ten joints, and always terminated by a club generally formed of the three last joints, which are in the form of narrow plates laid one against another like the leaves of a book, capable of opening to a considerable width ; sometimes, however, the joints of the club of the antennæ are much more numerous ; and in others the outer plates of the club are so shaped that they form a sort of box, within which the central plate is shut up. These organs are inserted in a deep excavation beneath the lateral margins of the head. The body is generally ovoid, oval, or rounded ; the outer edge of the anterior tibiæ is toothed ; and the joints of the tarsi, except in some males, are entire, and unprovided with cushions on the under surface ; the interior part of the head is often produced into a shield over the mouth ; and the mentum is occasionally very large, entirely closing the mouth from beneath. The mandibles, in certain of the dung-feeding species, offer a peculiarity not to be observed in any other coleopterous insects, that of being membranous. The males generally differ very greatly from their partners in the extraordinary horns with which the head and thorax are often provided, of which some examples will be seen in our plate of BEETLES, and in our article DYNASTES, wherein the figure of *D. hercules* has accidentally been turned with the back downwards. It is a curious circumstance, that these cornuted male insects are generally of a much larger size than the females, whereas in the generality of insects the contrary is the case.

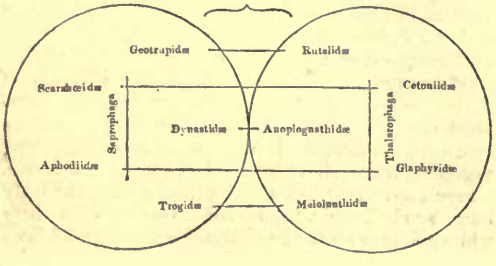
As regards their size, the singularity of their forms, and the brilliancy of colour of many of the species, they are amongst the most conspicuous of the beetles. It is, however, only to those species which feed upon living vegetable substances in their final state that the last remark may be applied, since many of the species which feed upon vegetable matter in a state of decomposition, and especially such as frequent the excrement of animals, are generally of a dark brown or black colour. Some exotic coprophagous species are, however, as splendidly coloured as the phyllophagous species. From the large size of many of these species, and especially of those inhabiting tropical climates, it must be evident that they must be eminently serviceable in clearing away decomposing vegetable matter, in which the larvæ in general reside. These larvæ are thick fleshy grubs, having the body long, semicylindric, transversely rugose, of a dirty white colour, with the head armed with powerful jaws

for biting, and other parts of the mouth and two antennæ. The body is composed of twelve rings, of which the last is the largest, and to the first three of which six scaly legs are attached; each side the body is furnished with nine spiracles; the extremity of the body is rounded and generally curved towards the breast, so that the back being convex or arched, the larvæ cannot conveniently stretch themselves in a straight direction; they consequently crawl but badly, constantly tumbling to one side or the other; but the legs of these larvæ are not walking legs, neither do their habits and localities require any such powers; so that the apparently awkward form of the body is seen, when these are taken into consideration, to be not so unnatural as was at first supposed. They feed upon dung, manure, rotting bark, the roots of vegetables, &c.. so that being in the midst of their food, powerful locomotive organs would be useless. Still legs are needed in order to enable the larvæ to make their way through the food. An idea may be obtained of the general form of these grubs from the figure of the preparatory stages of *Cetonia*, given in the article Cetoniidæ, or that of the larva of *Trichius*, figured in the article Insect; sometimes, as is the case with the larva of the cockchaffer, considerable damage is produced by their ravages. In some species the larva state extends for three or four years, at the expiration of which they form, in their retreats, an oval or elongate cocoon, composed of earth or the remains of the materials which they have devoured, and which they agglomerate together with a secretion which they emit for that purpose.

The nervous system of these insects, as considered in the larva and imago states, is subject to very remarkable variations, the ganglions being less numerous, or rather the greater number being confluent in the perfect state; the two posterior emitting a great number of elongated filaments, disposed like rays. The digestive system, as in all herbivorous insects, is considerably elongated.

In the new edition of Dejean's Catalogue, we find 2060 species of lamellicorn insects noticed; of this number, scarcely more than a twentieth part occur in this country, and of these the majority are of small size; but in our native list are to be mentioned the cockchaffer and stag-beetle, two of our largest coleopterous insects. But those are comparatively of small size, when placed in contrast with some of the exotic species. This group of insects has formed the subject of a most elaborate treatise by Mr. MacLeay, forming a portion of the Horæ Entomologicæ, by whom the intimate relation of the *Histeridæ* with the *Lucanidæ* (*Recticera*, *Thalerophaga*, MacLeay) was proved, and by whom the *Petalocera*, or that portion of the lamellicorn beetles corresponding with the Linnæan genus *Scarabæus*, was divided and arranged as follows.

Petalocera.



By this diagram, which in some degree illustrates the quinarian views and theory of Mr. MacLeay, it will be seen that the *Petalocera* are divisible into two groups, named *Thalerophaga* and *Saprophaga*, from the difference in their habits, the former feeding upon leaves and the latter upon moist decaying vegetable matter; that each of these two groups is divisible into five families; that these five families are allied together in such manner that they form a circle; and that the opposite families in each circle offer certain resemblances of analogy not only from the general form of the species, but also from the structure of the mouth, and consequently in the manner of living.

The following are the characters of the ten families into which Mr. MacLeay divides the Linnæan *Scarabæi*, with their corresponding groups according to Latreille. We shall defer our observations upon the lucanideous portion of the *Lamellicornes*, until we arrive at the article Lucanus.

Petalocera, Dumeril; Scarabæus, Linnæus; antennæ not elbowed, with a lamellate club; mandibles generally concealed.

A. *Saprophaga.*—Legs strong, the posterior pair remote, tibiæ broad, elytra often covering the anus.

* Coprophagi, dung feeders; maxillæ with membranous lobes, and therefore living upon juices, and as it were by licking their food.

1. *Geotrupidæ*, MacLeay (*Arenicoles geotrupides*, Latreille); mandibles corneous porrected; feed upon moist excrement; reside under dung or in boleti; digging under ground.
2. *Scarabæidæ*, MacLeay (*Coprophagi scarabæides*, p. Latreille); mandibles membranous, concealed under the clypeus, palpi hairy with the last joint small; feed upon moist excrement; reside in dung; fly in the twilight.
3. *Aphodiidæ*, MacLeay (*Coprophagi scarabæides*, p. Latreille); mandibles membranous, concealed, palpi naked with equal sized joints; feed upon moist excrement; reside in dung; fly in the sunshine.

** Xerophaga, feeders upon rotten vegetable matter; maxillæ horny, and therefore live on a more solid species of food, and by mastication.

4. *Trogidæ*, MacLeay (*Arenicoles trogides*, Latreille); maxillæ with two lobes, and a corneous curved tooth, anus covered; live in sandy places; feed on putrid matters.
5. *Dynastidæ*, MacLeay (*Xylophili*, p. Latreille); maxillæ dentate or unarmed, with one lobe, anus naked; feed on wood; reside in rotten wood, or under bark.

B. *Thalerophaga*, legs more slender, tibiæ narrower, elytra seldom covering the anus.

* *Phyllophaga*, leaf-eaters; maxillæ corneous.

6. *Anoplognathidæ*, MacLeay (*Phyllophagi*, p. Latreille); maxillæ dentate or unarmed; labrum triangular.
7. *Melolonthidæ*, MacLeay (*Phyllophagi* †, p. Latreille); maxillæ dentate; labrum linear or emarginate.

† There is an evident error relative to this group in the Règne Animal, second edition, vol. iv. p. 558, line 1, where the *Melolonthides* are referred to the *Xylophili* instead of the *Phyllophagi*.

** Anthobii, feeding on sap or the nectar of flowers; maxillæ with membranous lobes.

8. *Glaphyridæ*, MacLeay (*Anthobii*, Latreille); mandibles concealed under the clypeus, corneous, labrum exserted; probably biting the petals of flowers.

9. *Cetoniidæ*, MacLeay (*Melitophili*, Latreille); mandibles concealed under the clypeus, membranous; labrum covered by the clypeus; sap or honey feeders.

10. *Rutelidæ*, MacLeay (*Xylophili*, p. Latreille); mandibles porrected, corneous; habits unknown.

LAMIA (Fabricius). A very extensive and handsome genus, or rather sub-family, of coleopterous insects belonging to the section *Tetramera*, and sub-section *Longicornes* (*Cerambyx*, Linn.), having the labrum visible, extending across the entire breadth of the head; the jaws of moderate size, and alike in both sexes; the outer lobe of the maxillæ narrowed at the tip, and bent over the internal lobe; the eyes always notched and the head always vertical, with the face flattened. Latreille and Serville introduce into this sub-family, which they named *Lamiariæ*, the genus *Saperda*, and many Fabrician *Stenocorus*. And in the Annales de la Société Entomologique de France, for 1835, is given an entire revision of the whole sub-family, wherein no less than fifty-three generic groups are described. So little is, however, known or described by authors beyond merely structural details, that it would be useless to give a list of the names of these groups without their characters, and these latter would not enter into the plan of our work: we must therefore refer to our article Cerambyx, wherein we have treated of these insects with reference to their more general characters and habits in conjunction with the *Cerambycidæ*.

LAMIUM (Linnæus). A genus of European annual and perennial herbs, commonly called archangel. The flowers are didynamous, and belong to the *Labiatæ*. A few of the annual species are admitted into the flower garden, but the generality are worthless weeds.

LAMPADIA. A genus of molluscs established by de Montfort and now united to that of *Lenticulina*. They are microscopic shells, and from that cause frequently undiscovered.

LAMPREY (*Petromyzon*, that is, stone-sucker, from the habit of the fish in attaching itself to stones by means of its mouth). A genus of cartilaginous fishes with fixed gills, of which the following are the leading characters. There are seven gill openings on each side, on which account the lamprey is sometimes vulgarly designated the "nine eyed eel." The skin on the upper and under part of the body is elevated or produced into a sort of ridge, which to a certain extent serves the purpose of a fin; but it has little or nothing of the structure of a true fin, there being scarcely any traceable fibres in it; to say nothing of regular rays such as those which are found in the fins of more characteristic fishes; but that very flexibility of the skeleton, arising from the absence of salts of lime to which the absence of distinct bones and jointed articulations is owing, contains in itself a good deal of compensating power, by enabling the animal to bend its body readily, and thus turn the successive flexures into which it is bent into a means of progressive motion through the water, which, though not so rapid as that of those fishes which gain a momentum at once, is far less fatiguing in the performance. It is highly probable too that the breathing by means of fixed gills is a much less laborious operation than breathing with gills which are free, and which require the constant use of a complicated muscular apparatus. The particular mode of breathing in the lamprey, and indeed in the whole family *Cyclostomus*, "round mouth"—that is, having the mouth formed into a real sucker, by means of which the animals can adhere to that on which they feed, and feed at the same time—is not very well understood in the whole of its details; for though it is not probable that the respiration is suspended always when the animal thus adheres, yet it is not easy to see how a circulation of water, so as to bathe the branchial appendages in the walls of the cells, can be carried on. Lampreys, however, live both in the sea and the fresh waters, and are very tenacious of life. There are one or two species, and probably there may be more of fishes which are so obscure in many of their habits.

The Lamprey, or Sea Lamprey (*P. marinus*), is found in the seas of all the temperate parts of the northern hemisphere, and to a considerable distance eastward in the Mediterranean; but it does not reach the seas of the Greek peninsula. Whether the current of cold water which sets southward from the Black Sea, and which, during the melting of the snow on the southern Alps is also rolled down in great volume by the Po, may prevent the appearance in those seas of a fish whose sense of temperature is understood to be delicate, it is not easy to say; and, indeed, the physical causes of the geographical distribution of fishes are matters of which we know but little. It is found on the shores of Spain, France, and England, and those of Europe as far north as Norway. It is also found on the opposite shores of America, and in the northern part of the Pacific. The lamprey grows to the length of at least three feet. Its motion very much resembles that of a serpent, only it is more in the horizontal plane, and the body of the fish is remarkably light and flexible. The skin is soft and covered with a viscous secretion, and by many the flesh is highly esteemed. Those who are most recherche in this fish, and it has been a favourite with epicures for a very long time, consider it as in highest condition when the fish begins to ascend the rivers for the purpose of depositing its eggs. The Romans, during the progress of that excessive and unphilosophical luxury which ended in their downfall, were particularly fond of this fish; and in the spring, when it was first found in the mouths of the rivers, a lamprey of moderate size used to sell in Rome for ten pieces of gold. The skeleton of the lamprey, which is a very rudimental cartilaginous imitation of a vertebral column, shows some remarkable seasonal changes. When the animal begins to ascend the rivers, it is so gelatinous and soft as to be hardly distinguishable; but when the lamprey has been for some time in the fresh water, the skeleton becomes a much more firm cartilage, and loses the transparency which it had at the first, when at the same time the flesh has degenerated very much in quality.

The River Lamprey (*P. fluviatilis*), is a smaller species than the former and abounds in the fresh-water lakes and rivers of the northern countries; though it is not very clearly ascertained whether it in every situation migrates beween the fresh waters

and the sea; that it does so in many instances is is certain, and the probability is, that it may do so in all. It is therefore scarcely correct to call the one the sea lamprey, and the other the river one, because both visit the rivers and the sea alternately. The larger one is marbled with brown, yellow, and black; and the smaller one is bluish on the upper part and silvery below; and while the first grows to the length of three feet, the other is rarely found measuring twenty inches in length. They both ascend the rivers about the same time, however, only the smaller one resorts to smaller streams, so that it is much more frequently seen than the large one, and seen in fresh water. The time of their ascending varies of course with the latitude, the season, and the character of the water which the river discharges at the time. But it is always in the early part of the year, that is, about March or April; and as there are many rivers which are full of snow water at such seasons, it is highly probable that this coldness of the water may be one of the reasons why the larger one especially does not ascend them. They return again to the sea about midsummer; and on their descent, and for some time previous to it, they are not sought after as food, and, indeed, they are not wholesome. After they betake themselves to the sea, their manners there are very little known, because there is little inducement to seek after them until they return to the fresh water the next season.

The mouth of the lamprey, whether of the larger or the smaller kind, is a curious structure. The sucker by which it adheres, consists of a border outside the lips, representing on its outer circumference a row of conical papillæ, and within them several rows of smaller fibres. This forms a perfect adhesion to the surface, without interfering with the action of the parts within, which compose the mouth, properly so called. Those parts consist of the true lips, which are the real sucker, for the external part only adheres, but draws no nourishment. Besides the lips, there is an abundant provision of teeth; two of them are fast, the upper one having two points, and the lower one seven, and it is probable that these are the instruments by which it first wounds the animal on which it feeds. There are other teeth, however, which are moveable and smaller than these, and there are minute teeth even upon the tongue; so that the mouth is well armed, and can tear and grind down a pretty strong substance, so as to extract the nutritious matter that it may contain. What the lamprey does chiefly eat is not accurately known, but there does not appear to be much truth in the accounts which are given of its fastening upon the legs and feet of horses and cattle when they are fording the rivers. Its food must, however, be some succulent substance, because its digestive organs are remarkably simple; and though, we cannot state it as an absolute fact, that simplicity in an organ is an invariable sign that that organ has an easy task to perform, yet it is so in many cases. There is still a smaller river lamprey, which does not exceed eight or ten inches in length; but as it resembles the last mentioned one in colour and in manners, and frequents the same places, it is probable that it may be only the other in an early stage of its growth, and not a separate species.

The *Lampern*, or pride, has been already noticed in the article Ammocetes, so that it is unnecessary to make any particular reference to it here, though it is closely allied to the more typical lampreys. It is, however, more exclusively a river fish, and more of a mud fish than the lamprey; but it is not thicker than the barrel of a goose quill, and only five inches in length; it stands accused, however, of sucking the blood of other fishes by adhering to their gills, and though the fact is not by any means clearly made out, it is certainly not impossible. Reprisals are made, however, upon the lampern, not by the fishes of course, but by the fishermen, who eagerly seek for them as bait for their hooks; and as the fishes in the very places where they are supposed to commit their depredations, take them more readily than almost any other bait, it is not very probable that they could reach the gills of the same fishes, so as to do serious injury while the fishes remained at freedom to watch over and protect their own interests.

It is certain, however, that the Hag (*Myzine*), which is a still softer animal than the lampern, contrives to enter the mouths of fishes while fast on the lines, and extracts their substance by sucking, so as to reduce the fish to little better than an empty skin; but the hag inhabits the sea, and swims in the free water over the fishing banks, while the lampern is rarely found out of the mud and sludge at the bottoms of the rivers. It is said that it is found only in the waters of certain clay formations which are peculiar, and which contain a vast deal of the remains of the shells of mollusca; but whether the clay may have a power of retaining the nutritious substance of the inhabitants of those shells, is a matter not easily ascertained. It is possible that there may be some quality of this kind; for travellers not unworthy of credit mention tribes of the natives of South America who subists upon clay, and scarcely any thing else, for a longer period of every season than they could possibly exist without food.

LAMPRIAS (Bonelli). A pretty genus of carabideous beetles, belonging to the sub-family, *Brachinides*, and distinguished by their bright and contrasted colours; they are of small size, and reside in hedges.

LAMPYRIDÆ (Leach). A family of coleopterous insects belonging to the section *Pentamera* and sub-section *Serricornes*, having the body oblong and depressed, and of a soft consistence; the antennæ rather short and serrated; the palpi thickened at the tips; the thorax semicircular, or nearly square, concealing the head; the mandibles small, acute, and curved, and the penultimate joint of the tarsi bilobed. This family has for its type the common glow-worm, of which we have already given full details in its alphabetical place.

M. Laporte has lately published an elaborate revision of this extensive family in the Annales of the Entomological Society of France, in which he has proposed many new genera. He, however, restricts the family to the true glow-worms, which have the antennæ inserted close together at the base, the head not produced into a snout, and concealed by the thorax, and the eyes of the males are very large, and which possess luminous powers. The typical genus, *Lampyris*, is distinguished by the apterous condition of the females. Latreille, however, introduces into the family several other groups, namely, *Lycus*, and some other genera having the head exposed and produced into a deflexed snout, and both sexes possessing wings; *Drilus*, having the antennæ widely separated at the base, the head not rostrated, the eyes of moderate size in both sexes, and the females wingless; and *Telephorus* and several other genera, having the antennæ widely apart at the base, the

head not rostrated, the eyes of moderate size; the females winged, and the maxillary palpi but little longer than the labial. The last-named insects are commonly called soldiers and sailors by children.

LANIOGERUS. A genus of naked molluscs established by De Blainville from a specimen existing in the British Museum.

LANISTA. A genus of molluscs so named by De Montfort, but united with the genus *Ampullaria* by modern authors.

LANIUS—shrike, or butcher-bird. A genus of insectivorous birds, belonging to Cuvier's dentirostral order of the great family *Passeres*, and taking the lead in that order as being the nearest to the birds of prey; and though, generally speaking, insectivorous in their feeding, yet occasionally preying upon smaller birds, which they kill by striking on the head or pinching the neck, and afterwards they hew open the skull and devour the brain of their victim. The general characters are: the bill stout, very much compressed, of mean length, straight in the basal part, but curved toward the tip of the upper mandible, and furnished with a decided tooth; the base of the upper mandible beset with stiff hairs, which are pointed forward; and the under mandible straight, and having a notch answering to the tooth of the upper one. The bill is thus decidedly a carnivorous bill, although it differs from the bills of the diurnal birds of prey in not being curved from the base. The nostrils are placed laterally at the base of the bill, round in their form, and half closed by an arched membrane. The feet have four toes, entirely divided, or free to their bases, three turned to the front and one to the rear, the middle toe being shorter than the tarsus. The first quill of the wing is of moderate length, and the second shorter than the third and fourth, which are the longest. The wing is thus rounded in its termination, and consequently much better adapted for ascent and descent, or short and vigorous flight, than for continuous motion through the air. This agrees with the habit, which is that of subsisting on the largest insects, such as those beetles which in the perfect state are so injurious to the leaves of trees, and of which the larvæ, as inhabiting the earth for more than one year, are peculiarly destructive of the roots of the greens, and sometimes in the absence of those birds, which Providence has set over them to regulate their numbers, completely destroy the grass on the meadows, and the crops of corn in the fields. The shrikes do not attack the larvæ; for they are not, in any sense of the word, ground feeders: but they are exceedingly vigilant in attacking and destroying the full grown insects; and in doing this, they are perhaps of more service to the cultivator than the rook, which is the grand enemy of the larvæ. The shrikes are found about hedges and coppices, where they fly low, and hawk upon the wing for their food; and some of them, at least, have the habit of sticking upon the thorns the bodies of many of those insects which they capture, probably for the purpose of returning to eat them at their leisure. They seldom, if ever, attack birds larger than themselves, or any birds, indeed, which are in vigorous health at the time; but they are very prone to make prey of sick birds, and also of young ones. They have, in fact, the same sanguinary disposition as the regular birds of prey, only they are not so strong, or so powerfully armed. They are exceedingly courageous, and pursue their prey with most persevering industry. As is the case with predatory birds generally, the pairs evince great attachment for each other, and the parent birds equal attachment for the family. When the young are in want of food, the old birds are more than usually rapacious, and will attack young rabbits, which they despatch by striking on the posterior part of the skull with their bills, and then carry them to the nest. They prefer, however, the insect prey already alluded to; and the places which they frequent are marked by the exuviæ of the larger insects stuck upon the thorns of the hedges. Their flight is rapid, but very irregular, consisting of a succession of leaps. They live in families; and their cries to one another are shrill and piercing, though many of them have softer notes when they are flying singly in pursuit of their prey. Their nests are generally made in trees, the external fabric being neatly constructed of withered stems and fibres, and the interior lined with wool and other soft matters. There are a great many species enumerated by writers on ornithology; but the line of distinction between them and the thrush family, which they resemble in many respects, though they differ from them in others, is not very clearly drawn. We must content ourselves with noticing a few of the more remarkable.

Great ash-coloured Shrike (*L. excubitor*). This bird, from the number of names which it has acquired, must have drawn very considerable attention. It is called the grey shrike, the great butcher bird, the murdering bird, the French pie, and a number of other names; while the Americans, in some places, call it the nine killer, and in others white whisky John; the first name having allusion to the number of prey that it seizes, and fastens on the hedges before it eats any; and the second to the rapid and whisking nature of its flight. This species is ash and grey on the upper part, white on the under; the tail, except the side feathers, which are white, is of a black colour, as is also the eye streak. The colours are, however, subject to very considerable variations; for some are found almost entirely white, and others are of all shades between the common ash and grey, and a white colour. The female, which is of the same size with the male, retains one of the external characters of the birds of prey, at least in part; for the dull white on the under part is, in that sex, marked with semi-circular lines of a dusky colour, not unlike the markings on the under part of some of the hawks. The bill is of a black colour, very strong, considerably hooked at the tip, and having the notch or tooth very prominent. The gape, and over the nostrils, is beset with stiff bristles; but there is not even a rudiment of that cere which is characteristic of the true predatory birds. The tail is even at the end, and consists of twelve feathers. The legs and feet are black; and the irides are of a dusky colour. The length, both of the male and female, is about ten inches; and the extent of the wings is about fourteen.

The singular habit which this species of shrike, more than any of the others, has of sticking the remains of its prey, and sometimes the entire prey, upon the hedges, has given rise to curious conjectures, the most probable of which is, that they do so to attract other prey; for when the trophies of its former doing are thus exhibited upon the hedge, the shrike itself may often be observed beating about until some smaller bird comes to peck at the trophy; and then the shrike drops down, bears it to the ground, instantly dislocates its neck by the gripe of

the mandibles, and very speedily hews open the skull and devours the contents.

In Britain this species occurs only as a straggler; but it is very common in many parts of the European continent, and also of America. In the colder ones it is a migrant retiring in the winter, because there is no food for it; but in places where the summer is hot in proportion, and there are marshy grounds, and consequently many of the larger insects, it is very plentiful in the summer. In Russia, for instance, it occurs in great numbers during the summer, but disappears entirely before the severity of the winter sets in. It is found all the year over in France, where, in summer it haunts the forests, and in winter it resides in the valleys, and even approaches the precincts of human habitations. It chooses either the branchings or forkings of trees in thorny hedges as the situation for its nest, the frame work of which is formed of small twigs twisted and interwoven together with fibrous roots and moss. The nest is so compactly formed, that it is rendered almost impervious to the weather, and it is lined with wool, down, or other soft substance. The eggs vary from four to eight in number; they do not seem to be uniform in their colour; for they have been described by different naturalists as being variously marked. The parent birds of this species manifest a strong affection for their young, and exercise the most tender care in rearing and feeding them. When hatched, the young are quite naked; but the soft, downy, and warm lining of the nest affords them the requisite comfort in this state. Such is the friendly attachment of the old birds that they associate with their offspring till the following spring. During the autumnal and winter months the entire family may be seen flitting from tree to tree in social union, and never once commingling with other associates. They are distinguished by their incessant shrill cry of "troole, troole," which may be heard at a great distance. They repeat this cry almost without intermission when either perched on the tree top, or flying in the air. Their flight is performed by jerks and vibrations, always in an up and down direction; and when they perch upon a tree they always select the extremity of the highest branch for the purpose of enabling them to dart with more certainty and effect upon their prey. The method to which they resort in the killing of their larger prey is well illustrated in the following anecdote recorded by Edwards. "Mr Bell, while on his travels through Russia, had one of these birds given him, which he kept in a room, having fixed up a sharpened stick for him in the wall; and on turning small birds loose in the room, the butcher bird instantly caught them by the throat in such a manner as soon to suffocate them, and then stuck them on the stick, pulling them on with bill and claws; and so served as many as were turned loose, one after another, on the same stick."

The American bird which has been frequently referred to this species, and which is similar to it in most respects, but differs from it in others, appears to have exactly the same habits; and those habits are so well described by Wilson, that we cannot resist quoting a short passage.—"I have seen him," says the great ornithologist of North America, "in an open field, dart after one of our small sparrows with the rapidity of an arrow, and kill it almost instantly. Mr. William Bartram long ago informed me, that one of these shrikes had the temerity to pursue a snow bird (*F. Hudsonica*) into an open cage, which stood in the garden, and, before they could arrive to its assistance, had already strangled and scalped it, though he lost his liberty by the exploit. In short, I am of opinion, that his resolution and activity are amply sufficient to enable him to procure these small birds whenever he wants them, which, I believe, is never but when he is hard pressed by necessity, and a deficiency of his favourite insects; and that the crow or the blue jay may, with the same probability, be supposed to be laying baits for mice and flying squirrels, when they are hoarding their Indian corn, as he for birds, while thus disposing of the exuberance of his favourite food. Both the former and the latter retain the same habits in a state of confinement; the one filling every seam and chink of his cage with grain, crumbs of bread, &c., and the other sticking up, not only insects, but flesh, and the bodies of such birds as are thrown to him, on nails or sharpened sticks fixed up for the purpose. Nor, say others, is this practice of the shrike difficult to be accounted for. Nature has given to this bird a strong, sharp, and powerful beak, a broad head, and great strength in the muscles of the neck; but his legs, feet, and claws are by no means proportionally strong; and are unequal to the task of grasping and tearing his prey, like those of the owl and falcon kind. He, therefore, wisely avails himself of the powers of the former both in strangling his prey, and in tearing it to pieces while feeding.

"The character of the butcher bird is entitled to no common degree of respect. His activity is visible in all his motions; his courage and intrepidity are beyond every other bird of his size, (one of his own tribe only excepted, *L. tyrannus*, or king-bird;) and in affection for his young he is surpassed by no other.

"He associates with them in the latter part of summer, the whole family hunting in company. He attacks the largest hawk or eagle in their defence, with a resolution truly astonishing; so that all of them respect him, and on every occasion decline the contest. As the snows of winter approach, he descends from the mountainous forests, and from the regions of the north, to the more cultivated parts of the country, hovering about our hedge-rows, orchards and meadows, and disappears again early in April."

The species of shrikes enumerated by different writers are very many; but many of them are not easily distinguishable from the fly-catchers, to which the shrikes generally are closely allied; and we must content ourselves with a selection.

Red-backed Shrike (*L. collaris.*) This species which is rather a handsome one, appears in some districts of Britain as a summer migrant. It comes in May and departs in September, so that it is in the country only during the time that the larger summer beetles are in a state of maturity and on the wing; accordingly those beetles constitute the principal part of its food. This and some others of the insectivorous birds which regularly visit Britain, confine themselves to particular districts. The nightingale, for instance, appears only in the south eastern parts of the island, and in these it is less common and less melodious in its song, upon the cold retentive clays than upon the warm gravels. The shrikes and fly-catchers, which are nearly allied to the shrikes in their habits, are more partial to the central parts of the country, ranging along where the prevailing strata are oolites and stiff clays; and they seem to prefer the winds from the Atlantic to those from the

eastern sea; for the species under consideration is more numerous, and also extends further north on the west side of the island than on the east side.

As is the case with very many birds, especially with those which are only visitants and are local, the habits of the red-backed shrike have not been observed with the requisite degree of care. It has been unfortunate for the natural history of the British islands, that those who have had opportunities of observing animals in free nature have seldom been writers, while those who have been employed to write have as seldom been observers. In consequence of this very many of the printed descriptions of British birds have been compilations from foreign describers, where the physical characters of the country are very different from what they are with us, and the consequence is, that they do not answer correctly to what is observed in this country, and thus our written history and our living nature are very often at variance with each other; and it will take more time and labour to correct the blunders which have thus been committed, than it would do if the subject were unstudied, and free from this contamination.

The red-backed shrike is a very lively bird; and it so far resembles the birds of prey that the female is considerably larger than the male. The female is seven inches in length and twelve in the stretch of the wings, and weighs an ounce and a quarter; while the dimensions of the male are six and ten inches, and the weight only one ounce. The prevailing colours of both birds are reddish brown on the upper part, and soft greyish white on the under; but the under part of the male has a tinge of rose colour, while that of the female, still preserving the slight resemblance to birds of prey, is marked by dusky lines, as is the case with the larger grey species. This one stands accused of sometimes killing little birds; but if it does so, those birds do not show the same hostility to it which they generally show to enemies, whether of themselves or of their nests. The little birds may frequently be seen collecting their numbers in order to annoy the smaller hawks as killers of birds, or the cuckoo as a violator of nests; but they do not thus annoy the red-backed shrike, or indeed any of the shrikes. We may hence conclude that these birds are not habitual enemies of the smaller ones, otherwise the habitual instinct which displays itself against such as are known to be enemies would be displayed against them. Still these birds are exceedingly active; and when they are watching for their prey they are in a state of constant excitement. As is the habit of all the genus, they frequent hedges, coppices, and the margins of woods; and while they sit perched on a twig, they keep their body worked into that excitement which can enable them instantly to dart upon that against which they proceed. In this state the tail is expanded, the wings partially spread, the bill open, and the eye expressive of the utmost irritability. It has been reported of them that when thus excited, and no prey comes in their way, they can charm the fledglings of the small hedge birds within their reach, by imitating the calls of the parents; but the truth is, this matter has not been clearly established; and in many respects the ash-coloured shrike has been mixed up with the history of this one.

The nest of the red-backed shrike is very carefully hidden, and it is also neatly made. It is usually placed in a close hedge or bush, or in one of those short but thickly branched trees which are so common on the margins of forests. Externally, it is composed of mosses and vegetable fibres, mixed with wool; and the inner part is composed of hair, very neatly interlaced together. The eggs are five or six in number, having the ground colour whitish, but with the same blush of rosy tinge which characterises the under part of the male bird; and they are marked with spots of reddish brown. The young, as is the case with most birds which are for the greater part of their time upon the wing, remain long in the nest, and are diligently fed and carefully attended to by their parents. When they quit the nest, they bear a good deal of resemblance to the female, only they are not so red on the upper part.

The red-backed shrike, though very energetic, and much upon the wing in short flights, is far from being a graceful flyer. It gets through the air by a succession of leaps, in each of which it mounts considerably upward, and drops down again at the end; and it never rises into high flight while it is on its feeding grounds. The chief cause of this kind of flight appears to be the shortness and breadth of the wings, which prevent the bird from floating easily, so as to renew its impetus without descending below the line of its motion. When it migrates, as it unquestionably does, it in all probability takes a higher flight; because we could hardly imagine a bird to cross even the narrowest part of the Channel, with such a low and leaping flight as the shrike exhibits in those places where it takes its abode.

Wood-chat Shrike (*L. rutilus*). This is a more powerfully-winged, and altogether a more energetic and discursive bird, than the last-mentioned species. In Britain it is rare; and though its nest has been found in Norfolk (which by the way is a remarkable county for birds), it can hardly be regarded as any other than a straggler, inasmuch as neither the nest nor the bird have been observed regularly every year. On many parts of the continent of Europe it is by no means rare in the summer season, but it disappears rather early in the autumn; and is understood, like many of the summer migrants of Europe, to take up its abode in Egypt during the winter. As this species does not resort regularly to the British islands, it does not take a definite locality, but is generally found in those situations to which a side wind is most likely to blow it from the continent.

It measures about the same length as the female of the red-backed shrike, namely, about seven inches; but its wings are eighteen inches in stretch, which is three inches to each wing more than in that bird; of course it is much more capable of extended flight, and the style of its flying is altogether far more graceful. Its bill is dusky with a bluish tinge, stoutly made, very firm in the texture, and very decidedly notched towards the tip; the legs are dusky, and the claws black, very firm, pointed, and much hooked, so as to resemble in form the talons of a bird of prey, but they are much shorter in proportion to the size of the bird, and are to be regarded as perching or climbing claws rather than as killing ones. The forehead, or band down each side of the neck to the shoulders, the lesser coverts of the wings, and part of the quills, are dusky, or even in some instances black; the roots of the primary quills and the points of the secondary ones, and also the feathers on the scapulars, are white. The hind part of this head is rust-coloured, and the back dark ash; the throat, front

of the neck, and breast, are dull white, passing into yellowish on the belly and toward the vent feathers. The tail is long and strong, and a little rounded at the extremity; it is of a dusky colour, not quite so dark as that on the head, neck, and quills; and the rump feathers and upper tail coverts are still paler, dusky, and mottled with white. Altogether it is a very handsome bird, and perhaps it is to be regretted that it does not visit the country in greater numbers, or more regularly; for, on account of its activity and great power of wing, it cannot fail to be a great destroyer of insects, and as such very serviceable to vegetation.

Carolina Shrike (*L. Carolinensis*). This bird bears a considerable resemblance to the larger shrike of America, but it differs so much in size, in colour, in locality, and in habits, that it must be considered as a distinct species. Both are migratory birds, and appear in the United States only during the summer, retiring to more southerly climates as the severe weather sets in. The greater shrike, however, takes up its summer abode in the northern and middle states rather than in the southern; while the species now under consideration, though abundant in the southern states, very rarely appears in the northern. The rice plantations, on the damp and fertile grounds in Carolina and Georgia, are its principal haunts, and it is protected by the growers of rice as a bird which renders them essential service. The service which it renders is the destruction of mice, which are particularly injurious in those places. It takes its post on the fence enclosing the stacks of rice, watching with the same keen and persevering eye as a cat, and the instant that a mouse makes its appearance the bird darts upon it with the rapidity of lightning, and despatches it. Its feeding is not exclusively confined to mice, for it feeds on crickets and grasshoppers, and many of the larger insects, which both as larvæ and in the full grown state, are highly injurious to the crops. On this account it is an exceedingly valuable bird; and indeed there are very few birds so valuable to the cultivators of vegetables as those which clear the crops of destructive insects, and therefore it behoves all cultivators to understand well the nature and the food of those birds which come about their grounds; for there are many indiscrimate destroyers of every winged creature that they can kill, who exterminate, in as far as they are able, those very birds which are the best protectors of their favourite plants, inasmuch as they consume those destructive creatures which human labour cannot reach.

The Carolina shrike builds its nest near the ground, generally in close but detached bushes; and the sound which it utters in the pairing season is disagreeable and creaking. It evinces the same attachment for its young which is shown by most species of the shrike.

It is a short-winged bird in proportion to its size, and therefore does not take long flights, though it is certain and rapid in short ones. It measures about nine inches in length, and thirteen in the stretch of the wings. The colour on the upper part is dark ash; the scapulars and line above the eye is whitish; the wings black, with a small spot of white at the base of the primaries, which are pointed with white; a black streak extends along the front through each eye, reaching half way down the neck; the eye is dark hazel, sallow under the eye-brow; the four middle feathers of the tail are entirely black; and the four exterior ones on both sides are tipped with white more and more to the marginal one, which is almost all white, which colour prevails in the whole lower parts. In some specimens, the males and females both exhibit transverse lines of a pale brown colour. The female is rather smaller in size than the male, and considerably darker in colour, both on the lower and the upper parts; but the black does not extend so high on the first as it does on the male.

In America, which is a great country for insects, the species of insectivorous birds with notched bills adapted for the destruction of the larger insects are exceedingly numerous; but in many instances it is impossible to draw the line between them, so as to separate what are fly-catchers from what are shrikes, though it is probable that the greater number are entitled to rank with the first of these divisions. The king bird, or tyrant fly-catcher, has all the boldness of the shrikes; but still it evinces no disposition to kill little birds, though it attacks in defence of its young the very largest species with the utmost determination, and is quite sufficient to drive off even the most powerful of the birds of prey.

The great Shrike (*L. curvinus*), is a native of Africa, having the upper parts mottled with brown russet and ash colour, with the middle of the feathers black; a large fawn-coloured spot over the eye, and a dull brown on the ear covert; the quills have their upper webs russet, and are bordered with yellow, but ash and grey on their under sides; they are greyish white with a rose-coloured tinge, on the flanks; the bill is of a yellow colour, and the feet are dusky black. The colours on the female are less brilliant than those on the male, and the under part is streaked with dusky lines. The length of this species is about thirteen inches.

Olive Shrike (*L. olivaceus*), is another African species, much smaller than the preceding, being only six inches in length, and differing greatly from it in the markings of the colours. The upper parts are olive green; the quills blackish, bordered with olive green; the tail feathers yellowish, except the two middle ones, which are green; the bill and feet are brown, and the forehead and under parts yellow.

Some shrikes have the head crested, among which may be mentioned the crested shrike of China, and that of New Holland. The first is about seven inches and a half in length; it has the upper part brown, and the head black on the upper part, but with a brown crest; the cheeks, the throat, and the forepart of the neck are white, with a black streak extending from the gape, and a small red spot on the eye; the tail feathers are staged in the same manner as those of the magpie; they are brown for the greater part of their length, but white at the tips; the bill and feet blackish. The New Holland crested species is pale green, on the upper part is of the same colour; but the upper part of the neck, the quills, and the tail feathers are blackish; the under parts yellowish brown; the back yellow, and the feet brown.

In southern Africa, in Madagascar, and the adjoining islands, and in all the islands to the south and east of Asia, and also in the richer parts of south-eastern Asia, which have a comparatively moist climate, and consequently a nearly constant vegetation, with a corresponding abundance of large insects, shrikes, as well as fly-catchers and other birds that feed chiefly upon insects, are exceedingly numerous, and they vary much both in size and in colour. Their

habits are, however, so nearly allied to those of the species that have been already noticed, that a repetition of them would be unnecessary, and a mere enumeration of sizes and colours could not convey much useful information to the general reader; for which reasons we shall not enter into the details of them.

Shrikes are altogether rather an interesting genus of birds, on account of the kind of food which they consume, which consists chiefly of small animals that are particularly annoying to cultivators. In the system they hold a sort of intermediate place between the birds of prey, properly so called, and the crow tribe. They have the feet of the latter, but their bills approximate those of the former; and though many of them kill and eat smaller birds, there are none of them which rob the nests of the eggs that they contain, as is done by many of the crows; and they are not nearly so miscellaneous in their feeding, or so capable of subsisting upon vegetable substances, as crows are; and, therefore, when their insect food fails, they are under the necessity of shifting their quarters by migration. The style of their flight is also different from that of the crows, and so are the marking of their colours.

LANTERN-FLY. The name of a supposed luminous insect (see FULGORA), to the account of which we have to add, that the prince of Nieuwied, whose extensive researches in the Natural History of America which have so much contributed to elucidate many disputed points, render his recent decease an irretrievable loss to zoology, never observed the least traces of luminosity in the Brazilian lantern-fly during his travels in South America; whence the question of the supposed luminous powers of these insects which has lately been discussed at such an inconvenient length in the Entomological Magazine, may be considered as decided in the negative. Donovan, indeed, represented the Chinese species as emitting a white light from its snout whilst hovering in a bunch of chrysanthemums; but the artistical talents of this writer were too evident in all his works to allow any weight to be given to his authority in such a disputed point as the present. Another figure, with still less correctness, has made the rays spring, not from the snout, but from the body.

LAPIS LAZULI. The azure stone, or sapphire of the early mineralogists. This beautiful mineral is found in Persia, Bucharia, China, and in the neighbourhood of the Ural chain of mountains. It forms a considerable article of commerce in China, as it is used in ornamenting the best sort of earthenware manufactured in that country. It is found massive, disseminated, and in rolled pieces, the fragments being indeterminately irregular.

Lapis lazuli is much prized by lapidaries, on account of the fine polish it is capable of receiving; and as such, it forms a beautiful ornament in the formation of boxes and other small works of art. The usual belief, that it owes its beautiful colour to copper, is erroneous, as the most careful analysis furnishes no trace of that metal; iron is, however, found in considerable quantities. The name *ultramarine*, given to the pigment obtained from this mineral, is said to have been bestowed on it in consequence of the stone having been brought from beyond the sea. Lapis lazuli was once used in medicine, and from the splendid yellow veins that it presents, was called the "golden remedy."

LAPWING (*Vanellus*). A genus of *echassiers* or stilt birds, belonging to the pressirostral division, and nearly allied, in many of their characters, to the plovers and oyster-catchers, but sufficiently distinguished from both to entitle them to be ranked as a distinct genus; and, indeed, although the species are not very numerous, they admit of division into two sub-genera, lapwings, properly so called, and plover lapwings. The name lapwing alludes to the sound which these birds can make, either by striking the turns of the wings against each other over the back, or by striking the points of them with great force against the air; and the systematic name, *Vanellus*, is given to them on the same account. It means relating to a fan, or, as one would say, fan-bird, because the sound produced by the stroke of the wings is very similar to that made by suddenly opening a fan, or striking it forcibly against the air, in two parts of this exercise of the fan which is so humourously described in the Spectator.

The characters of the genus, taken as a whole, are as follows: the bill short, slender, straight, compressed, and enlarged at the tips of both mandibles; the basal part of the upper mandible furrowed by nasal grooves, in which the nostrils are placed laterally, and pierced longitudinally in a membrane which covers the groove. The feet are slender, and furnished with four toes, of which three are turned to the front, and the middle one united to the outer by a short membrane. The hind toe is always very short, and sometimes merely rudimental, or entirely wanting; and it is articulated so high upon the tarsus, that the point of it does not touch the ground in walking. The wings are, generally speaking, pointed; the first quill is the shortest, and the fourth and fifth are the longest in the wing. In some of the foreign species, the bastard wing is armed with a spur; and the presence or the absence of this is sometimes made the ground of subdivision, though so far as we are aware there is no other character which depends upon or follows this particular one.

Lapwings, as we shall see presently, are highly interesting birds, and therefore it is necessary that we should attend with some care to the characters of the three principal parts of their external organisation, the bill, the feet, and the wings. The slenderness and shortness of the bill both tend to give the bird very great command over it; and the enlargement of the mandibles at the tip enables it to snap and seize with great celerity. This suits well with the chief food of the lapwing, which consists of earth worms and insects, the former of which especially are exceedingly sensitive to everything that agitates the surface of the ground, and must be seized in an instant, otherwise they escape into their subterranean retreats. The feet are equally well fitted for light walking at a rapid pace, as the whole of the weight is always borne upon the three toes only, and thus the elasticity of all their joints comes into play; and the movements of the lapwing upon the ground are inferior in ease and rapidity only to those of the few genera of stilt birds, which are entirely destitute of the hind toe, and which are in general much less clever on the wing than the present genus. The wings are, however, perhaps the most beautiful part of the whole structure, admirably as the birds are formed in every respect. They are, as we have noticed, pointed wings, but the point is in the middle of the breadth, so as to divide the horizontal spread of the wing into nearly equal parts; and what is wanting in this respect is supplied

by the very peculiar bend of the wings of those birds. This gives them a very decided advantage over those birds which have wings pointed in their first quills, and straight in their general lines, such as are the wings of the swallows and swifts. These can turn laterally upon the points of the wings as pivots, with perhaps more celerity than the lapwings; but the lapwings can turn upwards or downwards, or in any oblique direction, much more cleverly; so that if we take all the possible directions of a wing into the account, there is perhaps no bird which has such perfect command of the air as the lapwing; and there is none which displays such antics in its aërial movements, or the contemplation of which is a more beautiful study, in the finest branch of animal mechanics. At the same time the birds are very elegant in their forms, compact and neat in their plumage, lively in their manners, inoffensive and uninjurious to man in their feeding, and altogether among the most interesting of the feathered race, though they are birds of the wilds, rather than of fertile and highly cultivated places, and discursive and migrant at different seasons of the year.

We shall now notice the principal species, and in doing this we shall begin with the typical one, or the lapwing properly so called, which is well known in all the swampy wilds of rather upland places in the British islands, and which is as much admired as it is well known, from the beauty of its form, and the singular energy and activity of its manners.

The crested Lapwing (*V. cristatus*). This is a bird which is pretty generally distributed, and which forces itself upon the notice of all the observers, on account of the brightness of its colours. The top of the head, the nape, the upper part of the neck, and the breast, are black with metallic reflections; and the feathers on the hind part of the head are formed into a beautiful fibrous crest. The upper part is a sort of mottled green with very rich metallic reflections. The quills of the wings are pure white, except a considerable space at the point, which is black, with the exception of the two external ones, and these are white for the whole of their length. The sides of the neck and all the under parts are pure white. The under tail coverts are russet; the bill is black; and the feet brownish red. The length of the full-grown bird is between eleven and twelve inches. The young before the first moult have the crest very short, a black patch under the eyes, the throat clouded with white and ash colour, and the greater part of the feathers on the upper part margined with russet-brown. The plumage both of the old and the young is subject to some variations, though the causes of these variations have not been investigated.

Lapwings are common in every part of Britain which is adapted to their habits; but unless it is on the sea-shore, and indeed even there, they are birds of seasonal appearance. In the breeding season they disperse themselves over the interior of the country, and seek those marshy places of the moors which are removed from human habitations. They are not found exclusively on the uplands; for their habit is not particular as to elevation above the level of the sea, their proper situation in wild nature being that ground which is intermediate between the wet and the dry, but rather nearer the former; and in such situations they are found from the margin of the salt marsh, which is barely elevated above the level of the sea, to the margin of the uppermost bound which is found on the slope of the mountain.

As is the case with many other birds of the same order, and especially of the same family, the lapwings are to be considered as dispersive rather than as migratory in the summer. When the winter sets in, and those small animals upon which they feed are either buried in the earth or confined, or treasured up in the egg, in the inland parts of the country, they resort to the sea, which, in all latitudes where it does not freeze, knows no winter as a sterile season in which it cannot supply food; and when the summer approaches, they disperse themselves over the country, each species resorting to that situation in which it can find the most abundant supply of food for itself and its young, and where its labours in the procuring of that food are of the greatest benefit.

The common lapwing, as is the case with most birds of the family, makes no regular nest, but merely smoothes and partially clears of herbage a little space under cover of the grass or heather. The eggs are four in number, as is the case in almost the whole of the family, and they are arranged in a regular quatrefoil or cross of four leaves, the small ends being almost in contact at the centre, and their large ends disposed outwards so regularly that the axis of each opposite pair form a straight line, and those of the two pairs are at right angles to each other. The ground colour of the eggs is of a pale greenish olive, and they are marked over with blotches of dusky and rather brownish black, which are more numerous and larger toward the large ends of the eggs than the small ones. The young are capable of using their feet cleverly almost the moment they leave the shell; but they are for some time covered with down, and not with feathers; and some time elapses before they are capable of flight. It is not long, however, before they are enabled, partially at least, to find their own food with comparatively little assistance from the parent birds; and until they are fledged and can use the wing, they are but rarely seen, as they crouch and conceal themselves among the herbage. By this means they are safe from ravens and other enemies, which prowl about the same sort of places in which lapwings are bred; and there is no doubt that the simplicity of the place where they are deposited, and the inconspicuous colour of the eggs, also contribute a good deal to the safety of the nest.

But in addition to those natural means of concealment, which do not call into exercise the instinct of the birds, lapwings are more assiduous, and perhaps more dexterous in decoying suspicious visiters away from their nests, than any birds with which we are acquainted. They do not show the least alarm, or resort to any stratagem in the case of sheep or cattle, but remain as quiet when these are ranging the places where they nestle, as if there were no animal there but themselves. Their next neighbour toward the hill, the plover, and also the snipe, which comes between them and the marsh, give them just as little alarm; and they are in no ways disturbed by hares, grouse, or any of the inhabitants of the wilds which do no injury to the nests of birds. If, however, a carrion crow, or a hooded crow, which is a more frequent visiter of their haunts, especially in the northern parts of the British islands, makes its appearance, they are up in arms; and as there are generally, if not invariably, more than one pair upon the same breeding ground, the whole are in the air and in

arms, if it is before the sitting is commenced or after the young are hatched, or all the males are so if it is during the time of incubation. Their gestures in the air upon such occasions are highly amusing; and if the enemy is on the wing they speedily batter him from the locality by striking at him, not with the bill, but with the turn of the wing, and they strike so rapidly and so hard, without in the least disturbing their own poise, that even the raven himself, strong as are his wings, and formidable as is his bill, is glad to make his escape from them. If the enemy is on the ground, a dog for instance, they annoy him even more; but while some one feigns lameness, and tempts him on to the pursuit, the others keep flying and wailing about him, and making the sound of their wings ring in his ears, till he is both bewildered and exhausted; and when a cur happens to cross the breeding ground of lapwings, he experiences as fatiguing and as profitless a hunt, as mongrels do with a hare, of which the first sight is the nearest. Lapwings are not quite so violent against human invaders of their breeding grounds, as they are against the predatory birds and quadrupeds; but still they exhibit enough of excitement to show that human beings are not very welcome visiters. They wheel about in the air, uttering their plaintive cry of *pee-weet*, in a state of no small excitement, while as they turn, which is often within a few inches of the intruder, the smart twitch which they give to the air with their wings sounds in the ear as if a blow were actually given. The cry is very wailing and melancholy in the sound, and the birds seem in great distress; but it is possible to subdue their excitement, and observe them on the ground conducting themselves with much apparent complacency, as if they felt grateful for not being injured. If one chooses to walk for a little while backwards and forwards over the breeding ground of lapwings, it is not long befor the whole of them suspend their clamour and their aërial activity, descend to the ground, and in perfect silence run about, as if showing themselves to him and claiming his acquaintance, and if it is a fine day, so that the sun brings out the metallic glances of the colours, it is impossible to imagine a finer sight than those running lapwings, which are perfectly familiarised to the observer, and will run almost to his feet without the least apprehension. If the herbage is not beaten, as if one were searching for nests or young ones, their excitement soon goes off, and they allow themselves to be approached within a very short distance. Indeed, they have little or no apprehension or dread, except for their eggs or their young, because they are so clever both on the foot and the wing, and can get so readily from the one to the other, that they have less occasion to fear enemies than almost any other birds. To the kite and the sparrow-hawk they are perfectly indifferent, because the first of these has scarcely courage sufficient for attacking so large a bird as a lapwing; and the second is so moderate in the velocity of its rush, though otherwise a formidable creature in proportion to its size, that the lapwing can get out of its way. Even the gos-hawk makes but little prey of the lapwing; but if the ger-falcon comes in the way, the doom of the lapwing is sealed notwithstanding the number and variety of its manœuvres. Yet, even the ger-falcon cannot get the better of the lapwing without gaining its topmost sky, and putting in exercise its most powerful rush; and therefore the capture of a lapwing by a ger-falcon is one of the finest sights in the whole action of birds.

Earth-worms are understood to constitute at every season of the year the principal food of the lapwing; and as those worms are always under ground when the sun is out, the birds are obliged to feed early in the morning, and thus they have the bright part of the day for repose, for sport, or for those manœuvres which they exercise in order to entice enemies, or suspected enemies, away from their nests and their young. We forgot to mention, when speaking of their resources in this way, the artifices of the female when sitting. As she and her nest are generally concealed under cover of vegetation of some kind or other, she does not rise readily; and as the male has fed before the time that visiters are generally abroad, he is in the vicinity, and on the alert to play off all his wiles for the purpose of keeping the female and the nest undisturbed and in safety. If, however, he should not succeed, and danger approaches nearer than the distance at which the instinct of the female teaches her that she is safe, she makes her escape from the nest. But she always plans it such a manner as that she can run unobserved before she rises; and if the danger is not very near, she runs to meet it, and then springs upward as if just started, and makes off in a direction which takes her still farther from it. In her progress she counterfeits lameness or mutilation, and tumbles along as if her legs or wings were broken, in order as it were to tempt the enemy with an easy capture; and if that enemy is a dog, especially a cur which runs indiscriminately at every thing, she is generally successful in her enticement. The pursuer very often gets nearly up to her, and this nearing induces him to proceed; but whenever he comes almost to close quarters, the apparently crippled bird gets very easily on the wing, and dashes so far in advance that she can again descend to the ground and practise her feigned lameness. When by the continuance of these stratagems she has succeeded in enticing the enemy to a sufficient distance from the nest, she rises on the wing, dashes off at rapid flight in another direction, doubles after a certain distance, and returning alights on the opposite side of the nest, and then runs to it in the same hiding manner with which she quitted it at the first. In consequence of these manœuvres, the nest of the lapwing is very rarely seen in proportion to the numbers of the birds; and when seen, it is rather by accident than from being betrayed by the rising of the female.

In the upland districts where lapwings, generally speaking, breed, we believe (though the fact has not been absolutely ascertained) that earth-worms, which constitute the principal food of these birds, pair only once a year, and that at the season when the lapwings have their broods, and stand most in need of provisions. But in the lower and warmer regions, the same worms are understood to pair twice in the year, namely, in the spring and in the autumn; and as they are in the best condition and most above the ground during the pairing time, they furnish the birds with an ample supply of food, both at the time when they are dispersed over their breeding places, and at those when they are on their journeys from and to the perennial pastures of the shores of the sea.

In many of the books which profess to treat of natural history, and which, like most professions and

professors, give the romance instead of the reality—the enticing nonsense rather than the instructive truth—it is asserted that the lapwings can, by the tread of their feet, force the worms out of the ground, and thus by their own exertions collect to the surface a supply of food for themselves. This, however, very much resembles the pretended capability of Owen Glendower of calling spirits from the vasty deep, as it is not likely that the worms would answer to any call which might be made upon them to come out of the ground in order to be eaten. The fact, indeed, is quite the reverse; for any agitation of the surface of the ground invariably sends the worms farther down, instead of bringing them to the surface; and this is proved by the conduct of earth-worms when hunted by the mole, for they always endeavour to get below the runs of that animal, instead of resorting to the surface, in order to escape from it. Besides this, the lapwing is so light an animal, that any concussion which it could give to the earth with its feet could not affect earth-worms, delicate as they are; and the peculiar elasticity of its feet, and the lightness of its tread, are obviously intended to prevent it from alarming its vermicular prey, and driving them into the earth by any concussion which it may impart to the surface. Such are a few particulars of the history of the common or crested lapwing, which is, all circumstances considered, one of the most interesting of British birds; and one which, notwithstanding its wailing notes and the waywardness of its manner, is one of the most interesting in every place where it makes its appearance.

The Grey Lapwing, or Grey Plover (*Squatarola cinerea*) is a bird nearly allied to the lapwing, but holding a situation intermediate between it and the plovers. It is not so large or so weighty a bird as the lapwing, neither is it so powerfully winged in proportion to its dimensions and volume. The lapwing measures nearly fourteen inches from the point of the bill to the extremity of the tail, and two feet and a half in the expanse of its ample wings, and its weight is at least half a pound when it is in good condition. The species now under consideration is only twelve inches in length, and two feet in the expansion of the wings; and it is an ounce, or an ounce and a half, lighter than the lapwing. It is, however, a more elongated bird, in proportion to its length, than any of the other two; and for this reason it is probably a bird of more powerful wing. Its bill is also longer in proportion than that of either the lapwing or the plover; and the hind toe is merely rudimental, being destitute of a claw, and never of such length as to reach the ground. The wings are also of a different construction from those of the common lapwing. They are pointed wings, but the point is not in the same part of the wing; for while it is in the middle in the common lapwing, it is in the anterior part in this bird, the first quill in the wing being the longest. Its habits are but little known, though it is probable that it occurs in more parts of Britain than is generally supposed. Small flocks, consisting of old ones and young ones blended together, appear on different parts of the season, and there is reason to believe that the young members of those flocks are reared within the country; but too little is known of the habits of the bird in its breeding places, to enable us to draw any certain conclusion respecting it. It is an upland bird in respect to its breeding ground; but as a British bird, it appears to resort only to those places which are nearest to the continent of Europe; and we believe that, during the summer season, it is more frequently met with in the mountains or hills in the county of Kincardine, than in any other part of the British islands. In England, it appears only in the winter season, and chiefly on the coasts, which shows that it is a bird which spends the summer in more inclement regions; but it is so local and comparatively rare, that no distinct conclusion can be come to respecting it.

The Spurred Lapwing (*V. albicillus*) is the only other species which we shall notice. It is of a rich grey on the upper part; the breast and the belly, the cheeks, the sides of the head, and the throat, are streaked with black and white, and there is a yellowish appendage to the head arising from the front and neck. The quills are black, the middle coverts of the wings bordered with white, the tail feathers whitish, the bill yellow, the feet orange, the length is thirteen inches, and the turn of the wing is armed with a spur.

LARCH is the *Larix Europæa* of Decandolle. It belongs to *Coniferæ*, and though a native of Germany, it is one of our most plentiful forest-trees. The larch is remarkable for the conical elegance of its growth, and the durability of its timber; in the last respect even rivalling the oak. The trees are readily raised from seed; and after being planted in rows in the nursery for a few years, are fit to be transplanted into their final stations.

It is considered an Alpine tree, being remarkably hardy; and, therefore, vast numbers of them have been planted on the mountains and poor wastes of Great Britain and Ireland within these last four-score years. The late dukes of Athol have been most successful planters; large tracts of hilly country, on the Athol estates, have been clothed with the larch, to the incalculably increased value of that in other respects almost barren possession. Nor has the introduction of this tree been confined to the Highlands; as they have been planted everywhere to the great advantage of the planters.

"In 1809, larch timber, grown by the duke of Athol, at Dunkeld, was first used in the British navy at Woolwich, in the building of the *Serapis* storeship, the *Sybille* frigate, the bottom of a lighter, and for piles driven into the mud, alternately wet and dry; and in all these stations proved a durable wood. The *Athol* of twenty-eight guns was also built entirely of larch timber from his grace's estate; and at the same time the *Niemen* of the best Riga. After their first course of service, on being examined, the *Niemen* was found in a decayed state, and condemned accordingly; whilst the *Athol* was again put into commission, and is at this time (December, 1832) on a voyage to the West Indies. It was also remarked that, during the time this larch timber lay in Woolwich dock-yard, exposed to the weather, neither the heart or sapwood was in the least decomposed; nor was there the slightest appearance of fungi growing upon it."

Mr. Pontey, forester to the duke of Portland, in his "Forest Pruner," highly recommends the larch as a durable timber tree, and hundreds of thousands have been planted at his instigation.

Within these five or six years, however, it has been found that the larch, in various parts of this country, has become liable to a serious defect called *pumping*—that is, from the decay of the heart-wood, the tree becomes hollow like a pump. Much has been written on the subject, but no satisfactory reason has yet been

given as to the immediate cause of it. It has occurred to single trees in the midst of hundreds of sound ones, on poor thin gravels and on rich loams, and on both wet and dry soils; whilst in other situations, where all these varieties of soil and circumstances exist, nothing of the kind has been observed. Many eminent arboriculturists are now studying the matter, and it is to be hoped that some clue will be discovered, which will lead to the cause of the failure.

The larices differ from the cedars by being deciduous. There are four species—the common, the daurian, the red or small fruited, and the black or pendulous. The last is chiefly remarkable for the graceful curve its leading shoot assumes, drooping towards the ground when about fifteen or twenty feet in height, and forming a natural arch of extreme elegance and beauty. The red is a slow-growing tree; and its timber is so close and heavy that it will hardly swim.

LARKSPUR is the genus *Delphinium* of Tournefort, an extensive family of beautiful flowering annuals and perennials, chiefly natives of Europe. The *D. grandiflorum*, and its varieties, are among the most splendid ornaments of the flower garden; and the great variety of colours in the annual species makes them universally admired.

LARVA. The technical term given to that state of the life of an insect immediately succeeding its escape from the egg, and previous to its assumption of the pupa state. See INSECT and CATERPILLAR.

LASIOCAMPA (Schrank). A genus of large lepidopterous insects, belonging to the section *Nocturna*, Latreille, family *Bombycidæ*, and containing the egger moths, a name given to these insects on account of the compact egg-like cocoon which they spin. The spiral tongue of the perfect insect is obsolete, the palpi minute, the antennæ strongly bipectinated, wings strong and rounded, the legs scarcely hairy. The larvæ are hairy, woolly bears as they are termed in some parts of the country, and roll themselves up in a coil when disturbed. The type is the *Bombyx rubi*, or fox-egger; and there are four or five other British species. Latreille introduces several other genera into the group, such as *Odonestis potatoria*, *Gastropacha quercifolia*, &c.

LASIOSPERMUM (La Gasca). A genus of ornamental trailing plants, natives of the south of Europe. They belong to *Compositæ*. The hardy species appear in the flower border, and were formerly called *Santolina*.

LATHRÆA (Linnæus). The *L. squamaria* is a very curious British parasitical plant. The roots attach themselves to those of trees or shrubs, and thence extract nourishment. The flowers are didynamous, and the plant belongs to the natural order *Orobancheæ*. This plant is rather rare, and found only in dry woods among leaf-mould. Its English name is toothwort, from the shape and colour of its bracteous scales.

LATHROBIUM (Gravenhorst). A genus of rove beetles (*Brachelytra*; sub-family *Staphylinides*), having the body long, slender, and nearly cylindric, with the last joint of the maxillary palpi minute and pointed; the antennæ are inserted near the base of the mandibles, and the anterior tarsi are dilated in both sexes; last joint long. Fifteen British species. Type *Staph. elongatus*, Linnæus.

LATHYRUS (Linnæus). A genus of elegant climbing plants, chiefly natives of Europe. Class and order *Diadelphia Decandria*, and natural order *Leguminosæ*. Many are ornamental, and some very useful as agricultural plants. In this genus, we find the everlasting pea (*L. sylvestris*), the sweet pea (*L. odoratus*), the Tangier pea (*L. Tingitanus*), the broad-leaved everlasting pea (*L. latifolius*), the chichling vetch (*L. sativus*), and the hairy vetch (*L. hirtus*); the two latter agricultural.

LATIRA. A genus of molluscs constituted by De Montfort, but properly belonging to the genus *Fusus*, with which it is now classed.

LATRIDIUS (Herbst). A genus of minute coleopterous insects of doubtful situation, placed by Latreille amongst the *Xylophaga*, and by Stephens in the family *Engidæ*, having the abdomen oval and broader than the head and thorax, the basal joint of the antennæ very large and globular, terminal joint large, palpi very minute. The type is the *Tenebrio lardarius* of DeGeer, by whom the transformations of this little beetle were observed, and of which he found the larvæ feeding upon cured pork. Marsham called this group *Corticaria*; but some of the smaller species having been considered as generically distinct, Herbst's prior name was retained for the typical species, and Marsham's given to the others. There are about twenty-four species of both groups.

LAUREL is the common name of a great many very different plants, but properly belongs only to the *Laurus nobilis* of Willdenow, or sweet bay of English authors. The genus *Laurus* includes above twenty-six beautiful trees and shrubs, many of them eminently useful, and all highly ornamental. Many are natives of tropical countries, where they assume the character of lofty or timber trees; those in this country are ranked as stove-plants. The North American species are mostly deciduous shrubs, and thrive in our shrubberies. The genus was much more extensive than it now is, as the cinnamon, the cassia, the camphor, and the sweet cinnamon, were all included by Linnæus and others. The laurels and some congenerous plants are associated in the natural order *Laurineæ*, which see.

LAUREL CHERRY is the *Cerasus laurocerasus* of Loiseleur Deslongchamps, the common laurel of our shrubberies; and the Portugal laurel is the *Cerasus Lusitanica* of the same author.

LAURESTINE is the *Viburnum tinus* of Linnæus, a common ornamental plant in every flower garden. This favourite plant is easily propagated by layers, or even by cuttings with the necessary care.

LAURINEÆ. A natural order, containing, according to the last authorities, seven genera and fifty-four species of trees and shrubs bearing fine foliage, but with inconspicuous flowers. By botanists, they are easily recognised by the singular circumstance of their anthers being from two to four-celled; the valves of each are hinged as it were to the upper edge of each cell, and opening from the base upwards. The germen is free, one-celled, and the ovule solitary and pendulous. The style simple, and the stigma obtuse. The fruit is fleshy and indehiscent, often surrounded by a large persistent calyx. The seed is without albumen, and without arillas; the straight embryo large and inverted, the radicle short and superior, the cotyledons somewhat convex, fleshy, and the two-leaved plumula conspicuous.

The *Laurineæ* are divided into two sub-types: the first contains the leafy arborescent aromatic species, the second those which are leafless, herbaceous, and

insipid. The first are all aromatic plants, and exceedingly uniform in their properties. They contain essential oil in abundance, which imparts to them a peculiar sweet, though sometimes strong and penetrating odour, and a warm and pleasant taste; hence they yield some of our most grateful stimulants and spices.

The old genus *Laurus* has been divided by modern botanists, and its species arranged in three or more genera, or sub-genera, called *Laurus*, *Persea*, and *Cinnamomum*. The first includes the bay, the false benzoin, and other laurels with two-celled anthers and naked fruit. The second, the cassia, the true cinnamon, and the camphor, in which the anthers are four-celled, and the fruit covered. And the third, the alligator-pear.

Laurus nobilis, the bay, is the only European plant belonging to the type. It is aromatic, like the rest of its associates; and before the introduction of the exotic species, bay-berries and bay-leaves were much esteemed in medicine. Its use in forming crowns for heroes and scholars, has long been also obsolete, though conquerors' statues still bear a sculptured wreath of barren boughs, while the Baccalaureate degree remains a symbol that the victories of Apollo are more fruitful than those of Mars.

Laurus Borbonia is the true red bay; it yields the Isabella wood, so much prized on account of its satiny appearance, for cabinet work; and its roots afford a violet dye. *L. chloroxylon* and *L. Indica*, the green-wood and the royal bays, are both much valued for their timber; the first is hard and tough, and from its common use in machinery, is called cog-wood; the latter is light, of a yellow colour, and known as Madeira mahogany.

The sassafras of medicine is the wood of the *L. sassafras*. The alligator-pear is the fruit of the *Persea gratissima*, an excellent West India fruit. The cinnamon of commerce is procured from several species, but the best is that obtained from the *Cinnamomum verum*. The juices of *L. caustica* are highly irritating; the bark of the *L. culilaban* is the clove-scented cinnamon; and from the fruit of *L. glauca*, a concrete oil is extracted, which is used in the manufacture of candles. The other genera, in this order, are the *Cryptocarya*, *Tetranthera*, *Cassytha*, and another, which has some affinity to *Laurinæ*, is *Agathophyllum*.

LAVANDULA (Linnæus). A genus of under-shrubs and herbs, natives of Europe. This well-known family belongs to *Labiatæ*. Two of the sorts are cultivated, and all are favourites, either for the beauty of their flowers, or the sweetness of their scent. The flowers and leaves of these plants have long been used as perfumes; and the ancients employed them to aromatise their baths, and to give a sweet scent to water in which they washed; hence, indeed, their generic name, *Lavandula*. The oil of *L. spica* is more pleasant than that of the other species, and is distinguished in commerce by the name of oil of spike, while the others are called oils of lavender. Sixty ounces of flowers yield only one ounce of oil; hence its high price, and the continual adulteration of the genuine drug with oil of turpentine. It contains a fourth of its weight or more of camphor, is a powerful stimulant, but its chief consumption is as a perfume; large quantities of the flowers are annually brought to London, where it is used by the citizens to perfume their wardrobes, and to expel the cloth-fretting moths.

LAVATERA (Linnæus). A genus of shrubs and annual and perennial herbs, chiefly natives of the temperate parts of the world. Class and order *Monadelphia Polyandria*, and natural order *Malvaceæ*. Generic character:—calyx half five-cleft; involucrum of one three-lobed leaf: petals inversely egg-shaped; stamens united in a cylinder; anthers kidney-shaped; style simple; stigmas several, like bristles; capsules many, one-seeded, and disposed in a crown. The shrubby *Lavateras* are green-house plants of easy culture. The herbaceous species are mostly annuals, and are planted in the open air.

LAWSONIA (Linnæus). A genus of tropical trees, belonging to the eighth class of Linnæus, and to the natural order *Salicariæ*. These trees succeed well in our stoves, and are propagated by cuttings. The *L. alba* is by some writers supposed to be the Gopher wood of Scripture, and is the plant that affords the celebrated henna, or al-hanneh of the Arabs. It is a curious fact that the unarmed variety should be spread over Egypt, Persia, and India, and be found even in America; while the *L. spinosa* is confined to the New World. A paste made of the pounded leaves of this plant is much used by the Egyptians, Arabs, and Turks, to dye their nails of a yellowish dark-red hue. This practice can be traced to a very high antiquity, for there is evidence that the nails of mummies have been so dyed. It does not seem that the women use henna either to heighten their own beauty, or to render their children more lovely; but rather as a mark of dignity, as slaves are forbidden to employ it. From the great esteem in which henna is held, and its vast consumption as an article of the toilet, it is cultivated expressly in Egypt for export to Constantinople, and yields the Pacha a considerable revenue. Henna is also used to dye the manes of horses, as well as to dye wool and leather. The flowers have a strong, and, to most Europeans, a disagreeable odour; but, notwithstanding their powerful hircine scent, the Oriental ladies use a water distilled from them as a cosmetic, and put them in beaupots to perfume their apartments.

LEAD. This mineral, next to iron, may be considered as the most useful of our subterranean treasures. The natural compounds of lead are too numerous to admit of a separate description; but the most important is the sulphuret, from whence the pure metal is chiefly procured.

Native carbonate of lead is one of the most beautiful of the metallic ores; it occurs crystallised and fibrous, the former being transparent, and the latter generally opaque. It is soft and brittle, and occasionally tinged green with carbonate of copper, or grey by sulphuret of lead. The octohedron is its primitive form, but it also occurs prismatic and tabular. This mineral is found in abundance both in Cumberland and Durham, and the acicular variety, possessing great beauty, in Cornwall.

The sulphuret of lead is less beautiful than the preceding, but much more extensively diffused. Its primitive form is the cube, of which there are several modifications, and among them the octohedron. The greatest quantities of this mineral are found in our own island, and in the northern parts of the continent of Europe. It may be proper to add that the greater part of the specimens of this mineral contain silver.

LEBECKIA (Thunberg). A genus of shrubs and under-shrubs, natives of the Cape of Good Hope, belonging to *Leguminosæ*. They are kept in green-

house collections, thrive on a compost of loam and moor-earth, and are propagated by cuttings.

LEBIA (Latreille). A genus of small but handsome species of coleopterous insects belonging to the family *Carabidæ* and sub-family *Brachinides*, having the elytra very broad, the thorax broader than long, with a transverse lobe on its posterior margin; the terminal joint of the palpi is larger than the preceding, with the penultimate joint of the tarsi more or less bifid. Type *Carabus crux minor*, Linnæus, a very rare and elegant British species, having a black cross upon the pale buff elytra. Bonelli separated some of the species under the name of *Lamprias*, which have linear antennæ, and the penultimate joint of the tarsi but slightly bilobed; which genus is adopted by the English, but rejected by the French entomologists.

LECHEA (Linnæus). A genus of pretty North American herbaceous perennials, belonging to Linnæus' third class, and to the natural order *Cistineæ*. These plants, according to Sweet, are best kept in small pots, and grown in turfy loam and moor-earth. They are increased by cuttings.

LECYTHIS (Linnæus). A genus of ornamental trees and shrubs, natives of South America. The flowers are polyandrious, and the genus belongs to *Myrtaceæ*. They succeed best in a rich loamy soil, and ripened cuttings produce roots in sand placed on hotbeds; the cuttings should not be stripped of their leaves. The fruit of *Lecythis* is a large pyxidium (like a chest or box) as big as a child's head, and with its operculum (opening), somewhat resembles an oil-jar, whence the generic name *L. grandiflora* is the greater, and *L. minor* the lesser, cannon-ball trees of Cumana; the former is one of the most gigantic trees in the ancient forests of Brazil. The seeds of all the species are edible, and used like chestnuts either raw or roasted: but after they are swallowed, they leave an unpleasant bitter taste in the mouth. Monkeys are, however, more fond of them than men; and hence the large seed-vessel full of seeds is called the "monkey's porridge-pot."

LEDON is the specific name of the *Cistus ledon* of Lambert. The ledon-gum rock-rose of the books and nurseries is a hardy ornamental shrub found in France.

LEDRA (Fabricius). A curious genus of homopterous insects belonging to the family *Cercopidæ*, having the margins of the thorax elevated on each side into a kind of ear-shaped appendage. The type of the genus is the *Cicada aurita*, Linnæus, a large and not uncommon insect in the south of England, of a dull brown colour.

LEDUM (Linnæus). A genus of North American shrubs, always seen in our gardens in company with the *Azaleas* and *Rhododendrons*, brought from the same country. In America it is called the *Labrador tea*, its leaves being used as a substitute for the true *Thea* during the war for independence. The flowers are decandrious; and the *Ledums*, of which there are four species, belong to the natural order *Rhodoraceæ*. The *Ledums* are raised from layers or seeds.

LEEA (Linnæus). A genus of tropical shrubs named in honour of Messrs. Lee, nurserymen and botanists of Hammersmith, near London. Class and order *Pentandria Monogynia*, and natural order *Melhaceæ*. Generic character:—flowers monœcious; calyx bell-shaped and five-cleft; corolla tube short, limb five-cleft, segments bagged; urceolus perigynous, cylindrical, in five divisions, each segment bifid; stamens alternating with the segments of the urceolus, short; anthers incumbent, style simple; stigmas thickish and gashed; berry five or six-seeded. These plants are kept in the stove, grown in light loam, and are propagated by cuttings.

LEE-CHEE, or LITCHI, is the *Euphoria litchi* of Desfontaines, and *Dimocarpus litchi* of Loureiro, a Chinese fruit-tree, belonging to the natural order *Sapindaceæ*. The fruit is sweet, with a sub-acid flavour, and esteemed by the Chinese. The fruit are in the greatest perfection when just gathered from the tree; and as they cannot be produced at Pekin by reason of the coldness of the climate, whole trees, it is said, are transported from Quantong to Pekin for the use of the Emperor every year.

LEEK. Is the *Allium porrum* of Linnæus, a well-known culinary vegetable. The cultivation is simple; a seed bed is sown in March; soon as the seedlings are of the size of a goose-quill they are transplanted into rows one foot apart, and six inches distant from each other, upon an open rich spot of well-digged ground. They need no other care, save keeping the ground clean among them till they are fit for use. If a large size be desirable, the richest ground must be chosen for them, together with early sowing and transplanting.

LEGUMINOSÆ. One of the largest and best defined natural orders of the vegetable kingdom. It contains all the plants bearing butterfly-shaped flowers and pod-like seed vessels. Two hundred and forty-four genera are already described in books, and nearly three thousand species have been named. This order comprises some of the most useful, as well as many of the most beautiful of plants. Among the former all the products called pulse are directly or indirectly serviceable to man; and among the latter we may instance the restharrow, broom, and furze upon our wastes, up to the lupines, the erythrinas, cytisus, wistarias, and achyronias of warmer climes. Many excellent medicines are also obtained from this order, as the cassia, senna, &c. Linnæus divided the pulse, which Jussieu and De Candolle have again conjoined into two orders, his thirty-second and thirty-third, called *Papilionaceæ* and *Lomentaceæ;* the first including those genera which have butterfly-shaped flowers and true legumes; the second, those in which the corollæ are regular, and for the most part rosaceous, and the fruit that modified form of legume which is known as a loment.

"The arrangement of this tribe of plants has been found to be attended with much difficulty. By Linnæus, and the writers who succeeded him, the number of genera was much smaller than those admitted by botanists of the present age; many additions have been made in consequence of the discovery of New Holland, and a large number of subdivisions in the old genera have been from time to time introduced by one writer or another. To combine those scattered improvements under one uniform system has lately been attempted by the learned professor De Candolle. He has divided *Leguminosæ* into two grand divisions, the first of which consists of plants the radicle of whose seed is curved back upon the edge of the cotyledons, and the second of those whose radicle and cotyledons are straight; the former are *Curvembriæ* and the latter *Rectembriæ*. In the *Curvembriæ*, certain diversities in the structure of the calyx and corolla again divide into two principal forms; one of

which, comprehending all the genera with papilionaceous flowers, is called *Papilionaceæ;* and the other, consisting of a very small number of species, with one or two petals or more, and an obscurely lobed calyx, is called *Swartziceæ*. The last is not subdivided, but *Papilionaceæ* resolve themselves into the two great tribes pointed out by M. De Candolle, namely, those with fleshy cotyledons and eatable pulse *Sarcolobæ*, and those with foliaceous cotyledons, and seeds which are not eatable, *Phyllolobæ*. Each of these is divisible by three, upon slight differences in the fructification. In *Rectembriæ* two sub-orders, *Mimosiæ* and *Cæsalpiniæ*, are formed upon variations in the æstivation of the calyx and corolla; in the former it is valvate, in the latter imbricated; the first constitute a single tribe, the latter into three, distinguished by less conspicuous peculiarities of structure."—Hort. Brit.

LEISTUS (Frölech; Pogonophorus, Latreille). A genus of coleopterous insects, belonging to the family *Carabidæ*, distinguished by the beautiful blue colour of the majority of the species of which it is composed, and the elongated and curiously spined lower lip; the palpi are very long, and the outside of the jaws greatly dilated at the base. The type is the *Carabus spinibarbus*, Fabricius. There are seven other British species.

LEMNA (Linnæus). A genus of well-known aquatic annuals, belonging to the natural order *Fluviales*. There are four species, all natives of Britain, and known by the name of duckweed. These are the plants which form "the green mantle of the standing pool," alluded to in King Lear.

LEMON. Is the *Citrus medica* of Rizzo, a common and well-known exotic fruit.

LEMUR. A genus of four-handed mammalia, forming a sort of link between the apes and monkeys, and those mammalia which are without hands. The name was originally given to these animals by Linnæus, in consequence of their habits being nocturnal, though in other respects it is rather fanciful to call them "ghosts," which is the meaning of the word lemur. As the genus was originally formed, it contained several animals differing from each other in many important characters, and as the foundation of it was nearly negative, it was of comparatively little use. Subsequent naturalists have divided the genus into three distinct parts, or indeed three separate genera—*Lemur*, properly so called, which contains several species, all of them natives of the island of Madagascar, and of that island only; *Loris*, sometimes improperly called sloths, and at other times slow lemurs, which are natives of India; and *Galago*, of which an account has been already given. We shall give a short notice of the Loris under that title, and confine the present article to the lemurs, properly so called. It is necessary to remark, however, that Landseer, who has given portraits of the red lemur and white fronted lemur, with his usual truth and effect, has introduced into the same plate *A. lori*, under the name of the slow-paced lemur; but the character of the animal is given with so much truth, that the trifling mistake in the name cannot mislead.

Lemurs are exceedingly singular animals, and they belong to an island of which the natural productions are altogether of a peculiar nature. It is remarkable, that though the distance between Madagascar and the main land of Africa is not very great, yet that there should be so great a difference between both the botany and the zoology of them as there actually is. So far as is known, there is no animal in Southern Africa at all resembling the lemur in its formation and habits, neither is there any resembling the ai-ai; and as both are handed animals, and combine, with the use of hands, habits which are not possessed by handed animals in any other part of the world, it becomes impossible to apply systematic terms to them with perfect correctness. Until New Holland was discovered, Madagascar was the largest island known; and Madagascar is more related to Africa in position than New Holland is to Asia. Yet we do not find in the climate of Madagascar much resemblance to that of Africa, or in the climate of New Holland much resemblance to that of Asia. Madagascar is by far the better climate of the two, and indeed, taking all circumstances together, it is perhaps one of the best climates in the world. The cruelties which were perpetrated upon the natives by early visiters, and the disposition which the natives showed to retaliate, indiscriminately upon all nations for the wrongs which they had suffered at the hands of a few, long prevented a proper knowledge of Madagascar and its productions; but since an end has been put to the cruel traffic in human beings, and the judicious conduct of our governors in Bourbon and Mauritius has taught the people of Madagascar that there are nations to be trusted, the country has been readily opened to the footsteps of science; and the blacks of Madagascar are becoming fond of the society, the merchandise, and partially also of the science of Europe. In consequence of this, we may expect that before many years shall elapse, the production of this extensive and singularly fertile and romantic island will be well known, and its inhabitants will be added to the list of independent and improving nations.

This is a pleasing prospect in respect both of natural science and of philanthropy; and when we cast our eyes over the globe, and consider the physical state of different regions, and the moral characters, or rather the moral capacities, of the inhabitants of those regions, we invariably find that whatever of apparent fierceness and cruelty there may be in the people of a land naturally rich, there is invariably more tractability in them than in the people of a poor country; and in process of time they rise in the scale of nations, and this almost in proportion to their apparent cruelty at the time when they are first visited by more civilised nations. Taking it altogether, New Holland has perhaps the most uncongenial climate, and the most unproductive soil of any country of the same extent; while its native productions, both animal and vegetable, afford the most scanty supply of human sustenance. There is no handed animal in any part of New Holland, though there are some climbing animals, and a few supplied with membranes, which assist them in leaping from branch to branch. In the rich woods of Madagascar again, we find handed animals numerous, and several of them, such as the lemurs now under notice, peculiar to that part of the world, and also in their habits. They indicate a country which has been from the first abundant in rich forests, while the absence of handed animals in the Australian forests leads us to suppose, that the general character of very much of the surface of that extensive country must be sterile.

Now these characters are strongly impressed upon

Red Lemur.

Slow-paced Lemur. White-fronted Lemur.

the people of the new countries. Those of Madagascar resisted the visits of Europeans at the first, and they were found collected in large masses so as to be formidable; but now, while the natives have been more consolidated, they seek the intercourse of foreigners, and improve and also increase in numbers from the stimulus of that intercourse. The natives of Australia, on the other hand, though their intercourse with Europeans has been more direct and close, have not derived the same advantages from it. That they are not without capacity, is proved by the fact, that many of the children have been very forward in the schools; but it has also happened that, instead of being thereby attached to civilisation, they have almost without exception gone back to the woods, and relapsed into the habits of their fathers. The character of many of the European inhabitants, as being convicts, working in chains, or under very severe laws, must no doubt have had a pretty strong repulsive effect upon the natives of New Holland, inasmuch as men could not be expected willingly to give up a state of freedom, however precarious, in order to join a nation, the one part of which compelled the other to work in fetters, and under terror of the whip. Thus, if we still have the natives of New Holland, and more especially those of Van Diemen's Island, whose characters are a little more energetic, acting the characters of liers in wait in the bush, and indiscriminate plunderers and murderers, we, in a great measure, have ourselves to thank for it, and it is impossible to say how much this may have retarded the prosperity of our empire in that part of the world. Yet still much must also be owing to physical circumstances; and the most striking of these is the absence of handed animals, to which the peculiar handed animals of Madagascar present a very striking contrast, and would of themselves lead to the facts which we have pointed out, both with regard to the general productions of the country, and to its human inhabitants.

The lemurs are among the most remarkable of the Madagascar animals; and though they resemble the monkeys in some of their structural characters, there are others in which they approximate more nearly to the canine race. They are not, indeed, decidedly carnivorous in the formation of their teeth, nor are they furnished with claws of a formidable character; but they are nocturnal in their activity, as foxes are, and the whole of that race when in a wild state. They are also very nimble animals in all their motions; and, along with a great variety of resources, they have a great deal of tractability. They have the hand of the monkey, so that they can climb a tree with equal expedition; their legs are at the same time articulated so as to be by no means inefficient in running; and to these properties they add the scent and the sagacity of the dog. Accordingly, some of them at least are trained for the chase, and for some domestic purposes; and though there is no account of their exercising that watchfulness which must be regarded as the most valuable quality of the dog, they form better substitutes for that animal than are anywhere else to be met with. Indeed, upon looking at the plate, it will be seen that, with the exception of the hands, and the greater proportional length of the tails, lemurs have not only much of the form, but they have also not a little of the expression, of dogs.

Still, though they are employed in the chase, and though they eat animal matter, the principal adaptation of their mouths is for the eating of fruits; and it is in this, and in the possessing of instruments adapted for climbing, that they bear the most resemblance to the monkeys, and are ranged next to them in the system.

In the upper jaw the lemurs have four incisive teeth, two canines and twelve grinders; but in the lower jaw there are six incisors, two canines, and only ten grinders. The upper jaw bears a considerable resemblance to that of the American monkey; while the lower jaw differs, both in the number of incisive teeth and in their form and position. They are very much elongated, very slender, and not directed upwards as in the apes, but pointing so much forward as to be nearly horizontal. The external one on each side differs in form from the others, and is so much larger that it is doubtful whether this and the one which follows it are the true canine, though that tooth is certainly not entitled to be classed as a grinder. If, however, this second tooth in the lower jaw—that is, the fourth from the front—is to be considered as the true canine, there is a difference in the mouth of the lemur from that of all animals with which we are acquainted; inasmuch as the upper canine stands farther forward than the other, whereas in other animals, the canine in the under jaw is in advance. The true grinders are all of the same form, with two points, one external and the other internal. In the upper jaw there are three grinders, of which the first is the largest and the second the smallest, the first having two tubercles on the outside very much developed. The false grinders, which are three in number, are separated from the canine by an interval. In the different species, however, there are great differences in the form of the mouth, so that it is not easy to reduce them to any general description; and the best conclusion to which we can come on an inspection of the mouth is, that the animals are very miscellaneous in their feeding. This agrees with their habits, so far as these are known, for being wholly nocturnal animals, and living in the woods, it is impossible to examine them with the requisite degree of care. Nor can we draw any certain conclusion from what they eat in a state of domestication, because they are very miscellaneous, and will eat indiscriminately fruits, farinaceous roots, insects, and animal substances.

The limbs of those animals, more especially their hind ones, are very considerably elongated; the thumbs in them are placed at a great distance from the fingers, completely free to their articulations, so that the hand forms a very efficient grasping instrument. All their fingers, or toes rather, have flat nails, with the exception of the second one on the hind foot, which has the phalanx which bears the claw very slender, and the claw itself is awl shaped. The tail is generally longer than the body, and adds much to the beauty of the form of the animal; but it is not prehensile, or capable of laying hold, which is another distinction between the lemurs and those monkeys to which they bear so close a resemblance in many respects. Generally speaking, the whole form of the lemur is slender and flexible; the head is elongated, with a triangular profile, and a slender muzzle bearing no inconsiderable resemblance to that of the fox, for which reason they have sometimes been called fox-headed monkeys. Their covering is, generally speaking, woolly, very abundant, and much frizzled out on the body; their ears are short, rounded, and covered with silky hair; their nostrils are in the

form of terminal slits; and the hair of that part of the body where they are placed more resembles that of some of the marsupial animals of Australia, than of the mammalia of Europe. The eyes are not placed looking directly to the front, as they are in man, neither are they completely lateral, but they hold an intermediate position. The mammæ are two in number, and situated on the breast.

Altogether these animals thus combine the leading characters of the handed animal, with those of the quadruped. Their principal dwelling is in the trees, and they are very dexterous in leaping from branch to branch, though they do this only early in the morning, or late in the evening, as during the day they remain in a state of repose, and very generally rolled up. As they partake so much of the characters of apes, or rather of monkeys, it may naturally be expected that they also partake of the habits of these animals; but from all the accounts it should seem that they partake more of the good qualities than of the bad. They have the same ardour of character when excited, as the monkeys have; but there is far more repose about them, and they have none of those propensities which render monkeys in general both mischievous and repulsive. They are also far more docile and tractable when in a state of confinement. There is one respect, however, in which both agree, and that is the extreme affection of the females for their young; and it will generally be found that whenever this propensity is very strong, there is always a corresponding degree of ardour in the whole character of the animal. We have already mentioned that Madagascar, and we might have added the adjoining islands, are the only known localities where lemurs are natives. Several specimens of them have been brought to Europe, where they have lived, and some have produced young in menageries; but they are liable to suffer severely in the cold of the climate, notwithstanding the ample supply of fur with which they are covered.

The species of lemurs are not very satisfactorily made out, and there are sufficient reasons why this should be the case. It is but lately that their native regions have begun to be looked upon with any thing like a scientific eye; and as, from the mere fact of their being handed animals, they were long considered as belonging to the family of the apes, which gave a false impression of their general character. They are so very peculiar in their structure and habits, and so confined in their geographical distribution, that there is no doubt they would form a very valuable index to the physical condition of their native localities, if they were a little better understood than they are at present. Mammalia are from their structure much more limited, that is, much more dependent on local circumstances, than birds are, which can betake themselves to the air and range from place to place independently of the surface of the earth; and therefore, if we find any mammalia of very peculiar structure in any particular spot or distinct country, they are always the very best means we can have of ascertaining the physical circumstances of that country, and from those circumstances a general idea of its climate and productions. To do this with proper effect, it is absolutely necessary that we should perfectly understand the mechanics of the animal system, more especially the articulations of the limbs. Now though the lemur is a climbing animal, and resides for the most part in trees, it is not so exclusively a tree animal as the ape, the baboon, or the monkey. These have not only the cross motion of the anterior extremities much more powerful than the motion in the mesial plane, but they have so much oblique articulation in the bones of the hind thigh and leg, and such a turning inwards of the foot upon that leg, that they get on more lamely upon the ground in proportion as they are more at home upon the tree. The baboons, many of which live where trees are thinly scattered, are better set on the legs than the apes of the close forests; and so is the chimpansee of Africa better set on the legs than those long armed apes which inhabit the tangled forests of Java, Sumatra, and the other rich isles of the east. So also on the American continent, the spider monkeys, and the other races with very produced extremities and prehensile tails, which are found only in the closest woods, are much less clever on their feet than such species as have occasion to range from tree to tree. The structure of the lemur is different from that of any of them, and the habit agrees with the structure. Though it has hands on all the four feet, these hands are not turned on edge, neither are the joints so constructed as that the animal can turn the hand directly outwards so as to grasp a branch. Its mode of climbing is, more correctly speaking, a leaping from part to part of the tree; and thus, though it can grasp the branch upon which it more immediately rests, it cannot range over or beat all the parts of a tree in succession, in the same manner as apes and monkeys do, therefore it must be regarded as not so exclusively confined in its feeding to what the tree produces. We have said, that in some of its characters the lemur approaches more nearly to the canine race than to any other family of animals. But allowing this, it partakes also of some of the characters of the cat, not as respects its food, its method of procuring that food, or its general disposition, but as respects its organisation for motion. There is much spring and elasticity in the backbone, and the tail has that great length which is always characteristic of an animal which can leap, or which otherwise takes its motion steadily upon a definite line; and as the tail of the lemur is perhaps more produced in proportion to the size of the animal than that of any animal in which the tail is not prehensile, we may naturally suppose that it proportionally assists the animal in its function of leaping. Perhaps the nearest approximation which we have to the lemur in this respect, is in the AILURUS of northern India; but the ailurus, as may be seen by referring to that article, takes the remainder of its character as much from the cat family as the lemur does from the monkey. Indeed, before we could satisfactorily point out the proper place of these very peculiar animals in a natural system in which animals should be arranged strictly according to their organisation and geographical distribution taken jointly, we would require to bring under review all those animals to which a resemblance may be traced in the lemur; and this would be far too extended as well as too elaborate a matter for being treated of in a popular work adapted for common readers only. We shall therefore shortly notice the species as they are described by naturalists, without pledging ourselves that we enumerate the whole, that the whole are known, or that some which are described as separate species may not be mere varieties of age, or resulting from accidental circumstances

The Red Lemur (*L. ruber*) is the species figured at the top of the plate Lemurs. It is, generally speaking, all over of a maroon red colour, with the exception of the hands, the tail, the head, the insides of the legs, and the belly, and these are black. There is also a half collar of white on the upper part of the neck. The first good representation which was given of this lemur was a drawing made by Commerçon, during his residence in Madagascar, and to whom we are indebted for many valuable truths in the zoology of that part of the world; but in consequence of his drawing not being accompanied by any description in writing, it was neglected until the return of Peron from the Southern Seas, who brought with him a stuffed skin of the animal. There was also a specimen, a female, in the collection of Mr. Bullock, in which the colours were remarkably beautiful, the whole upper part being rich maroon, and the under part, including the face and the tail, jet black; the collar had a greyish tinge, and a spot of the same colour marked the middle of each foot. There is every reason to believe, however, that the colour is subject to some variation; and the female has the white markings less distinct and pure than the male, which has sometimes caused it to be considered as a different species. It measures rather more than a foot from the back of the head to the origin of the tail, and stands nearly the same height, taken to the most elevated part of the back. The tail is more than a foot and a half in length, and, though not prehensile, has considerable power of motion. It is very easily tamed, and of the most gentle and inoffensive disposition. In its waking hours it is remarkably nimble in its motions; but it passes the greater part of the day in a state of complete repose, during which it is rolled up, with the head placed between the feet, and the tail brought over. From this habit of indolence during the daylight, it is not so interesting in a collection as one might, from its gentleness and docility, be led to suppose. Indeed it is only in their own native localities that those animals which are local and peculiar can be seen to proper advantage; and therefore, in order to form an adequate idea of the lemur, it is necessary to form some idea of a Madagascar forest, as the one is somewhat out of place without the other. The forests of Madagascar cover the greater part of the surface of the country, except where they have been cleared by artificial means. Many of them belong to the palm family, grow in the marshy grounds, and produce abundance of fruit; and the number of trees furnishing valuable timber and dye stuffs, and resins or gums of various kinds, is very great. These forests grow with great rapidity, and hide the country down to the water's edge; and as is the case in most warm climates where the rains are heavy, extensive salt marshes are formed by banks, which are thrown up by the conflicting actions of the river floods, and the sea; but in general the low grounds are so damp that the dry season tells much less severely upon them than it does in most other countries; and the consequence is, that vegetation is in a state of perpetual growth; and as it is the habit of tropical trees to bear fruit over the greater part of the year, such animals as the lemurs never suffer much from scarcity of food; and the short time in which their great activity finds their supply is sufficient to account for the indolence of their habits during the greater part of their time, for it is a law in the economy of most animals that all those which can find sufficient food in a short time, either from their own superior powers, from the abundance of the food, or from both, pass much of their time in a state of rest or indolence.

White-fronted Lemur (*L. albifrons*). This species is of a reddish-brown colour in the upper part generally, with grey on the hind part of the head and the shoulders. The face as high as the eyes is black in both sexes; but in the male a band of white crosses the upper part of it, though this band does not exist in the female. The female has, however, those parts grey which are white in the male. Of the habits of this species (and it may be said of all the species), very little is known in a state of nature; and as we have already mentioned, no satisfactory conclusion can be drawn from specimens kept in a state of confinement. One which was kept in the French Museum brought forth a young one. Until it was produced, the mother was very gentle and familiar, fawning on the visiters, licking their hands, and showing many of the attentions of a dog. But no sooner was the young one produced than it occupied and even absorbed the greater part of her attention; and she became retiring and suspicious, and offered to attack those who approached her, especially if they attempted to touch the young one. As it grew up, however, her suspicions abated: and by the time that the young one was capable of finding its own food, which was at about the end of three months, all the gentleness and familiarity of the mother's character returned; clearly showing that the temporary change which had taken place in her disposition arose solely from affection for her young one, and not from any disposition to do mischief. The affection on the part of the young one was reciprocal; for on the least cause of disturbance, or even noise, it ran to its mother, and endeavoured to conceal itself in her fur.

The Mococo or Buffon (*L. catta*) is one of the most beautiful species of the genus, and also one of the best defined. The epithet cota, which is given to it partly on the supposition of its tongue being rough like the tongue of a cat, is not correct however; for it is a smooth-tongued animal, and one which is so gentle and affectionate in its manners that it courts rather than shuns the society of human beings. The fur is reddish ash on the upper part, ash coloured on the flanks, and white on the under part; and the tail is beautifully annulated with pure white and black. There is a peculiarity in the structure of the hand of this animal, and partially also in most of the genus. The naked palm extends, though concealed in part by the hair on the upper surface, along the under surface, nearly midway to the apparent length of the fore arm; and thus the hand or paw becomes a sort of double grasping instrument, and can either hold on like a hook or act with the thumb opposed to the fingers, as necessity may require. Thus it is one of the most efficient instruments among the branches of a tree that can well be supposed, and enables the animal to climb over flexible leaves which could not be easily accomplished by means of hands of the common structure. Nor is it unworthy of remark, that in this formation of the hand there is a very considerable approximation to the mode of action, though not exactly to the form of instrument, of the sloths. This lemur, as well as some others, gets the name of mongou, which is indeed generally bestowed upon all those which have

more or less of brownish ash in their colouring; but it does not appear that there is any particular distinction in character or disposition that accompanies this difference of colour; and where the habits of animals are so much alike as they are in all the lemurs, mere difference of colour is of very little consequence.

The Mongous or Buffon (*L. mongoz*) is rather a questionable species, but it is usually characterised as follows: length from the hind head to the tail rather more than a foot; length of the tail nearly two feet; five fingers on all the feet, with the thumbs on the hind ones much stronger and more developed than those on the fore; all the nails are flat, with the exception of that of the first finger on the hind foot, which is a slender and pointed claw, as may be observed in the figure of the white-fronted lemur given in the plate already referred to. The nostrils are at the extremity of the muzzle, as is the case in the dog family, and there is no doubt that the sense of smelling assists the animal very much in finding its food during the night. The ears are rounded externally, and the opening is pretty large, so that the sense of hearing is also acute. The naked skin on the under side of the fingers is peculiarly delicate, and no doubt forms a very efficient organ of touch.

The variegated Lemur (*L. macaco*) is not very well named, because all the lemurs are varied in the colour; but this one has the colours much more varied than most of the others, by large spots of black and white. The male has the sides of the nose, the corners of the mouth, the upper part of the neck, the back, and the flanks white; and the top of the head, the belly, the tail, and the insides of the legs black, with the exception of a white bar across the middle. It is said, that in this species the young females are like the males, and afterwards changed to a different colour; which is different from most animals, as the young male more frequently resembles the female, and does not acquire the characteristic markings of his sex until he arrives at maturity.

The Dwarf Lemur (*L. nain*) is much smaller than any of the species hitherto noticed; it is understood to be the animal which Buffon described under the name of the Madagascar rat, and which has on that account been sometimes called *L. murinus;* but it is not in any sense of the word a rat, or a murine animal of any description, unless in its being of small size, and having a long tail. In its organs of locomotion it resembles the larger and more characteristic lemurs; but its head is rounder, and its muzzle shorter, and in this respect it bears nearly the same analogy to them that the pug dog does to the fox. It is also described as being more a nocturnal animal than any of the others, with very large round eyes, and a broad muzzle, with the nostrils in advance of the jaws. The general covering is thick fur, greyish fawn on the upper part, and whitish on the under; and the face and naked skin of the hands are flesh coloured. M. F. Cuvier has described an individual of this species, the manners of which he watched with much attention. It was placed in a nest of hay, where it remained during the day rolled up like a ball, and in a state of the most profound repose, but as soon as the night set in it was all life and activity. It leaped along its cage with a rapidity equal to the flight of a bird, and it could bound vertically from the ground to the height of six feet. This last evolution is rather a remarkable one when we consider the small size of the animal, for it is not above ten inches long in the body, nor exceeding six inches high at the shoulder. This is another instance of the necessity of guarding against confounding the muscular power or energy of an animal with the mere volume of its muscles; for this, the smallest of all the lemurs is by far the most agile and energetic of the whole.

There are various other species named by different writers, but the history of the genus is still too imperfect, and the variations of colour to which the same species is subject, are so ill made out, that some of the distinctions which are drawn are means of confusion, not of information. Years must elapse, and the very singular physical character of Madagascar and the adjoining islands, together with the working of the several monsoons upon it, must be fully investigated, before we can settle its natural history.

LENTIBULARIÆ. A small natural order, containing only two genera, viz., *Pinguicula* and *Utricularia* of Linnæus; very pretty interesting aquatics, which are with difficulty cultivated. The *Pinguiculas* are either European or North American, inhabiting elevated patches in bogs: the *Utricularias* are floaters, found in marshes and little rills; their flowers are white, yellow, or blue. The *Pinguiculæ*, or butterworts, have been so called from the greasy appearance of their foliage. Like other marsh plants, they have been accused of occasioning the flukes in sheep which feed upon them. This is attributable rather to the larvæ of the fluke, or *fascicula hepatica*, which abound in marshy districts, adhering to the herbage, and thus being conveyed into the alimentary canal, than to the immediate agency of the *Pinguicula*. When mixed with cow's milk, the juice of the leaves of these plants acts like the common rennet. *Utricularia* is physiologically interesting, from the many bone-like vesicles that are developed on its immersed foliage, and which serve to float the plant. During certain seasons the *Utricularias* are wholly submerged, and then the vesicles are full of water; but when the flowers begin to be developed, these bladders, the apertures of which are closed by a curious valve, contain only air. This is probably separated by the vital energy of the plant; and during its gradual evolution the water is absorbed or expelled, and is prevented returning, either by the mechanical structure of the valve, or by the constant evolution of air. Hence the whole plant is buoyed up, and gradually rises to the surface; the flowers then expand, the seed-vessels are fertilised, and the seeds ripened; after which the living energy of the plant flags, air no longer is secreted in the vesicles; these again become filled with water, the whole plant sinks to the bottom, and the seeds are thus sown in their proper soil.

LENTICULINA. A genus of molluscs comprising many species, all of them microscopic shells. They have been subdivided by De Montfort into so many genera, that it became necessary to consolidate the species. In their general character they partake of the formation of the *Nautilus*, being of a compressed sub-discoid shape; the centre smooth, but more generally with small knobs; the chambers not very numerous, externally visible and lying in a radiating position from the centre to the circumference of the shell's disc; some are umbilicated, others not. The derivation of the name appears to be from a little bean or grain of seed, which they may be said to resemble. Shells of this genus are frequently

found in a fossil state, but the greater number of species are recent, though but little known, and constantly overlooked in consequence of their diminutive size. On this subject we cannot resist observing, that were additional proofs required to convince the unbeliever of the infinite wisdom of the God of nature, and of the unity of purpose displayed throughout creation, these little shells would afford that satisfaction; for in them we discover analogous forms with those of the largest growth, and their diminutive tenants, each endowed with similar functions, each destined to play its part in the scheme of wisdom, and each of as much use in their sphere of action, as the elephant, whale, tiger, or other powerful animal in its predestined habits. The ingenuity of man has accomplished wonders in assisting us to see, and even study, marvellous creatures whose existence was scarcely guessed at before the perfection of optical instruments. By these much has indeed been effected, but it also leads to a safe conclusion that much more is yet to be done. Let us go on to the utmost verge of human industry, ingenuity, and rational intelligence, we can only arrive at this result—that the more man has cause to boast of his discoveries, the more he is bound to praise HIM who made us what we are, and not WE ourselves.

LENTIL. Is the *Ervum lens* of Linnæus, the common tare, some few of which are excellent fodder plants, others noisome weeds. Two or three of them have been used as human food from very high antiquity. Lentils, when boiled, readily dissolve into a pulpy mass of a chocolate colour; and we learn that it was for a mess of this "red porridge" for which Esau, thence called Edom, sold his birthright. In Egypt and Syria they are parched over the fire in pans, and sold as the best portable food on long journeys. They are also much used in catholic countries during lent. The London cooks prize them as an ingredient in both soups and sauces.

LENTISCUS. Is the specific name of the *Pistacia*, otherwise called the mastich tree. *P. lentiscus* is so called on account of the viscidity of its exudations. This tree affords the true mastich of commerce, which is procured by making transverse incisions through the bark, whence the glutinous juices escape; and, when inspissated by exposure to the air, are collected in the form of tears. Mastich is considered astringent and diuretic, but it is very little employed in medicine.

LEONOTIS (R. Brown). A genus of African shrubs cultivated in our greenhouses, and known by the name of lion's ear. Class and order *Didynamia Gymnospermia*, and natural order *Labiatæ*. The flowers are showy; the plants thrive in light loamy soil, and are increased by cuttings.

LEONTICE (Linnæus). A genus of tuberous-rooted perennials, natives of the warmest as well as of the coldest parts of Europe. They belong to *Berberideæ*, and are increased by dividing the roots.

LEOPARD'S BANE. Is the *Doronicum pardalianches* of Linnæus. The flowers are showy, come forth early, and belong to *Compositæ*; are well worth cultivating, and are increased by dividing the roots.

LEPADICEA. The first family of the class *Nematopoda*, the genus *Lepas* of Linnæus, and the *Anatifa* of Lamarck. This family, as it is constituted by modern naturalists, comprises the genera *Gymnolepas*, *Pentalepas*, *Polylepas*, and *Litholepas*. These molluscs are so widely distinct from every other, that they may immediately be discovered by their general appearance; the specific differences require more attention, and demand a closer investigation than naturalists have hitherto devoted to them. The space allotted to this subject will not permit us to enlarge to the extent necessary to gratify our own wishes; and as an eminent German naturalist has long been promising the result of his accurate investigations and laborious attention, we will not attempt to forestall his information, or give an incomplete view of it, confining ourselves at present to a general description of these singular and interesting molluscs. The animal possesses an oval formed body, more or less compressed; the mantle slit or divided at its inferior or posterior portion, though, according to the natural position of these animals, it may be termed the upper and anterior portion; the mantle is prolonged on the other side by a fleshy pedicle or stem, more or less capable of extension or contraction; this is attached to submarine bodies, and acted upon by a transverse adductor muscle. The testaceous portion is formed of five pieces or valves, squamose, or like scales touching each other more or less at their edges; one dorsal and median; two laterally anterior; and two laterally posterior; they are sometimes without any, but more frequently with numerous accessory pieces placed at the base of the shell even in the pedicle. These molluscs are invariably fixed on various floating or other submarine bodies, in very extensive groups, or thinly scattered, hanging as it were with their heads downwards, at a small depth in the sea. They appear to delight in the constant motion of the waves, which probably contributes to supply them more easily with food, which otherwise they have no mode of seeking, beyond the limited locomotion the length of their fleshy stalk permits them to enjoy. They are carnivorous, seizing their food by means of the articulated appendages with which the posterior part of their bodies is provided; these are in continual agitation, and either present a bait to the small crustaceous animals upon which they feed, or serve as feelers or smellers to indicate the proximity of their prey; and the denticulated jaws enabling them to crush, and as it were to masticate their food. It appears likely that their propagation is carried on by means of eggs, which are deposited in certain places by the assistance of a long retractile portion of the body, terminating the ovarium; and they live and die on the spot which first brought them into existence, possessing, as before remarked, no power of quitting the object to which they are affixed. In the arrangement now adopted, a very simple guide may be observed, which in the first place leads to their classification; it is the length of the pedicle, which in the first genus is very long, gradually becoming shorter in the other genera, till it ceases, and thus forms a natural transition to the *Balanides*, in which no fleshy stem or pedicle exists, the shells being firmly fixed at their base to the substance they are found upon, which a reference to the article BALANUS will more fully explain, and under that of ANATIFA will be found other interesting facts relating to the family *Lepadicea*, or genus *Lepas* of Bruguière. From the different views naturalists sometimes take, and the names they give to genera of their formation, much confusion arises, and the study of malacology is rendered additionally complex. Thus Dr. Leach constituted the genera *Otion* and *Cineras*, now included in Cuvier's genus *Gymnolepas*; he also separated two species of

the genus *Pentalepas* into the genera *Pentalasmis* and *Pollicipede*, and in the genus *Polylepas* he separated a species under the name of *Scalpellum*. Notwithstanding the respect that is due to every thing Dr. Leach has done towards facilitating the study of natural history, we think in the present instance it is much simplified by doing away with these extremely minute distinctions, more important to the physiologist than instructive to the student. This family *Lepadieea*, and the second *Balanidea*, lead to the second class, including the genus *Chiton*, and constituting De Blainville's sub-type *Malentozoaria* or articulated molluscs. The two first families constitute the class *Nematopoda*, which answers to Cuvier and Lamarck's *Cirnepeda*; this was divided by the latter into two orders—the first, *Pedunculata*, included all of those molluscs whose bodies were supported on a fleshy stem or tubular pedicle; the secoud, *Sessilia*, or such species as were permanently attached, or, to use an expressive French term, *soldered* at their base, to the place in which they were born, but little objection can be made to that arrangement; we, nevertheless, give a preference to the simplicity of the classification above described, and in every branch of the study of nature we most earnestly recommend that the leading characters she constantly furnishes should guide authors in forming the true basis of every system.

LEPAS (Linnæus; Cirrepeda, Cuvier, Lamarck; and Nematopoda, De Blainville). A class of molluscs. See Lepadicea.

LEPIDIUM (Linnæus). An extensive genus of herbaceous plants, chiefly annuals, and for the most part European weeds. They belong to *Cruciferæ* and are the pepperworts of English authors. The species called *L. sativa* is the common garden cress, and is a native of Persia; another called *L. oleraceum* is the New Zealand cress, also now in cultivation.

LEPIDOPTERA (Linnæus). A very extensive and beautiful order of four-winged insects, known by the English names butterflies and moths, and distinguished by having the wings composed of a double transparent membrane, clothed on the upper and under sides with minute coloured scales, resembling dust or farina. The eyes are large and lateral, the antennæ generally long and multi-articulate, and very variable in form; the mouth is composed apparently of a long and spirally coiled organ, which, when examined, is found to consist of two pieces, representing the maxillæ, sometimes being provided with a small jointed appendage or palpus at its base. This very slender and delicate proboscis (or spiritrompe, as it is called by Latreille, or antlia, by Kirby and Spence), is employed by the insect in sipping the sweets from the flowers, upon which alone it subsists, and which, by its peculiar construction, is admirably adapted for penetrating the narrowest blossoms. When at rest it is rolled up in a coil, and defended by two large and compressed palpi, composed of three joints, inserted upon a lip fixed to the front of the head. A more minute examination of the head, however, proves that the rudiments of the other parts of the mouth, namely, an upper lip and a pair of mandibles, also exist, but in a very minute state, and as it would seem, unfitted for any service in feeding—a peculiarity the more remarkable, because in the preparatory state of the larva the mandibles are very robust and horny, and constantly employed in biting the leaves, which at that time serve for the support of the insect. The mesothorax is furnished at the sides with a pair of large scales called pterygodes (*Paraptera* or *tegulæ*, vide vol. ii., p. 858) affixed at the base of the exterior wings on the upper side. The abdomen is destitute of any sting, although Dr. Burmeister has recently noticed an exotic species contained in the Royal Collection at Berlin, which appeared to be provided with an instrument of this kind, but which we should be inclined rather to regard as the acute extremity of the ovipositor, which, in many of the species whose larvæ are subterraneous or subcortical in their habits, is long and acute. The body of these insects is very pilose; it is also very variable in respect to its size; those species which are pre-eminently distinguished for their powers of flight having the body, and especially the thorax, very robust; whilst in the *Erycinidæ*, *Geometridæ*, and many others whose flight is weak, it is slender; indeed the last-mentioned family has, from this circumstance, obtained the name of slender bodies amongst the English collectors. The form of the pterygodes also is very variable, giving to the thorax a diversity of appearance; thus in the genus *Cucullia* (moths belonging to the family *Noctuidæ*) the pterygodes are very large, and the thorax is pushed forwards, forming a sort of hood over the heads, whilst in *Xylina* they are more elongated, so as to give the sides of the thorax an elevated appearance, with the centre depressed. The colour of the thorax is generally similar to that of the anterior wings in the majority of the moths, as well as in the butterflies, in which it is clothed with fur hairs; but the prothorax often presents peculiarities of character: thus, in the larger typical butterflies, *Papilionidæ*, it is marked with two or more red or yellow spots, sometimes uniting to form a kind of collar. The wings are attached to the lateral and superior part of the thorax, and are always present; except in a few species of which the females are apterous, or have the wings reduced to small and useless appendages, the fine layers of membrane of which the wings is composed, like the upper and lower surface of a leaf, are kept expanded by a number of longitudinal corneous veins or nerves, as they have been called, but which Dr. Leach termed *Pterygostia* or wing-bones. These nerves here, as in the *Diptera* and *Hymenoptera*, according to their number and position, offer very important characters, for generic distribution, but which have been too much neglected by authors. M. Boisduval, however, in his just published Spécies Général des Lepidoptères, Paris, 1836, has performed good service in this branch of the science by describing and delineating the nerves of the wings of many of the species of lepidoptera; although it is proper to observe, in justice to our own countryman, Jones, that he long ago published a valuable memoir in the second volume of the Linnæan Transactions, in which the same subject was well treated. The structure of the scales, which give to the wings of these insects all their beauty, has been described in our article Insect. The slight manner by which they are attached to the wing causes them to scale off on the least touch, so that by laying a butterfly in a reversed position on a piece of gummed paper, an exact impression of its markings will be obtained; the scales, however, being reversed, the broad extremity of each series of scales which was laid (roof-like) upon the succeeding row being hidden, and the pointed base exposed. In some species the representation will not resemble the markings of the butterfly, evidently

owing to these species having a double layer of scales on both sides of the wing, the under layer usually consisting of white scales. On denuding a wing of its scales, the points in which they were inserted are clearly to be perceived in the form of minute dots. Of the number of these scales it would be difficult to give a correct idea in the various species; Leuwenhoeck, however, states that there are more than 400,000 on the wings of the moth of the silkworm. In some species of lepidoptera, however, the wings are more or less vitreous, and consequently denuded of scales, or have but a few of them; and in others certain portions of the wing exhibit small transparent patches similarly denuded, as in the great atlas moth. In many species scales exhibit metallic tints, which, indeed, in some exotic butterflies, are so exceedingly resplendent, that in the bright light of the sun it is almost impossible to look upon them. In like manner several of our fritillary butterflies, and especially *Lathonia*, or the queen of Spain, has the under surface of the lower wings adorned with beautiful silvery spots. "How this remarkable effect of metallic lustre is produced seems not to have engaged the attention of entomologists. M. Audebert is of opinion that the similar lustre of the plumes of the humming birds (*Trochilus*) is owing to their density, to the polish of their surface, and to the great number of little minute concave mirrors which are observable on their little beards. (Nouv. Dict. d'Hist. Nat., viii. 257). But these observations will not apply to the scales of the wings of the butterflies, which are always very thin, and very flat; in some instances, as in *Morpho Menelaus*, there appears more than one very slight channel upon a scale, but this takes place also in others that reflect no lustre. Their metallic hues must therefore principally be occasioned by the high polish of their surface and the richness of their tints. It is the purity of the white, in conjunction with their shining surface, contrasted with the dull opaque colour of the under side of the secondary wings, that causes the spots that decorate those of the fritillaries to emulate the lustre of silver." (Introd. to Ent., vol. iii., p. 652). The curious apparatus, consisting of a loop and a strong bristle, whereby the two wings on each side are retained together, is found in many of these insects, and indeed is not met with in any other order. The loop is formed either by an elevated portion of the membrane of the strong central nerve of the upper wing, or by a little tuft of raised hairs. M. Poey has observed that it is simple in the males but multiplied in the females, so that it furnishes a good character to distinguish the sexes. In our article Catocala we have made some general observations upon the distribution of colours in insects, whence it will be evident that it is in the day-flying species that we are to expect the greatest variety of tints; and hence it is, amongst the butterflies especially, as every one knows, that the most splendid hues and the most beautiful markings exist. Moreover it is to be observed that here, as in some tribes of plants, certain tints prevail in particular groups; thus the *Pontiæ* and *Pierides* are generally white; *Colias* and its allies yellow; *Polyommatus* blue; *Argynnis* and *Melitæa* yellow or buff, spotted with black, &c.; in like manner peculiar markings prevail in certain groups, so that in many cases it is easy, by merely examining a fragment of one of their wings, to ascertain the tribe of which the insect to which it belonged formed part. Thus in *Doritis* the centre of the wings have large eyes, with red and black circles. In *Colias* the centre of the posterior wings on the inferior surface has a silvery eyelet; the species of *Danais*, *Idæa*, and *Euplæa*, have the breast and head spotted with white, and in *Acræa* the base of the wing is more or less spotted with black.

The form of the wings is very much varied, preserving, however, in the species of the various groups a certain resemblance in form; but this, however, must not be alone regarded, for amongst the strange freaks of nature we find many groups widely apart, and belonging in fact to different primary sections in the order, exhibiting so great a resemblance together, not only in appearance, but even its habitats and habits, that an unaccustomed eye would be tempted to assert that the individuals formed but a single species. Thus *Geometra dealbata* flies about the footpaths in woods, with *Pontia napi*. In the woods of Brazil, *Acræa Thalia* (a butterfly) and *Castnia acræoides* (a moth) fly together; and in the thick forests of Guiana *Castnia linus* and *Heliconia psidii*, are confounded together whilst on the wing. In like manner *Castnia cronis* of Surinam was actually described by Cramer as the female of *Papilio cronis*. Analogies equally strong exist amongst the species contained in the separate sections; thus *Euterpe teria*, belonging to the *Pierides*, was actually placed, by Latreille and Godart, in the genus *Papilio*, to some of which, in its black wings and red spots, it bears so great a resemblance. Another and still more remote species of analogy exists between some lepidoptera and the insects belonging to other orders; thus the species of *Sesia* and *Ægeria* so much resemble some bees and wasps that they have obtained the names of wasp, hornet, and bee-sphinxes; and indeed we find such an author as Professor Bradley so far deficient upon this subject as to admit into his work a quotation to the following effect: "There are gradual alterations from a perfect moth to the bee kind; and indeed, if we examine the 26th plate, we may find a just proportion from one to the other. The antennæ of all are alike, and their bodies are just different enough to be distinguished from one another." The figures referred to representing the *Macroglossa stellatarum* (the humming-bird sphinx), *Trochilium fusiforne* (the narrow bordered bee-sphinx), *Trochilium bombyliforme* (the narrow-bordered ditto), and *Bombus terrestris* (the humble bee), of which last the antennæ are blameably made like those of the preceding insect, that they may the better correspond with the text! The species of *Ægeria* have, in like manner, received a series of names, illustrating their striking analogy with many other insects of different orders; thus we have *Ægeria Tipuliformis*, *Æger. Chrysidiformis*, &c., and the *Glaucopis coarctata*, in the coarctate form of its abdomen, exhibits a strong resemblance to an *Ichneumon*. As to the analogies between the lepidoptera and other more distinct tribes of animals, it will suffice to state, that the humming-bird moth, and many other sphingidæ or hawk-moths, have obtained these names from this kind of resemblance, whilst some of the larger exotic moths, and especially the gigantic Brazilian *Erebus*, which measures nearly a foot across the wings, have markings on their wings, which have induced the name of *Strix* (owl) to be applied to the last-named insect; and every school-boy knows that the name owlets or owlards is given to large pale-coloured thick-bodied moths, such as the puss moth, which fly about in the twilight.

The legs of these insects are slender and hairy, offering, in many species, various remarkable peculiarities in the different sexes which have not hitherto been sufficiently examined. In general, the six legs are alike, but in some butterflies, which have thence been termed *Tetrapodes*, the fore legs are either very small or occasionally rudimental. In the majority of these insects, the only difference between the males and females consists in the larger size of the latter, and especially of the abdominal portion of the body. The colours of the males are, however, often more brilliant, and the markings more decided, than in the other sex. In some species of moths, the wings in the females are very short, and quite unfitted for flight, and in others they are entirely obsolete. Some females, in this case, also much resemble this larvæ, such as those of *Psyche* and *Oiketicus*. Various differences also exist in the colours of the opposite sexes, as in the orange-tip butterfly, of which the males have the tip of the anterior wings orange-coloured, no trace of which is to be seen in the females; or still more strikingly in the ghostmoth (*Hepialus humuli*), or the muslin moth, (*arctia mendica*,) in which the colour of the wings is entirely different in the opposite sexes. Many instances have been observed, in which the same specimen has exhibited the characters both of the male and female insect, half of the body being masculine and the other half feminine; and we have seen at Berlin a specimen of the scarce egger-moth, which was actually quartered in this manner, the front part of the body and front wings being half male and half female, and the hind part and hind wings half female and half male. M. Andersegg, a Swiss entomologist, has also observed a specimen of *Setina*, which exhibited not only hermaphroditism, but also hybridism, one side being that of a male, *S. ramosa*, the other a female, *S. aurita*.

These insects undergo the ordinary transformations to which insects are subject, being produced from eggs, and appearing as caterpillars, after which they become pupæ or chrysalides, and finally arrive at the perfect state; but as we have already, in our articles Insects, Caterpillar, Cocoon, Chrysalis, and Butterfly, described these various states, we shall now content ourselves with a short notice of the chief modes of distribution of the insects.

In the earlier editions of the *Systema Naturæ* Linnæus adopted only two genera; namely *Papilio* for the butterflies, and *Phalæna* for the moths. In the last editions, however, he added a third genus, *Sphinx*, and subdivided these three groups in the following manner:—

1. *Papilio*. Antennæ clavate.
   - *A. Equites.*—Posterior margin of the wing longer than the anal margin, divided into Trojans, having red spots on the breast, and Greeks having no spots.
   - B. *Heliconii.*—Wings narrow, entire, often almost naked.
   - C. *Danai.*—Wings entire, divided into the *Candidi* or whites, and *festivi* or variegated.
   - D. *Nymphales.*—Wings dentated, divided into the *Ocellati*, or those with eye-like spots, and the *Phalerati*, or those with simple spots.
   - E. *Plebeii.*—Caterpillars, short, thick—divided into the *Rurales*, or those with dark spots, and the *Urbicolæ* with transparent spots.

2. *Sphinx*. Antennæ prismatic, thickest in the middle.

3. *Phalæna*. Antennæ setaceous, often feathered, divided into
   - A. *Attaci.*—Wings somewhat extended and inclined at rest.
   - B. *Bombyces.*—Wings crossed upon the body, antennæ pectinated.
   - C. *Noctuæ.*—Wings crossed upon the body, antennæ setaceous.
   - D. *Geometræ.*—Wings horizontal.
   - E. *Tortrices.*—Wings very obtuse, front margin curved.
   - F. *Pyrales.*—Wings forming with the body a furcate delta.
   - G. *Tineæ.*—Wings rolled into a cylinder.
   - H. *Alucitæ.*—Wings digitated.

Latreille adopted the Linnæan groups, to which he gave the names of—1. *Diurna* (day fliers). 2. *Crepuscularia* (twilight fliers); and 3. *Nocturna* (night fliers). This mode of primary distinction has also been adopted by Mr. Stephens; by whom, however, a distinct mode of classification of the *Nocturna*, or Linnæan *Phalænæ*, has been proposed, and by whom the following groups, considered as of equivalent rank with the *Diurna* and *Crepuscularia*, have been formed.

1. *Lepidoptera pomeridiana*, corresponding with the Linnæan *Bombyces*, and comprising four families: *Hepialidæ*, *Bombycidæ*, *Notodontidæ*, and *Arctiidæ*.

2. *Lepidoptera nocturna*, corresponding with the Linnæan *Noctuæ*, and comprising two families, *Lithosiidæ*, and *Noctuidæ*.

3. *Lepidoptera semidiurna*, corresponding with the Linnæan *Geometræ* and *Pyrales*, and comprising the families *Geometridæ*, *Platypterycidæ*, and *Pyralidæ*.

4. *Lepidoptera vespertina*, corresponding with the Linnæan *Tortrices*, *Tineæ*, and *Alucitæ*, and comprising the families *Tortricidæ*, *Yponomeutidæ*, *Tineidæ*, and *Alucitidæ*.

There are still two other very valuable works upon the lepidoptera, of the mode of distribution of which we would have given an account; their incomplete state, however, prevents our doing this. We allude to Dr. Horsfield's *Lepidoptera Javanica*, and the before-mentioned work of M. Boisduval; the former of which, by its philosophical introduction, and the latter by the careful description of all the species of this order, which it will contain, are especially deserving of attention. The British species, of which there are nearly 2000, have been described by Mr. Stephens in his Illustrations of British Entomology, and by the late lamented A. H. Haworth in his rare *Lepidoptera Britannica*.

LEPISMA. Linnæus. A genus of apterous insects, belonging to the order *Thysanura*, *Leach*, and family *Lepismidæ*, having the body more or less compressed, and posteriorly attenuated with a double series of lateral moveable appendages or false legs on the underside of the body, and the anus furnished with three filaments. The thorax is composed of three segments, each bearing a pair of legs; the antennæ are long and setaceous. These insects are of small size, and are clothed with a fine silvery kind of small scales, which give the body a glittering appearance. They run well, and some species leap to a considerable distance by means of the anal appendages, whence they have obtained the names of springtailed insects. They are chiefly found under stones in damp situations, in moss, &c. The sugar louse,

also, a small and very agile species, found in casks of sugar, is also a member of this group, and is termed *L. saccharina*. (See the Transactions of the Entomological Society, Vol. I., for a Monograph upon the Thysanura of Ireland, by R. Templeton, Esq.)

LEPTIS (Fabricius). A genus of dipterous insects, belonging to the family *Rhagionidæ*, having the antennæ as long as the head, with the basal joint elongated and cylindrical; the second short, the third conical, the palpi turned upwards; the posterior tarsi thicker than those of the anterior legs, and the abdomen linear. The type is the *Musca vermileo* of Linnæus, an insect having somewhat the appearance of a moderate sized *Tipula*. Its larva is cylindric and fleshy, with the anterior part of the body much attenuated. It resides in sandy places on the continent, where it forms a burrow, at the bottom of which it hides itself, sometimes concealing itself entirely, and sometimes partially, and seizes upon any insect which may happen to fall into the hole, round which it writhes itself like a serpent; it then pierces its skin with the sharp setæ with which its mouth is furnished, sucks its juices, and then by a sudden motion of the body, similar to that made by the larva of the cheese-fly, throws it aside. The pupa is enclosed in a cocoon of sand.

LEPTOSPERMUM (Forster). An interesting genus of evergreen shrubs from New South Wales. The flowers are icosandrious, and belong to *Myrtaceæ*. Generic character: calyx turbinate, limb five cleft; petals five, inserted into the calyx; stamens fixed in the throat of the calyx, shorter than the petals, style filiform, stigma headed; capsule four or five celled, cells full of seeds. The *Leptospermums* are grown in sandy loam and moor-earth, and increased by cuttings of the young shoots.

LEPTURIDÆ. A family of coleopterous insects, belonging to the section *Tetramera*, and sub-section *Longicornes*, having the eyes entire and rounded, or but very slightly emarginate, with the antennæ inserted in front of them, or at least at the outer extremity of the emargination, and never within the eye itself, as in the *Cerambycidæ;* the head is always bent downwards, and prolonged behind the eyes into a sort of neck. The antennæ are moderately long, and the abdomen is gradually attenuated towards the tip. This is a family of considerable extent, comprising many handsome species, forming the Linnæan genus *Leptura*. They are found in the spring and summer months in flowers, especially those of the whitethorn and umbelliferæ; they fly well in the sunshine. Their larvæ are found in rotten trees, upon the bark of which the perfect insects are also often to be seen. There are thirteen genera in this family described by M. Serville in his Monograph contained in the Annales de la Societé Entomologique de France for 1835, including *Rhagium*, *Toxotus*, *Pachyta*, *Gramoptera* (*Lept femorata*, *ruficornis*, &c.). *Leptura* and *Strangalia* (*L. calcarata vel elongata*), examples of all of which are found in this country. The typical genus *Leptura* is distinguished by the elongated body, attenuated from the base to the extremity of the elytra; the antennæ eleven jointed; the thorax unarmed at the sides, and broader behind than before. The type of the genus is the *L. melanura*, Linnæus, a common British species.

LESPEDEZA (Michaux). A genus of perennial plants, chiefly herbaceous, belonging to *Diadelphia*, and natural order *Leguminosæ*. Many of the species are hardy; some of them receive the protection of the greenhouse, are increased by cuttings, and succeed with the ordinary management.

LESSERTIA (De Candolle). A genus of undershrubs, herbs, and annuals, natives of the Cape of Good Hope. They belong to *Leguminosæ*. They are grown in loam and peat-earth, and may be raised from cuttings or seeds, which are sometimes produced in abundance.

LESTEVA (Latreille; ANTHOPHAGUS, Gravenhorst). A genus of coleopterous insects, belonging the family *Stephylinidæ*, and remarkable for the resemblance which some of the species exhibit to the smaller *Carabidæ* with truncated elytra, whence the the type of this genus has been named *L. caraboides*. They are of small size, and are found under stones and moss in damp places.

LETHRUS (Scopoli). A genus of coleopterous insects belonging to the *Lamellicornes*, and family *Geotrupidæ*, having the terminal joints of the antennæ formed into a reversed conical mass; the head is very large, as well as the mandibles, which in the males are armed with a strong curved tooth; the abdomen is very short and semicircular. These insects, of which there are several species, the type being the *L. cephalotes*, Fabricius, inhabit Hungary and Western Russia, where, according to Count Gotth. Fischer de Waldheim, this species is very injurious, devouring the tender shoots of various plants, and especially of the vines, which it bites off with its powerful jaws, and drags backwards into its narrow burrow in which it resides together with its partner. During the season of coupling, a strange male will sometimes make his appearance at the mouth of the hole, when a violent battle ensues, which ends only with the death or flight of the intruder. The celebrated Russian entomologist above mentioned, has described several new species of this curious genus in his splendid Entomographia Russia, vol. I, part xiii.

LETTUCE. See LACTUCA.

LEUCADENDRON (Linnæus). A numerous genus of evergreen shrubs, natives of the south of Africa. Class and order *Diœcia Tetrandria*, and natural order *Proteaceæ*. These plants require to be placed in a compost of light loam and moor-earth, with the pots well drained, as they are liable to suffer if overwatered.

LEUCOJUM (Linnæus). A genus of bulbous perennials, chiefly European. They belong to the sixth class of Linnæus, and to the natural order *Amaryllideæ*. The English name of these plants is snow-flake, from the flowers of one of the species appearing early, shaped like those of the snow-drop. Another species, a native of England, flowers in the beginning of summer, and is then very conspicuous. Increased by offsets.

LEUCOSPIS (Fabricius). A genus of hymenopterous insects, belonging to the family *Chalcididæ*, of which they constitute the largest species, and are distinguished by the singular position of the ovipositor, which, when unemployed, is laid along the back, sometimes extending as far as the scutellum. These are handsome insects, varied with yellow and black, and inhabit the middle and south parts of Europe, America, Asia, &c. There are about thirty species known.

LEUZEA (De Candolle). A genus of herbaceous plants, chiefly European. They belong to *Compositæ*, and were called *Centaurea* by Linnæus.

A light flower border is suitable for them, and they are increased by seeds or dividing the roots.

LIATRIS (Gærtner). A genus of North American herbaceous plants, belonging to *Compositæ*. Several species are in our flower gardens, and esteemed handsome. Some of them have this peculiarity, that whereas most other plants having a spike of flowers, blow from the bottom upwards; this blooms first at the top, and successionally flower after flower downwards. They are propagated by slips and by seeds, which should be sown as soon as ripe.

LIBELLULIDÆ (Leach). A family of neuropterous insects, comprising the dragon-flies, or genus *Libellula* of Linnæus, distinguished by the minute size of the antennæ (whence they form with the ephemeræ the group named *Subulicornes* of Latreille), and the large size of the mandibles. Having in our articles DRAGON-FLY and INSECT (vol. ii. p. 847), given various details relative to the natural history of these insects, it only here remains for us to notice the mode in which the Linnæan genus has been divided by recent authors. Fabricius introduced two additional genera, *Æschna* and *Agrion*, and Dr. Leach divided the Linnæan group into two families, *Agrionidæ*, which see, and *Libellulidæ*; in the latter of which the wings are horizontally extended when at rest. He also proposeed the additional genera, *Anax*, *Cordulia*, *Cordulegaster*, and *Gomphus*, all of which are British, founded upon tne form of the wings, and of the abdomen and anal appendages; the typical genus *Libellula* (having for its type the *Libellula depressa* of Linnæus), having the posterior wings alike in both sexes, and the abdomen more or less depressed. The typical species above mentioned is a large and handsome insect, often to be seen in the summer hovering over stagnant water; the abdomen of the males being of an opaque blue colour, and that of the females dark fulvous brown; the wings have a large dark patch at the base.

LICHENES. Is a natural order of Jussieu's second grand division, *Cellulares*. There are thirty-five genera and four hundred and twelve species already described, and no doubt many more remain to be discovered. The lichens are useful in the economy of nature in preparing the surface of the earth for the reception of larger vegetables. Some few of them are eatable, others are used by the dyer, and and several are medicinal. Various species appear as the weather-stains on old walls; they cover desert wastes, or mottle the bark of ancient trees.

LICINUS (Latreille). A genus of coleopterous insects, belonging to the family *Carabidæ*, sub-family *Harpalides*, having the last joint of the palpi large and hatchet-shaped, the mentum without a central tooth, and obtuse mandibles; the body is broad and depressed, and the species are of black colours. Three only are found in England, *Carabus silphoides* of Fabricius being the type.

LIGHTFOOTIA (Le Heretier). A genus of undershrubs, natives of the Cape of Good Hope, belonging to *Pentandria monogynia*, and to the natural order, *Campanulaceæ*. Generic character: calyx of five sepals; petals lance-shaped, stamens, filaments dilated at the base, and forming a hollow; stigma from three to five-cleft; seed-vessel three to five-celled. Succeeds with the ordinary green-house management.

LIGULUS. A genus of molluscs constituted by Dr. Leach, but now forming a subdivision of the genus *Lutricola*.

LIGUSTICUM (Linnæus). A genus of large herbaceous perennials, natives chiefly of Europe. The flowers are pentandrious, and the genus belongs to the order *Umbelliferæ*. The common sort is cultivated in gardens under the name of lovage, used as a potherb, and propagated by seed.

LIGUSTRUM (Linnæus). A genus of two species, und of one of which there are several varieties. Class and order, *Decandria monogynia*, and natural order, *Oleinæ*. The common privet is a native of Britain, and one of its varieties is an evergreen, and much in repute for thickening shrubberies and forming evergreen hedges for shelter or ornament. *L. lucidum*, the Chinese privet, is rather a tender plant, and requires a sheltered situation; both are easily propagated by cuttings or layers.

LILAC. Is the *Syringa vulgaris* of Linnæus, of which there are four varieties in our shrubberies. Two other species ornament our gardens, namely, the Chinese and the Persian: of the latter there are two or three varieties. They are all easily propagated by layers or suckers from the root.

LILIUM (Linnæus). A splendid genus of bulbous flowering plants, belonging to the sixth class of Linnæus, and to the natural order, *Tulipaceæ*. Generic character: corolla bell-shaped, regularly six-parted, segments spreading and reflexed, with a nectariferous furrow down the centre; stamens inserted into the base of the corolla; anthers versatile; style columnar; stigma three-lobed; capsule three-sided, six-furrowed, three-celled, three-valved; valves united by a fibrous net; seeds compressed. The *L. candidum*, the white lily, stands deservedly at the head of the genus: and nothing shows more decidedly the estimation in which it is held, than that it is seen in almost every cottage garden. The superb, the chalcidonian, and the tiger species, are all equally valued; indeed, the whole of the twenty-six species are highly ornamental, and easily increased by offsets from the bulbs. They affect a light rich soil; but the North American species do best in moor-earth.

LILY OF THE VALLEY. Is the *Convallaria majalis* of Linnæus. A British plant so much admired, as to be seen in every garden.

LIMAX (Linnæus, and modern authors). This mollusc is so well known as the common slug of all countries, that a description of it would here be useless merely to point out its general character; but as it is one of those unfortunate animals whose appearance inspires mankind with disgust, and renders it an object of persecution and destruction, few of our readers would probably be tempted to examine it minutely for his instruction, or deem it worthy of attracting any portion of his admiration. We shall, therefore, give a more particular description of its wonderful structure than so humble an inhabitant of this planet may appear to deserve; we would also gladly awaken sentiments of compassion towards it, upon the principle we have attempted to establish with regard to its neighbour and relative, the common snail. The body of this terrestrial mollusc is an elongated, oblong, oval form; it is completely gasteropod, or crawling on its belly, possessing no externally formed legs, but progressing in its motion by means of certain internal muscles, so arranged as to give a fixed reliance on each in succession, as the advance or step forward is made, from the first seg-

ment of the body to all the others; and in certain situations where the ground is ill adapted to the animal's locomotion, a slimy juice is expelled from its body to smooth the path, or give an additional hold to its footing. The skin of the slug is very thick, but more particularly at the anterior part of the back, where it forms a sort of fleshy fold or shield, extending more or less over the sides of the animal's body; in the interior of this is contained a rudiment of shell in the shape of a small detached flat osseous substance in some species, and in others there are only corpuscular grains or elementary parts of bone to be discovered; these are not exhibited on the exterior, but doubtless tend to guard the pulmonary cavity which lies on the right side immediately beneath this shield or fleshy cowl. The animal has four tentacula, retractile, and capable of considerable extension; the larger or posterior pair are furnished with eyes at their summits; these, with the other tentacula, assist as feelers to avoid danger, and are probably furnished with organs of smell to guide the animal to its food, its visual faculties appearing extremely limited. These tentacula constitute an important part of the animal's economy of structure, so much so indeed that nature is said to renew them when they have been destroyed by accident or philosophical cruelty; the fact does not, however, rest upon any confirmation of our own, though it is corroborated by analogous circumstances in other molluscous animals, which leave but little doubt of its truth. Abundant as these molluscs are, they are difficult to separate into species, and only a few appear to have been distinctly characterised by naturalists; their habitat is also equally general, as they are found in the tropical and northern hemispheres, where, like the snail, they perform the functions of their existence with greater advantage to mankind than they receive credit for. Had our limits permitted, we should have been pleased to have had an opportunity of carrying on this article to a somewhat greater extent by endeavouring to trace the interesting chain which evidently connects the *Limax* or common slug, in which the portions of testaceous matter are merely elementary to other molluscs, in which they become small tabular pieces—a solid crustaceous substance, a small well-defined shell, partially covering the branchial cavity of the animal's body, and finally a perfect shell, serving as a defence and retreat for the entire body of the animal; these connecting links may be traced in the *Parmacella*, *Testacella*, *Onchidium*, *Dolabella*, and *Vitrina*, till we arrive at the *Helix;* or pursue the reverse course, and trace the links from the perfect *Helix* down to the *Limax*, which seems to be the more natural arrangement. In throwing out this suggestion we will lend our assistance, by describing minutely each of the genera we have named as bearing on the question, and to the best of our judgment draw just conclusions by analogous reasoning in those instances where we cannot obtain information from actual observation or the well authenticated researches of competent naturalists.

Limacina (Cuvier; Clio Helicina, Linnæus). Gmelin called this genus of molluscs *Helicina*, which appears more descriptive of its general characters; but the name of *Limacina*, given by Lamarck, has been adopted by succeeding authors. In many respects it approximates to the genus *Planorbis*, particularly in having a very wide umbilicus, formed by the flat spread of the whorls. The shell is thin, fragile, and papyraceous; its whorls spiral as in the common *Helix*, but united in a discoid form. The body of the animal is of an oblong form, with two branchial fins situated at the base of the neck; the posterior part of the body spiral. This genus differs in few particulars from the Linnæan genus *Clio;* the animal, however, possesses the power of retreating completely within its shell, which is not the case with the *Clio*. The *Limacina* inhabits the North Seas, and is classed by Lamarck as the second genus of the fifth order *Pteropoda* or winged feet. De Blainville has called this genus *Spiratella;* he observes that the characters were taken from Captain Scoresby's Voyages, and are established on an almost microscopic animal found in the Arctic Seas.

Limacinea. The third family of the first order *Pulmobranchiata*, first class *Cephalophora*. It includes the genera *Succinea*, *Bulimus*, *Achatina*, *Clausilia*, *Puppa*, *Anastoma*, *Helix*, *Carocolla*, *Helicolimax*, *Testacella*, *Parmacella*. *Limacina*, *Limax*, and *Orchidium*. The form of the animal is very various: the head, provided with two pairs of tentacula, completely retractile within the animal's body, the posterior pair larger than the other pair, and bearing the eyes at their extremities; one tooth on the upper lip; the tongue or lingual mass is small, and covered with a skin thickly set with microscopic teeth or bristles. The shells of these genera, which constitute the family *Limacinea*, are as different in their form as the animals inhabiting them, the one occasioning the other, but their general characters never vary; in many respects, such as being always spiral, of an oval or globular form, more or less discoid or compressed; the summit of the whorls smooth, always without an epidermis; the aperture round, semilunar, oval, or angular, but never notched. The animals inhabiting these genera are all terrestrial, and feed on vegetables generally, such as fruit or other soft substances which admit of being reduced by the action of the tongue in licking them. The garden snail in this, as well as many other instances illustrative of the structure and habits of a considerable portion of molluscs, may constantly and easily be seen; and a reference to the article Helix will further explain some of the daily habits of all similarly constructed animals. The great number of terrestrial molluscs that exist in every climate, and their beauty and usefulness in almost all countries, have excited considerable interest, and occasioned consequently many ample and minute descriptions of their species. Several eminent naturalists have attempted a general classification, in which, however, a contrariety of opinion must ever exist; but the late Baron de Ferussac appears to have reconciled most of the disputed points. His splendid work on Terrestrial Molluscs must ever be viewed as a masterly and elegant production, and will be handed down to posterity a monument worthy of his great name as a profund naturalist, enlightened scholar, and amiable man. In the genera contained in this family, we have preserved in our order of enumeration the usually received arrangement of modern naturalists, without disputing its general excellence; and in such instances as have occasioned a slight difference of opinion, we have frankly expressed our reasons for dissenting from such high authorities, not in a spirit of self-sufficiency, but rather to throw out an useful hint by which the difficulties now surrounding the study of malacology may in some degree be lessened, and a lure held out to our readers to

mark, learn, and reason for themselves; for if they would become proficients in natural history, they must read the book of nature in her own deeply traced and undeviating characters of truth and infinite wisdom.

LIMA (Bruguière, Cuvier, Lamarck; OSTREA LIMA of Linnæus). A genus of molluscs confounded by old authors with the *Ostrea;* a separation from them, however, is manifestly correct, as the animal has become well known, and is ably described by recent authors. Its body is slightly compressed; it has a byssiform abdominal appendage; the edges of the mantle are furnished with several rows of tentacular cirri; the mouth surrounded by a thick lip, with a fringed edge. The shell is equivalve, oval, more or less oblique, gaping at the anterior part of the lower side, the summits anterior and distant, the hinge longitudinal, without teeth, and the ligament rounded, nearly external and inserted in a cavity on each valve. The muscular impression is central, and distinctly divided into three portions; the ears at the base are very small, but quite visible; the colour of the valves is a delicate white. Some species are more ventricose than others, but they all possess longitudinal ribs armed with vaulted scales, imbrications like a rasp, whence its name, or with striæ; the margins are crenulated, and closely interlock when the valves shut. Lamarck enumerates six species, inhabiting India, America, Australia, and the Mediterranean; and many fossil species are known. It is of the second family *Subrostracea*, third order *Lamellibranchiata*, class *Acephalophora*.

LIME is the *Citrus limonum* of Rizzo, a useful fruit-tree indigenous in India, and cultivated in many other parts of the world, for its juice which is so useful in medicine, and many domestic and culinary purposes. The wild lime is probably the original species whence has been obtained all the fine varieties of this valuable family.

LIME TREE is the *Tilia microphylla* of Linnæus. The genus are European and North American timber trees, very commonly used in ornamental planting, for forming avenues, open groves, and form handsome objects when planted singly on dressed ground. The timber is soft, very white, and chiefly used in turnery. All the sorts may be readily propagated by layers.

LIMNIIDÆ (Stephens). A family of small aquatic *Coleoptera*, belonging to the section *Pentamera*, and sub-section *Philhydrida*, distinguished by having the antennæ nine or eleven-jointed, filiform, or but slightly thickened towards the tips, and as long as the head and thorax; the legs are furnished with two very strong claws, and the last joint of the tarsi is very long. The British genera are *Limnius*, Illiger (or, more properly, *Elmis*, and hence the family name should be changed to *Elmidæ*), and *Georyssus*. The species are small, and although residing in deep and running water, they are not formed for swimming; but still we find their legs, and especially their large tarsal claws, admirably adapted for retaining firm hold of the tough under-surface of stones, beneath which they are always found. There are twelve British species of *Limnius*, and one of *Georyssus*.

LIMNACEA. The first family of the first order *Pulmobranchiata;* second class *Paracephalophora*. All the molluscs included in this family are inhabitants of fresh water rivers, or stagnant pools, frequently merely floating on the surface, and sometimes at the bottom. The form of these shells vary considerably; but the substance of the shell is constantly thin, and the external edge always sharp. Most of them being within our daily reach, a very minute description of them here is not necessary.

The shape of the animal constructing these molluscs, varies as in every other instance. Their general characteristics are, in many respects, similar to the family *Limacinea*. They have, however, only one pair of completely retractile flattened tentacula, upon which the sessile eyes are situated on the internal side of their base. They are amphibious, usually without an operculum; but the aperture, under some circumstances, closed by a thin calcareous cover. The genera included in this family are *Lymnæa*, *Physa*, and *Planorbis*. They are abundantly found in all countries; each genus containing numerous species, particularly that of *Planorbis*.

LIMNOCHARIS (Boufland). An aquatic genus of plants, natives of Brazil, belonging to *Polyandria monogynia*, and to the natural order *Hydrocharideæ*. Generic character: calyx of three sepals; carolla of three small petals; stamens inserted into the receptacle: capsules several, one celled, and many seeded. This is grown and readily flowered in our stoves in tubs of water. The organisation of the leaves is curious: at the point of the costa or midrib of the leaf, there is an aperture whence pure water appears to be distilled in globular drops. The *L. plumieri* is only a biennial; and, therefore, to preserve the plant, seeds should be saved.

LIMNORIA (Leach). A genus of minute but very destructive crustaceous insects, belonging to the order *Isopoda*, and family *Cymothoidæ*, having the eyes granular, the antennæ four in number, and inserted nearly in a line, and four-jointed; the legs similarly formed and fit for walking; the abdomen six-jointed, the last segment being large and subor-bicular. The only species is the *Limnoria terebrans*, which does not exceed one-sixth of an inch in length, but which, from its wood-eating habits and great powers of multiplication, is one of the most destructive of our insect enemies, attacking piles of wood immersed in the water, in our dock-yards, flood-gates, timber bridges, chain piers, &c., and which in a very short time it completely perforates in a most alarming manner, boring to the depth of several inches in every direction. It is found in many parts of the coast, both of Great Britain and Ireland (see Thompson and Coldstream in the Edinburgh New Philosophical Journal, 1834), and France. From Coldstream's elaborate paper just referred to, it is evident that the boring of this little insect in the wood has for its object the obtaining a supply of food, as "the contents of the stomach resembled comminuted wood," and that it commences its ravages on an entire piece of wood, by fixing upon the soft parts situated between the harder annual layers, and by subsequently working upwards at an angle of 45°, keeping in preference in the course of the soft layer into which it bored at first; the mandibles appear to be its chief tools; it likewise appears necessary that the hole should be filled with salt water whilst the insect is at work. Very often, however, the galleries are horizontal, and sometimes perpendicular, the walls being as smooth as if cut by a sharp knife. With a view, however, of more particularly calling the attention of scientific persons, and especially those whose knowledge of chemistry may best enable them to suggest prac-

ticable remedies against the attacks of this pest, we will notice more precisely the extent to which the damage caused by it has extended in some of our public works, our information being condensed from Mr. Coldstream's paper. During the building of the Bell Rock Light-house, it was necessary to erect a temporary wooden building, in which the engineer and his assistants resided, and which was supported by twelve large beams of Memel fir fixed in bolt holes cut in the rock; the sides of these beams were charred and pitched, but the bottoms, which closely fitted to the holes, were left naked. In the second year the edges of these timbers were in a state of decay, owing to the borings of the *Limnoria*. The logs of Norwegian pine laid down to support the temporary railways were also very much destroyed: the timbers, which were at first ten inches square, being reduced in four years to seven inches; that is, losing at the rate of one inch per annum. In several instances, also, the house timbers were so completely eaten away at the bottom, that they stood clear of the rock, supported only by the bolts and stancheons. The piles supporting the timber bridge at Montrose "were very much destroyed by the borings of the same animal, so that the stability of the whole structure was seriously endangered;" and in like manner the piles supporting the Trinity Chain Pier at Leith were in 1825, four years only after their first fixture, found to have been so very much destroyed by the *Limnoria* as to be useless, and they were at a great expense removed and replaced by new ones; the girth of some of them which were originally forty-eight inches in circumference, having been reduced to six inches, so that the least force was sufficient to break them through. The attention of scientific men became at length seriously aroused; various plans for remedying the mischief were proposed and tried; but none succeeded so well as covering the whole surface of the pile, from the place where it met the bottom of the sea to within a foot or two of mean high-water mark, with broad-headed iron nails, technically called scupper nails, set close together; the taste of wood, now encrusted with a thick coat, as well as impregnated with oxide of iron caused by the presence of the nails, probably offending the taste of the *Limnoria*. Thus a piece of wood covered on three of its sides with the scupper nails was found to have the whole interior eaten away, so much of the exterior only being left as had been penetrated by the nails on the sides. This plan was adopted at an expense of about 1000*l.* in the Leith pier, which cost 30,000*l.*, and after four years, it was discovered that none of the piles thus protected had been penetrated by the *Limnoria;* whilst some wood work attached to the pier, but not so defended, is now much destroyed. It is essential, however, to watch the condition of the piles from time to time, even though covered with the iron nails, because the heads of the nails frequently fall off after being much oxidated; and it is very possible that the coat of oxide which they have previously communicated to the pile may also be abraded so as to leave the wood entirely exposed to the enemy, and the nails which fall away ought to be replaced by new ones as fast as possible. We cannot take our leave of Mr. Coldstream's paper without quoting at length his admirable and truly philosophical observations upon the purposes which the *Limnoria* is fitted to serve in the economy of nature, and which it will be seen correspond in some respects with the remarks which we made upon the injuries arising from the attacks of insects in our general article Insect. "Although the destructive agency exerted by this minute animal be forced upon our attention, chiefly by its ravages in works of great practical utility, and therefore cannot at first view be regarded by us with complacency or admiration; yet, upon further reflection, we must be convinced that the purposes which the *Limnoria* is fitted to serve in the great plan of the creation, are such as could be accomplished by no other living creature with which we are acquainted, and that they are calculated to contribute in no small degree to the comfort and well being of man. Let us consider, for instance, how possible it is that large trees or masses of wood floated down by rivers might accumulate on shoals at their mouths to such an extent as materially to diminish the outlet for the waters, which then would rise and overflow their banks, were it not for the destructive boring of the *Limnoria:* what could not be accomplished by the brute force of any marine animal, and might baffle even the ingenuity and power of man himself, is yet quietly accomplished by the gradual but steady operations of a tiny crab."—"Nor must we omit to notice the possibility of its being the means occasionally of causing the removal of those serious obstacles to the safe navigation of shallow seas, which are caused by the masts of sunken vessels. But whether we be right or wrong in our suppositions as to the use it may be of in the economy of nature, we cannot be mistaken in regarding the ravages of the *Limnoria* as showing what formidable enemies to man the Creator can prepare, even amongst what appear to us the most insignificant of His works, and how He, who ruleth over all, effects important purposes, by means of the smallest and apparently most incompetent agents."

We must also refer to a paper by the Rev. F. W. Hope, contained in the second number of the Transactions of the Entomological Society, in which several useful remedies are suggested; and we would also notice the probability, that the immersion of wood to be employed in submarine works in Kyan's patent solution, would also be very serviceable.

LIMULUS (Fabricius). A curious exotic genus of *Crustacea*, constituting the sub-order *Xyphosura* (see article Crustacea), and known by the common name of king crabs, having the body covered by a large and nearly rounded shell, divided into two parts, the anterior being large and semilunar, and the posterior toothed at the sides, and deeply notched behind, and terminated by a very long and acute spine; the mouth is not provided with any sucker, the coxæ of the six anterior pairs of legs being dilated and spined, and performing the office of jaws; the anterior pair of legs is very short, and seem to serve as a pair of claws assisting in carrying materials to the mouth; the five following pairs are larger, and terminated by small bifid claws, but do not extend beyond the margins of the shell; the terminal legs, which are ten in number, are transformed into thin lamellated plates serving for branchiæ. These king crabs sometimes attain the length of two feet. They inhabit the tropical seas, frequenting the coasts, and appearing to be found only in the East Indies and the shores of America. According to M. Leconte, they are given to pigs for food, and the long and pointed tail is sometimes employed by the Indians for the points of their arrows. Their eggs are eaten by the Chinese. Fossil

species are described and figured by Knoor in his Monuments of the Deluge. There are two genera, namely, *Tachyphlæres*, having the four anterior legs terminated by a monodactyle claw in one sex; and *Limulus*, in which the two anterior legs in one sex are monodactyle.

LINEÆ. A small natural order of plants, separated from *Caryophylleæ* by M. Decandolle. It contains only two genera, viz. *Radiola* and *Linum*; there are only one species of the first, and above forty of the second, among which is the useful *Linum usitatissimum*, which yields that important article FLAX. The species are herbaceous or suffruticose plants, with simple entire leaves, usually alternate and without stipules, but sometimes with basal glands. The inflorescence is terminal, in racemose corymbs or panicles; the flowers are regular and united, either blue, white, or yellow, and very fugacious. The *Linums* are remarkable for the beauty of their flowers, but still more for, as has been already observed, the excellence of the fibre, which, when duly prepared, forms the flax of commerce, whence linen is made. Its seeds are oleaginous, and from them linseed-oil is expressed; and the residue after expression is the oil-cake upon which oxen are fattened. The seeds also contain a large quantity of bland mucilage, whence their use in decoction as demulcents; and linseed meal forms one of the best materials for cataplasms.

The flax used in this country is mostly of foreign growth, for notwithstanding the rewards held out by the legislature to encourage its domestic culture, it is found in well-peopled districts to be an unprofitable investment, not only for its inferior value to corn, but because it is such a scourge to the land on which it is grown. The *Radiola millegrana* is a small British annual found on sandy ground.

LINGULA (Lamarck), *Patella unguis* (Linnæus). This singular mollusc is an instance of the vagaries exhibited by nature in her productions; and whenever they occur they give rise to infinite speculation in the minds of naturalists, to reconcile their apparent anomalies with the general laws that govern the structure of other creatures in the same branch of creation. Many of these sports of nature, or monstrosities, if we may presume so to term them, are to be accounted for by local or adventitious circumstances; but all we know of the greater number of them is that they are, and the why rests upon the most consistent train of philosophical reasoning that can be exercised in explanation; one constant conclusion we must always arrive at, that they are all peculiarly constructed for some wise purpose, and form so many additional proofs of infinite wisdom. Without enumerating any of the circumstantial details handed down to us by Aristotle, Pliny, and the early naturalists, respecting dragons, mermaids, and other fabulous creatures of that dark era of superstitious ignorance, or quoting instances of a far more recent date, when the good old Gerarde so solemnly affirmed that barnacles generated ducks and geese, we have only to ask ourselves what faith we should have placed in that person who first discovered or described a quadruped with its head to all appearance similar to that of a bird, as is the fact with the *Ornithorhynchus* or *Bradypus platypus*, had we not the evidence of our own senses to confirm it; or could we have credited that this planet was once tenanted with the stupendous race of creatures whose fossil remains are daily brought to light by the indefatigable zeal of geologists, and whose existence goes well nigh to shake our faith even with their bones before us. It therefore becomes necessary for every one to pause and reflect, before he pronounces anything impossible in nature, or the dream of a poetic imagination, because he cannot readily fathom the anomalies it presents. Well may it be said that "travellers see strange sights," some of which, acting on an unenlightened mind, or but superficially observed, soon get clothed in fiction by frequent repetition, till at length they are worked up into a marvellous tale, too monstrous to be credited, though founded, in the first instance, upon one of those capricious examples of nature's power. We must not, however, dwell longer on a subject that would lead us into a wider field of speculation than it is our duty here to pursue, but return to the singular mollusc which has given rise to this digression. The *Lingula* is strictly a bivalve mollusc, its valves being of an equilateral, subequivalve form, truncated at their upper end, with a slight point in the centre of each, formed by the angular depressed rib which runs along the back of the valves, giving them the appearance of the upper mandibles of a duck's bill, whence the name of the species called, *Lingula anatina*; these valves are covered with a sea-green epidermis, and sometimes attain the size of three inches in length by half an inch in breadth, becoming much narrower or quite pointed opposite the patulous termination; but it is unlike every other bivalve, inasmuch as there is not the slightest indication of these valves being in any way connected together by the ordinary methods of nature. They possess no indications of teeth, hinge, or ligament; and their union would in vain have been guessed at, had it not been discovered that a junction is effected by means of the pointed ends of the valves being inserted, and vertically fixed in a fibro-gelatinous stem or peduncle, similar to that existing in the anatifa and its congeners. Linnæus classed this mollusc with his genus *Patella*, and a more excusable error cannot be found in the annals of natural history, for had that great master seen no more than one valve of this shell, as some authors imagine, he could only conclude it to be a patella closely allied to those species which have since formed the genus *Parmophora*, to which the resemblance is rendered more strong by the valves of the lingula possessing small internal granular callosities, visible in the *Parmophora* and other genera of *Patellæ*; but it is equally obvious that had Linnæus examined numberless specimens unconnected, or not *in situ*, he would still have found stronger grounds of confirmation in the conclusion he had drawn. Some naturalists have thrown out a hint that a connecting link might be traced between this mollusc and the family *Lepidacea*; but an examination of the anatomical structure of both leads to no such result, the fleshy stem being the only character common to each, if we except the long tentacular appendages existing on both sides of the animal's body, and serving as a bait, the organs of smell, or feelers, by means of which their food is discovered and seized, and which are spirally folded within the valves when the animal is in a state of repose, their position being distinctly marked on the internal surface of the valves. Like the *Lepidacea*, too, these molluscs are limited to the locomotion afforded by the contraction or expansion of their flexible peduncle; they cannot remove from place to place, but live and die on the spot which first gave life to their egg or germ. Whether they are found in congregated families, like the

Lepidacea, we know not, but every reason tends to point out that such must be the case; these are therefore the only important similar characteristics, while the distinctive ones are far more remarkable. The lingula also cannot be a carnivorous animal, not possessing the strong horny or ciliated processes that enable the *Lepidacea* to crush and, as it were, masticate their food. These shells are found in the Indian Ocean and Molucca Islands. Two species are mentioned, besides that described by Lamarck, but we only know of this one. De France describes two fossil genera. In the arrangement of De Blainville's Malacology, this genus is the first of the order *Palliobranchiata*, first section; and in Lamarck's system it is the first genus of the class *Conchifera*, first order *Monomyaria*, first tribe *Brachiopoda*, in which he includes the genera *Terebratula* and *Orbicula*.

LINNÆA (Gronovius). A genus named in honour of the celebrated Linnæus. It belongs to *Didynamia angiospermia*, and natural order *Caprifoliaceæ*. Generic character:—calyx double; the exterior four-cleft; interior five-cleft; corolla bell-shaped; limb nearly equally five-lobed; stamens included; anthers ovate: style bearing a headed stigma; berry three-celled, two of them seedless; a creeping plant found on mountains in Scotland.

LINTHURIS (De Montfort). A microscopic fossil mollusc, described by De France as nearly allied to the *Nautilacea*.

LION. See Cat.

LIQUORICE is the *Glycyrrhiza glabra* of Tournefort, cultivated for the juice extractible from the root. See Glycyrrhiza.

LIRIODENDRON (Linnæus). A genus of trees containing two species, which, from the amplitude of the flowers, are called tulip trees. They belong to *Magnoliaceæ*, are natives of North America, and have been long cultivated in Britain, forming a beautiful variety among other ornamental trees. They are commonly raised from seeds imported from America; and when sown in the spring, do not readily vegetate the first year, but lie inactive till the second year.

LISIANTHUS (Brown). A genus of trees, shrubs, and biennial herbs, natives of the West India islands. The flowers are pentandrious, and the genus belongs to *Gentianeæ*. Generic character:—calyx somewhat bell-shaped, five-cleft, margin of the segments colourless and lying back; corolla funnel-shaped, throat beardless, limb five-cleft; stamens inserted into the base of the tube; anthers arrow-shaped, two-celled; style elongated; stigma in two plates, or shells; seed vessel two-celled, dissepiments and valves, turned back. Some of the species are handsome flowering plants, and well worth cultivation; they are readily propagated by cuttings struck in sand under a glass.

LISSOCHILUS (R. Brown). A genus of splendid flowering *Orchideæ*, natives of the Cape of Good Hope. They grow best in turfy peat, mixed with a little loam; and can only be increased by divisions of the root.

LISTERA (R. Brown). A genus of two British plants, belonging to *Orchideæ*, formerly called *Neottia* by Richard, and are the "twayblade" of English botany, commonly found in damp woods.

LITHERINA (De Ferussac). A genus of mollusces separated from the genus *Turbo* of other authors. We do not, however, think the distinction sufficiently great to warrant its being constituted a genus.

LITHOLEPAS (Sowerby). A genus of molluscs possessing most of the characters common to the *Lepadicea*, and, like them, having its valves fixed to a flexible peduncle, at the base of which is a testaceous appendage resembling a reversed patella, consisting of eight contiguous pieces of an unequal size, six of them lateral, whose lower ones are very small, one large dorsal one, and one very small ventral one. The peculiar faculty this mollusc has of forming excavations in which it lives in the rocks of Mount Serrat, is unlike all other of its congeners; and the animal must be considered the type of an intermediate species between the *Lepas* and the *Balanus*.

LITHOSIIDÆ (Stephens). A family of nocturnal lepidopterous insects or moths, distinguished by the slenderness of the body, the length and narrowness of the wings, which are convoluted when at rest; the palpi are cylindric, and the antennæ are slender, and sometimes pectinated in the males. Latreille united these insects with many others into a family, which he named *Pseudo bombyces*, and they certainly very much recede from the typical appearance of the feathered full-bodied moths, having, in several respects, a much nearer relationship with the *Tineidæ*, with which also their larvæ nearly correspond. The moths do not present any remarkable peculiarities for notice. The genera are *Callimorpha*, containing the pink under-wing moth (*C. Jacobæa*), *Eulepia*, *Decopeia*, *Lithosia*, *Gnophria*, and *Setina*. The species of the last named genera, and especially those of *Lithosia*, are called footman-moths by collectors, from the colours, which are generally dull ochre or buff, with a narrow lighter coloured margin to the wings. The type of the genus is the *Phalæna noctua complana* (Linnæus), which has the anterior wings lead coloured, with the front margin clay coloured, and the posterior wings yellow. It is about an inch and a quarter in expanse, and is sufficiently common in woods near London. There are nine other species.

LITHOSPERMUM (Linnæus). A genus of annual, biennial, and perennial herbs, mostly natives of Europe. Several of them are natives of England, and the *L. officinale* is the gromwell of English botany.

LITUACEA (Lamarck, De Blainville). A family of molluscs whose animals are not at all known, without they resemble those of the *Spirula*. The genera included are mostly fossil; but the *Spirula* is a recent well known shell, and will more easily illustrate the characters of this family than a detailed description.

LIXUS (Fabricius). An extensive genus of coleopterous insects belonging to the family *Curculionidæ* or weevils, having the body long and narrow, and sometimes even linear, with the antennæ twelve-jointed, inserted behind the middle of the rostrum, the club being fusiform; the rostrum is long and cylindric, nearly straight, and not inclined to the breast; the femora are unarmed, and the tibiæ have a hook at the tip. The exotic species are numerous, but there are only five found in this country, the type being the *L. paraplecticus*, the larva of which feeds on the stems of the phellandrium, and produces a disease in horses which may happen to eat it with the plant.

LIZARD (Lacerta, or rather Lacertidæ, the lizard family). The second family into which Cuvier divides his second order of reptiles, *Sauria*, and fol-

lowing immediately the crocodiles, which some of the larger species resemble a good deal in their appearappearance, though they are very different in their habits. Lizard has so frequently been used as the name of almost every saurian reptile, without exception, that the meaning of it is loose; and even the best systematic naturalists are hardly agreed as to the extent to which it ought to be applied; so that even Cuvier, whose judgment in the classification of animals according to the structure ranks so high, found it necessary to separate the family of lizards into two distinct orders—monitor lizards, and lizards properly so called; and we shall follow the same order in our brief notice.

Lizards are found chiefly in the warmer parts of the globe; and though many of them frequent marshy places, and the margins of the waters, and they are all to be considered as properly land animals, and not aquatic ones. Many of them can swim, and do take to the water; and some of the larger of these, which are of considerable size, though small in comparison with full grown crocodiles, prey upon small animals in shady places by the sides of the water, and occasionally upon fishes; yet they have not the strength nor the ferocity of the crocodiles.

The distinguishing characters of the lizards are:—the tongue slender, extensile, and forming two filaments or branches at the point; as in various kinds of serpents, they all move with rapidity, though in this respect there are considerable differences between them; they have five toes on each of their feet, three to their bases of unequal length, more especially on the hind feet, and all furnished with claws. Their bodies are lengthened; and their scales on the belly and tail are ranged in transverse bands. The tympanum is on the same level with the head, or only a little raised; a production of the skin, in which there is an opening, which acts as a sphincter, protects the eye by acting something in the manner of a third eyelid. The false ribs do not extend entirely round the body so as to form a complete circle. The opening of the ear is oval, and very conspicuous; but there is not an elevated crest either on the head or along the back. The tail is, at least, as long as the body. It is of a cylindrical form, and composed of jointed rings, and without upper crests. The feet are all nearly of equal length; and under each thigh there is a range of small porous scaly tubercles. There are five distinct toes on each foot, terminated by crooked claws. A good many of the species are found in woody situations, where they seek their food among the foliage, or in the underwood. This food consists chiefly of insects. Others inhabit ruinous buildings; and they are even met with near the habitations of man, subsisting partly on insects and partly on vegetables. A few others are found frequenting marshes, ponds, or lakes, where they prey on the small animals which inhabit them. The lizards are, generally speaking, active, lively reptiles, and, all circumstances considered, may be reckoned the least repulsive of all the saurian tribes. They are perfectly innocent in their manners; and not a few of them are of an agreeable form, and beautifully coloured, constituting pleasing objects in the scenery of tropical countries. This is especially the case with many of the smaller ones, which reside in dry places, and resort to the trees, among which their motions are often so rapid that they bear no inconsiderable resemblance to finely coloured birds.

Though the true lizards have not the ferocious disposition of the crocodiles, and few or none of them give out those poisonous, or otherwise offensive secretions which are given out by some other saurians, yet there are sometimes prejudices against them merely on account of their form, though others are highly esteemed in consequence of real or supposed services which they render to mankind by destroying animals more offensive than themselves. They are, as we have said, conveniently divided into two generic sections, monitors and proper lizards; and the first admit of sub-division.

Monitors. This name is not very appropriate, because it is somewhat doubtful to what extent these animals give the warning against crocodiles and caymans which they are supposed to give; but they have been still more unfortunate in getting the name of a tribe of American Indians, the Topinambos, among whom an American species is called *Temapora*; and Seba, we believe, in transferring this name into natural history, mistook the name of the people for the name of the animal; and accordingly, until Cuvier set them right, naturalists were in the habit of calling those large lizards *Tubinambes*. They are by far the largest of the lizard family; and some of them grow to the length of five or six feet. They have teeth in both jaws, but none on the palate; and they swim better than most other lizards, in consequence of the tail being compressed laterally, and having a pretty strong lateral motion, so that it can act like the tail of a fish. They chiefly inhabit the edges of the waters; and very many of them find the principal part of their food by swimming; but there are also others which are, strictly speaking, land animals, and are found near the borders of the deserts. The cry which they utter when alarmed, or otherwise affected, is a sort of hissing whistle; and the reason of their being called monitors, or safe-guards, is supposed to be their uttering this cry on the appearance of the more formidable reptiles, and by that means warning other creatures of their danger; but the fact of their doing this is reported rather than proved.

Cuvier makes three sub-divisions of them:—monitors, properly so called, which are all inhabitants of the warmer parts of the eastern continent: dragons, which are found in South America; and safe-guards, which inhabit the same country. We shall notice one or two of the leading species in each of the subdivisions.

Monitor of the Nile (*L. Nilotica*). This is a species which has been much celebrated for the services rendered to mankind in protecting them from the crocodiles of the Nile, both by giving warning of their approach, and by eating the eggs and the young. How far this may have been true in former times cannot be very clearly ascertained; but in upper Egypt at least, it does not appear that much warning is given by this lizard, though it still continues to eat the eggs and the young of the crocodile. Crocodiles are not so numerous in the Lower Nile as they are represented to have once been, and they are not nearly so formidable, it being rare that any human being falls a victim to them. But in the south, above the cataracts, and about the province of Sennaar, where the climate is more tropical, they are far more formidable, and often seize those who are washing clothes, or otherwise employed near the edge of the water. This lizard grows to the length of five or six feet. It is of a brown colour, clouded with lighter or darker shades,

which form a number of variously shaped compartments; and which shows how little dependence is to be placed upon the traditions of these animals which have been handed down from very early times. It is alleged that this lizard of the Nile is nothing but a crocodile which has been hatched in a place too dry for bringing the real crocodile to the maturity of its size and power. The teeth which are in both jaws are strong and conical; but those in the back part of the mouth become rounded as the animal gets old. The tail is marked with regular rings of eye-shaped spots; and though round at the base, it is marked with a keel for the greater part of its length. The ancient Egyptians appear to have been very partial to this lizard, for it is delineated on many of their monuments.

Land Monitor of Egypt. This species is termed *Ouaran el hard* by the Arabs, while the former is simply denominated ouaran. It is considerably smaller, though still a reptile of no inconsiderable size. The keel on its tail is also much less produced and fitted for swimming than that of the former, and its teeth are more compressed and have trenchant edges. This species is employed by the jugglers of Cairo in playing many tricks; but they deprive it of its teeth before they venture to take many liberties with it. This species also has been known from remote antiquity.

The Monitor of the Congo is nearly of the same size as that of the Nile, but it is more handsome in its colours. It is very abundant in the river after which it is named, and in several other rivers of Central Africa. It is ravenous in its feeding, destroying a number of offensive animals, and on this account the negroes entice it to their cottages, where it is a great favourite.

The species nearly allied to this one, but with trenchant teeth, and tails still better adapted for swimming, are very numerous in the rivers of Africa, of India, of the Oriental Islands, and of New Holland; but they are so similar in their manners, that a detailed account of them would be little else than a list of different shades of colour. One of these from New Holland is blackish, variously clouded, and mottled on the back, and having the feet and the tail marked with rings of yellow. It is about three feet and a half in length when full grown, and it is said to attempt hiding itself in the water when it is pursued. There are few collections of animals in which specimens of lizards of this description are not found in considerable numbers; but very often without any description or even the name of the place of which they are native, and thus they are of no use in illustrating the history of living nature. One of the most industrious explainers of these was Daudin; but as he adopted the names of the American Indians, and the greater number of their species are not American at all, a slight air of ridicule is thrown over his otherwise meritorious labours.

The other monitors are distinguished by angular plates on the head, and large four-cornered scales on the body and tail, while the skin of the throat is covered with small scales, and marked by two or three transverse folds. There is a row of pores on the inside of each thigh.

The Dragon Lizard is the type of the first of these sub-divisions. It has the scales elevated in the middle in the same manner as those of the crocodiles, and forming a crest on the tail, which organ is very much compressed. But though it has more resemblance to a crocodile than any of the lizards have, it does not partake of the character of that animal; and its habits are different, although the tail is compressed; it does not swim rapidly; but it runs well, and is very expert at climbing trees. It is found in the marshy parts of tropical America, where they are covered with trees. Some of the toes, especially those on the hind feet, are very long and slender: and the claws, though small, are firm and sharp pointed. It is not so aquatic in its habits as the other lizards of the same division; and it spends much of its time in basking in the sun. It is rather a formidable reptile, measuring from four to six feet in length, and armed with powerful teeth, which, though it usually employs them only against those small animals upon which it feeds, it can yet turn into effective weapons of defence when an attack is made upon it. It is sought after with a good deal of eagerness, its flesh being not only eaten, but reckoned a great delicacy. Its swiftness and power of climbing trees render the catching of it no very easy matter; and when it is surprised upon the ground, it generally contrives to escape into some burrow or crevice, where it bites very desperately in defence of its position. The numbers are not in proportion to the fertility of the animal, because its eggs are consumed by many of the frequenters of the same localities, and they are much sought after by the people, who prize them very highly, as being at once very delicate and very nutritious. The female produces several dozens of them in a season; but, as is the habit with all the class, she pays no attention to them after she has once deposited them in ground fit for hatching them.

Safeguard Monitors. These differ from the species last described, in having the scales on the back and tail flat or without any keel. The teeth are notched in the young stage, but with age those in the hind part of the mouth become rounded. The more typical safeguards have the tail more or less compressed; and they live on the banks of rivers, and can swim when occasion requires, though they spend the greater part of their time on the bank, and not in the water. It is this division which are more particularly said to give warning by their whistling sound at the approach of destroying reptiles; but they themselves are destructive, though upon rather a smaller scale. They feed upon insects, of which they capture vast numbers, and also upon aquatic reptiles of inferior size, and upon eggs. Many of themselves, and also of their eggs, are in return eaten by the inhabitants; and indeed, it is a remarkable property of the whole lizard family, that, with the exception perhaps of the green turtle, their eggs and flesh are more free from any rank or musky flavour than those of any other reptiles whatever; while many of the animals upon which they feed, are such as it is desirable to get rid of.

The great American Safeguard is the most typical species. It is marked with yellow points and spots, disposed upon a white ground; is blackish on the upper part of the body, and yellowish on the under part. It attains the length of six feet, though specimens so large are not very often met with. It runs with great swiftness along the ground, but takes to the water when hard pursued, where, however, it dives rather than swims; and it keeps very near the bank for fear of the alligators. It burrows in the earth, where it digs its own hiding place. It is not under-

stood to be so prolific as some of the other species, but it is very generally distributed along the banks of the rivers and margins of places that are liable to be flooded. It is sought with nearly the same avidity as the species last mentioned. This sub-division is readily distinguished from all the other lizards by well marked characters. Thus the monitors of the old continent have the teeth sharp; and the true lizards of the same continent have teeth on the palate. From the iguanas again it is distinguished by the form of the tongue, which in them is neither extensile, nor divided into two filaments at the point as it is in every division of the lizard, family. The iguanas were once ranked among the lizards by naturalists, and they are still called lizards in common language. It is the same with the crocodile family; but they are readily distinguished from the safeguard, though in nearly the same places and nearly the same size, by having only four toes in each of the hind feet, and having them more or less united by membranes, which is not the case in any of the lizards. There are other lizards bearing considerable resemblance to the safeguards, found in the same country, but distinguished by having the tail round and furnished with the same kind of square scales both on the body and on the tail. A slight notice of them was given in the article Ameiva; but we may add, that though they have the general character of these lizards, yet they differ in some particulars. The country which these inhabit, is, however, so very extensive, that it has been examined by naturalists of discrimination at comparatively only a few points; and therefore it is impossible to discriminate the more minute distinctions of species, even though the subject were of sufficient importance, which, in a popular point of view at least, it is not. It seems, however, that as they get further removed from the water, and resemble more the common lizards of the eastern continent in their localities, they also resemble them more in their habits. Still, however, there is always a sufficient distinction to prevent a native of the one continent from being mistaken for a native of the other. Those American lizards, how similar soever they may be to the others in their external appearance, have no grinders, few of them have any colour on the throat, and the scales on that part of the body are very small. Some of these American ones are very handsome in their colours and quick in their motions; their average lengths are about a foot or eighteen inches.

The Lizards, properly so called, form the second genus of the family; and as they are natives of the eastern continent, and many of them interesting, we shall give a brief enumeration of their general characters and the means by which they can be distinguished from those other saurians with which they have been so frequently confounded. The tongue differs little from that of the rest of the family; but the palate is furnished with two rows of teeth. A transverse band of broad scales forms a collar on the under part of the neck; while the part of the neck above and also the belly, or breast immediately below this collar, is covered with small scales. The body is lengthened, and never furnished with wings or flying membranes of any description. The feet have five toes on each, armed with claws, and grasping toward the centre, so as to take a firm hold of even a slight projection; but they are never so formed as to oppose each other in grasping. The bones of the upper part of the head project over the orbits of the eyes and temples, so as to form a sort of canopy, which is either covered with large scales, or consists of one entire plate of scaly matter. The eyes are like those of the rest of the family; and under each thigh there is a row of little rough scaly projections containing pores. The scales on the belly are placed in transverse rows; and those on the back have slight keels; but they do not overlap each other so as to be imbricated like the tiles on a roof. The tail is composed of a great number of articulated joints; and it is round, and without any crest. This tail is exceedingly brittle, and a portion of it can be separated by almost the slightest touch; but it has the property of reproduction in a very short time. Lizards are monogamous, and always found in pairs; they are strictly land animals in their haunts, and never by any chance take to the water. They are found in most warm and dry countries, and in many parts of those which are temperate. In the latter they hybernate; and it is possible that in all countries they pass some considerable portion of the year in a dormant state. When excited by the heat of the sun they are exceedingly active, and have all the energies of life remarkably strong about them; but they can subsist for a very long time without any food. It is also probable that they live for many years; and indeed long life is a very general attribute of those animals which enjoy a seasonal repose in the course of the year. It is easy to see why this should be the case; for the awakening from this repose bears some resemblance to a regeneration of the animal into young life. Perhaps lizards are more susceptible to changes of the atmosphere than any other vertebrated animals; and therefore they may be taken as good indications of the characters of climates. They all live upon insects, and such small prey; and none of them possess any poisonous quality, or shows any disposition to attack a warm blooded animal, or, generally speaking, a reptile; but many of them when attacked defend themselves with great resolution, and bite much more keenly than one would be apt to suppose. It is indeed doubtful whether some of the larger species do not prey on the smaller, and also upon the more minute of the serpent tribes. They are abundant in some of the warmer parts of Europe. We shall notice one or two of the species.

The Great Green Lizard.—This is one of the most gaily-coloured of the whole family; and it is also the largest of all the true lizards. It occurs in all those parts of Europe which abut upon the Mediterranean, and have the climate and the soil warm. It is not found in the central parts of France, though it often is in the warm and sandy plains of Languedoc, where it pursues its trade of insect-catching with great assiduity during the summer months. The fact of its hybernating does not confine it so closely to tropical latitudes as many other animals which are less sensitive to cold; for it is met with in some places far to the north, or otherwise having the winter very severe. Linnæus enumerates it among the animals of Sweden, and Captain Cook found it in Kamtschatka, where the winter is exceedingly cold, though the summer both there and in Sweden is very hot. It is doubtful, however, whether there may not be several species confounded in the older descriptions; as spotted, streaked, and grey lizards have been sometimes confounded under the general

name of agile or nimble lizards, which is a property common to them all. It is rather a bold animal; and it is sometimes said to swallow mice and other small animals. When attacked it defends itself with great resolution; if its swiftness is not sufficient for enabling it to escape the danger, it will snap and bite readily at a stick; and when a dog attempts to seize it, it will bound upwards, and fasten on the nose of the dog during its descent. In many places it is supposed to be poisonous; and in not a few it is looked upon as endowed with supernatural powers of mischief. It is however perfectly innocent both as to the poison and to the league with the powers of darkness, and carries on all its operations by mechanical action, and in the light of the sun. The species and varieties (for the one is not clearly distinguished from the other) are however very many; and the manners of all are so much alike, that we must pass them over. There is, however, one of which some notice may be given, inasmuch as it occurs more abundantly in Europe than any of the others. This is

The Nimble Lizard. (*L. agilis* of Linnæus, *L. velox* of Pallas, and the scaly lizard of Pennant.) This species is exceedingly numerous in France, Austria, and other parts of the Continent, in some of which its flesh is in much request as an article of food; and was once prescribed on account of supposed medicinal qualities, which of course it does not possess. It is so abundant in the neighbourhood of the Austrian capital, that Laurenti recommends it as food for the poor, and says "that during the season of its appearance, it would furnish by no means a scanty supply. It is usually termed the grey lizard of the walls, because it is seen very much upon dry walls in gardens during the summer months. In length it varies from five to six inches. The scales on the upper part are of small size and six-sided; the neck is nearly of the same thickness as the body; and the tail tapers to a point. This is a very lively and at the same time a most inoffensive animal, and there is something not unpleasant in the account given of its domestic economy. The couple remain for a long time together, passing their winter in one sleep, and their summer in joint activity. The eggs are round, about a third of an inch in diameter; and though it is not understood that any incubation is practised by either parent, yet both are attentive to the young, seeking food for them, carrying them out to the sun when it is clear and warm, and removing them to shelter when it is dark and cold. These attentions are continued until the young have acquired sufficient strength to enable them to provide for themselves; and whenever this takes place, they are expelled from the paternal abode, and sent to seek habitations of their own. They have not long, however, to continue this operation during the first year of their lives; for the time of hybernating comes on soon after they come to maturity.

Such is a slight outline of the natural history, and a brief notice of some of the leading species of what may, perhaps, be regarded as the most interesting of all the families which compose the class of Reptiles.

LOASEÆ. A small natural order of plants, containing five genera and twelve species. *Loasa* and its typical allies are American herbs, with often scandent stems and tendrils, more or less covered with stiff hairs, and frequently furnished with stings. The leaves are opposite or alternate, without stipules, and simple, but often variously lobed and cut. The inflorescence is axillary, terminal, or lateral; and the peduncles are flowered. The flowers are large and elegant, regular and united.

This order contains the following genera, viz.—*Bartonia*, *Blumenbachia*, *Loasa*, *Scyphanthus*, and *Mentzelia*.

LOBARIA (Müller). A genus of molluscs, not possessing the smallest rudiment of shell. This genus established by Müller, was previously called *Doridium* and *Bullidium* by Meckel, and *Acera* by Cuvier.

LOBELIA (Linnæus). A very extensive genus of beautiful herbs, natives of almost all parts of the world. Class and order *Pentandria Monogynia*, and natural order, to which the genus gives a title, viz.—*Lobeliaceæ*. Generic character:—calyx of five teeth; corolla tubular, irregular, cut lengthwise; limb two-lipped, the upper two, and the lower three-cleft; anthers united and bearded; style simple; a ciliated indusium under the stigma; capsule two-celled.

LOBELIACEÆ. A natural order of plants, containing the following genera, viz.—*Lobelia*, *Monopsis*, *Clintonia*, *Lechenaultia*, and *Cyphia*. Of these, there are ninety species, chiefly *Lobelias*, almost all fine flowering plants. Some of the species are medicinal; but some are dangerous if incautiously used. From the anthers of *Lobelia* being united in a cylinder round the style, like those of the class *Syngenesia*, Linnæus placed the genus in that class, in an order called *Monogamia*; but modern botanists refer it to his fifth class and natural order as above.

LOCUSTIDÆ (Leach). A family of orthopterous insects, belonging to the section *Saltatoria*, or those furnished with hind legs formed for leaping, and forming a portion of the great genus *Gryllus* of Linnæus, but distinguished by the shortness of the antennæ, which are filiform, prismatic, or ensiform: the males have the base of the wing covers (tegmina), not furnished with a circular spot of membranous texture, and the chirrupping noise which they make is produced by rubbing the hind femora against the margins of the wing covers; the females are not furnished with an elongated exserted ovipositor; the wings and wing covers are not horizontal as in the crickets, but laterally deflexed like the roof of a house; the ocelli are distinct, and three in number; the upper lip is notched; the jaws are robust, horny, and dentated; the abdomen is conical and compressed at the sides. These insects are exceedingly active, leaping to great distances, and flying with equal agility, and at considerable heights, feeding voraciously upon vegetables, to which they are sometimes very destructive.

We have already alluded in our article Gryllus to the changes of nomenclature to which this and the other groups of the Linnæan genus have been subjected, and to which we conceive a more appropriate series of names cannot be adopted than those which we have employed, by which the too renowned locust of the Scriptures retains its generic name of *Locusta*. There are indeed many small British species congenerous with this celebrated insect, but they are of too diminutive a size when compared with their tropical brethren, to commit those devastations for which the real locust is distinguished. This species, the *Locusta migratoria* (*Gryllus migratorius*, Linnæus), and several others nearly allied to it, but of a still larger size are occasionally produced in immense swarms, and of which both as regards their migrations and the ravages which they produce, accounts are recorded in so many works of natural history and

voyages. Indeed, it may well be said, that of all our insect enemies, the locust is the most terrible, its countless myriads changing the appearance of a fertile country into an arid desert; reducing whole districts to the most frightful want, and of which even the death is a cause of misery from the immense number of bodies which, from their putrefaction, put a final stroke to the mischief by infecting the atmosphere with a poisonous effluvium, and thus destroying those which have escaped the horrors of famine. It may be said that our picture is too highly coloured; but these insects, and the effects which they have produced, have emerged from the domain of natural history, and become the materials of the history of nations, the different periods of their appearance being recorded in the narratives of the historian, like the sudden irruptions of hordes of barbarians, which are scarcely less to be feared than these winged plagues.

By the despiser of the small things of the creation, insects are alike regarded with disgust, or considered as unworthy of regard; we would, however, call to his remembrance, the fact, that out of the seven grievous plagues of Egypt, four were caused by frogs, lice, flies, and locusts. We are not amongst those who would teach natural history out of the Holy Scriptures, which were written for far higher ends, but we cannot avoid quoting from the account of the last of these plagues the following description:—"And the locusts went up over all the land of Egypt, and rested on all the coasts of Egypt, very grievous were they, before them were no such locusts as they, neither after them shall be such (*i. e.* as regards the vast extent of their devastations). For they covered the face of the whole earth, so that the land was darkened; and they did eat every herb of the land, and all the fruit of the trees which the hail had left, and there remained not any green thing on the trees, or in the herb of the field, through all the land of Egypt." Exodus, chap. x., vers. 14, 15. But it is in the second chapter of the Prophecies of Joel that we meet with the most splendid and poetical description of the ravages of these animals. Their coming is called "a day of darkness and gloominess, a day of clouds and of thick darkness;" evidently in allusion to their immense swarms hiding the sun during their flight:—"The land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them."—"Like the noise of chariots on the tops of mountains shall they leap, like the noise of a flame of fire that devoureth the stubble, as a strong people set in battle array"—alluding to their great powers of leaping, and to the noise which they make in biting the plants with their strong horny jaws. "They shall run like mighty men, they shall climb the wall like men of war, and they shall march every one on his ways, and they shall not break their ranks;"—"they shall run upon the wall; they shall climb up upon the houses; they shall enter in at the windows like a thief." Thus accurately describing the fixed determination with which they pursue their migratory route, and which, as the writer is informed by a recent traveller in Syria and Egypt, is the mode of progression adopted by the larvæ and pupæ, which are destitute of wings, and which are so thick upon the ground, that at every footstep they are trodden to death.

This statement corresponds with that given with more minute detail by the Russian traveller Pallas, who tells us that in serene weather they are in full motion in the morning, immediately after the evaporation of the dew, and if no dew has fallen, they appear as soon as the sun imparts the genial warmth. At first some are seen running about like messengers among the reposing swarms, which are lying partly compressed upon the ground at the side of small eminences, and partly attached to tall plants and shrubs. Shortly after the whole body begins to move forward in one direction, and with little deviation. They resemble a swarm of ants all taking the same course at small distances, but without touching each other; they uniformly travel towards a certain region as fast as a fly can run, and without leaping unless pursued; in which case, indeed, they disperse, but soon collect again and follow their former route. In this manner they advance from morning to evening without halting, frequently at the rate of a hundred fathoms and upwards in the course of a day. Although they prefer marching along high roads, footpaths, or open tracts, yet, when their progress is opposed by bushes, hedges, and ditches, they penetrate through them; their way can only be impeded by the waters of brooks or canals, as they are apparently terrified at every kind of moisture. Often, however, they endeavour to gain the opposite bank with the aid of overhanging boughs; and if the stalks of plants or shrubs be laid across the water, they pass in close columns over these temporary bridges, on which they even seem to rest and enjoy the refreshing coolness. Towards sunset the whole swarm gradually collect in parties and creep up the plants, or encamp on slight eminences. On cold, cloudy, or rainy days they do not travel. As soon as they acquire wings, they progressively disperse, but still fly about in large swarms.

On turning to profane authors we find equally abundant evidence that the locusts have lost none of their destructive powers. Pliny tells us that, in some of the countries of Greece, there existed a law compelling the inhabitants to destroy these insects in the three states, of egg, larva, and imago. And in the Isle of Lemnos, in particular, each citizen was bound annually to supply a fixed number of locusts. Entire legions of Roman soldiers were also employed for this purpose in the north of Africa, which country, as well as the western parts of Asia, has evidently been in all ages the most exposed to the attacks of these enemies of the human race. Oresius tells us that in the year 800 every vestige of vegetation disappeared from the face of the earth owing to the presence of the locusts, which being afterwards blown into the sea and their bodies washed on shore, emitted a stench as infectious as that arising from the remains of a mighty army, precisely as described by Joel, chap. xi., verse 20. And it is also said by St. Augustin, that a plague produced, or probably induced by the same cause, destroyed in the kingdom of Numidia and adjacent parts a population of 800,000 inhabitants.

But Spain, Italy, France, Turkey, Southern Russia, Poland, and even Sweden, have been at times visited by the destructive swarms of these insects, although our own island has been marvellously preserved; a straggling locust having, however, been from time to time found alive in this country, one of which is in the collection of the writer of this article, from that of Mr. Donovan. In the year 591, Italy was attacked by a terrible swarm, the effluvium from which destroyed, according to Mouffet, a prodigious number of men and beasts; and a famine was produced in

the kingdom of Venice, from which 30,000 persons perished. In 1600, Russia, Poland, and Lithuania were visited: the locusts arriving in such immense swarms that the air was darkened as in a storm. Wallachia, Moldavia, Transylvania, Hungary, and Poland, were inundated, in 1747 and 1748, by similar swarms, of which an account is inserted in the Philosophical Transactions. In 1749 they reached as far north as Sweden; and it is recorded that Charles XII. being in Bessarabia, thought himself overcome with a terrible tempest with hail, when a cloud of locusts fell upon his army, covering both man and horse, and impeding his march. During this visit their numbers were so great that they were compared to a fall of snow, or rather to a cloud of smoke passing rapidly along, and every spot where they stopped in their passage soon exhibited the most dismal desolation; the under herbs being first attacked, and then the leaves and even the bark of trees. In 1780 the kingdom of Morocco was subjected to the terrible ravages of these locusts, which produced a frightful famine, the poor being compelled to dig up and eat the roots of plants, and to hunt for grains of corn in the dung of animals, upon which they fed with voracity, the streets and roads being strewed with the dead bodies of the victims. In 1784 and 1797, Mr. Barrow, in his Travels in the South of Africa, has stated that they covered a surface of two thousand square miles; and when cast into the sea by a strong wind from the north-east, and washed upon the beach, they formed a line fifty miles long, and produced a barrier along the coast three or four feet high; and when the wind again changed, so powerful was the stench which their putrifying bodies caused, that it was perceived inland to a distance of 150 miles. Previous to the plague which devasted the Barbary States in 1799, the locusts covered the surface of the land from Mogadore to Tangier, according to Mr. Jackson, and presented a singular observation. The entire range bordering upon the desert of Sahara was ravaged by these insects, whilst on the other side of the river El Kos not a single one was to be seen. They had proceeded so far north, and then journeyed to the east, so that all the northern parts of El Araiche abounded in fruits and grain, whilst the adjacent country offered the most complete picture of desolation. They were at length swept into the Atlantic Ocean by a tempest, and, as at other times, a plague was produced by the odours exhaling from their putrifying bodies, but an abundant growth of plants followed their departure. The Arabs of the Desert, the enemies of their race, rejoice when the swarms of locusts arrive from the north, their arrival foretelling a general mortality, which they call *el khere*, or the blessing; they then quit their desert abodes, and, with a view of plunder, fix their tents in the districts attacked by the locusts.

The following circumstance, recorded in an American Journal, offers a convincing proof that the action of the wind is a great auxiliary in the migrations of the locusts. A vessel was detained in 1811 by a dead calm in the Atlantic Ocean, at a distance of about 200 miles from the Canary Islands, the nearest land; and a slight wind from the north-east having sprung up, the vessel was suddenly visited by a cloud of these insects which lighted upon the deck, rigging, &c., and, instead of appearing fatigued by their long flight, they sprang into the air on being attempted to be taken hold of by the sailors; the wind, which was but slight, continued for one hour; during which time the locusts continued to fall upon the vessel; many also fell into the sea.

The propagative powers of locusts are so prodigious, that in the countries which they thus visit in swarms, in a very little time it is easy to collect their eggs by baskets full. In the south of France, where some species appear at certain seasons, and produce much detriment, sums are given for certain quantities of these eggs, and which are then destroyed. This was especially the case in 1613, 1805, 1822, and 1824, when fifty centimes (equal to 5*d.*) were paid for each kilogramme of eggs, and twenty-five centimes for each kilogramme of insects.

According to a statement made by M. Solier to the Entomological Society of France (Annales, vol. ii., p. 486), the city of Marseilles paid in the first mentioned year the immense sum of 20,000 francs *, and the city of Arles 25,000, for destroying the insects and gathering the eggs. In 1822, 1227 francs were paid; in 1824, 5542 francs; and in 1825, 6200 francs for this purpose; but in these latter years the number of locusts could not be compared with that of the year 1613, when they destroyed 1500 acres of corn in the environs of Arles. Their migrations in 1780 in Transylvania were equally expensive, fifteen hundred persons being employed in collecting the eggs, each of whom filled a sack; and yet in the following year their numbers were scarcely diminished, for millions of eggs were after the spring dug up and destroyed by the inhabitants, who were called upon to perform this labour.

We have already said that many distinct species of *Locustidæ* have obtained the name of locust, which may be regarded as a generic rather than a specific term; in like manner the term migratory locust is employed in a general sense, and is applicable only to those which, having multiplied in a prodigious manner, owing to favourable circumstances, and consumed the entire vegetation of the district where they were produced, make their way to other districts in search of food. Many species of locusts, on the contrary, appear only in a single spot, where they do not multiply with such rapidity, although the variations of heat and cold, drought or moisture, influence the propagation of these as well as the true migratory species. In the following year, when the weather is dry and hot, the eggs are hatched, and the young locusts, resembling their parents in form, but wanting wings, are produced. The eggs are deposited in cylindrical burrows, several inches long, near the surface of the ground; they are easily discovered, the aperture not being closed. They are found in uncultivated ground, and the nest is an inch and a half deep in the species found in the south of France. The tubes or burrows are formed of a layer of earth covered by gluten, their diameter being that of the abdomen of the females, their direction being generally horizontal. The number of eggs contained in each tube is about fifty or sixty, which are inclosed in a very thin and common envelope.

We have hitherto spoken of the locust only as a destructive enemy; nevertheless, in certain countries, the inhabitants, as though anxious to make amends for its injuries, employ it both as a food and as an article of commerce. In Arabia they are collected in great numbers, dried, and used as bread in seasons of scarcity. The reader will also remember, that the

* A franc is equal to tenpence English.

food of St. John in the wilderness consisted only of insects or their productions—being locusts and wild honey. The writer hereof has tasted locusts cured in the Levant, and found them rather sweet, but of an insipid taste. According to some travellers, they are roasted or fried on a hot fire, their legs and wings, and, as some say, also their entrails, being first removed. In many parts of Arabia they are strung in rows by the women and children, and sold. By some they are seasoned, and by others boiled; and really, when we remember the vegetable nature of their food, there must, be less real ground of objection to use them in this manner, than there is to eat shrimps, prawns, crayfish, &c., which feed upon the grossest impurities. Certain it is, many nations do eat locusts cooked in one way or another, and have thence obtained the name of *Acridophagi*. It is also true that travellers have differed in their opinion as to the taste of this kind of food. Some have also asserted that a continued use of it produces ill effects; but the observations upon this subject are too vague to allow us to be certain on this point.

In this country we possess about twenty-five native species belonging to the genus *Locusta*, of comparatively small size, and which are found on grassy banks and commons, &c.; about eight species of *Gomphocerus*, Leach (in which the antennæ are thickened at the tips), and several species of *Acrydium* (*Tetrix*, Latreille), in which the prothorax is produced into a long point behind, covering the remainder of the body. These last are the smallest species of the family. The exotic species are very numerous, and often very brilliantly coloured.

LOCUST TREE is the *Hymenæa courbaril* of Linnæus, an ornamental West Indian tree, belonging to *Leguminosæ*.

LODDIGESIA (Bot. Mag.). An under-shrub from the Cape of Good Hope, named in honour of Conrad Loddiges, a celebrated nurseryman of Hackney. It belongs to *Leguminosæ*, is grown in loam and moor-earth, and increased by cuttings.

LOGWOOD is the *Hæmatoxylon Campechianum* of Linnæus. It is used medicinally, and also as a dye stuff; for which latter purpose many thousand tons are annually imported into this country.

LOLIGO (Sepia Loligo, Linnæus). A molluscous animal, whose description will be found under the article Sepia.

LOLIGOPSIS (Lamarck) A molluscous animal, whose description will be found under the article Sepia.

LOLIUM (Linnæus). A genus belonging to the *Gramineæ*, and one of our best cultivated grasses commonly known by the name of rye-grass It is an early shooting plant, and is, therefore, chiefly used in laying down permanent meadow, or pastures. It is also sown among clover to improve the quality of the forage; and sown and made into hay by itself, is the most valuable of all forage for horses. The seed is a very considerable article in the seedsman's warehouse, vast quantities being purchased by farmers every year The *L. temulentum* is a noxious plant, and deleterious among wheat.

LOMATIA (R. Brown). A genus of greenhouse plants, introduced from New South Wales, belonging to the fourth class of Linnæan botany, and to the natural order *Proteaceæ*. The species succeed in moor-earth, with a mixture of loam, and are increased by cuttings.

LONCHOCARPUS (Humboldt). A genus of South American trees, belonging to the class *Diadelphia*, and to the natural order *Leguminosæ*. These plants were called *Dalbergia* and *Robinia* by other authors. They are stove plants, thrive on sandy loam, and may be increased by cuttings in the usual way.

LONDON PRIDE is the *Saxifraga umbrosa* of Linnæus, a well known plant, common in every cottage garden.

LONDON ROCKET is the *Sisymbrium irio* of Linnæus, common on every old wall.

LONGICORNES. A very extensive subsection of coleopterous insects, belonging to the section *Tetramera*, and distinguished by the great length of the antennæ, and the generally elongated form of the body and short head. By the latter characters it is at once distinguished from the rostrated *Rhyncophora*, and the more or less rounded *Cyclica*. The subsection corresponds with the Linnæan genera *Cerambyx*, *Necydalis*, and *Leptura*, which see, and more especially the first of these articles under its family name of Cerambycidæ.

LONGIPENNES.—The second of the four families into which Cuvier divides the web-footed birds, and including those which are most discursive over the waters. They are in fact the characteristic winged inhabitants of the high seas, and sailors meet with them at almost every point from the one pole to the other. The character from which they get their family name is the great length of their wings. Their feet also have the hind toe free of the web, or altogether wanting. Those of the former character are, generally speaking, good walkers, resort occasionally to the shores at other than their breeding times, and some of them proceed inland, though none of them reside permanently there. Those which have the second character do not in general walk so well, are less commonly seen on land, and many of them skim along the surface with level wings, and tip the water with the webs of their feet to assist them in their motion. The family includes the petrels, the puffins, the gulls, the skuas, the albatross, the terns, the noddies, and the storm petrels.

LONGIROSTRES. Cuvier's third family of *Echassiers* or stilt birds, which comprises a great number of those birds which frequent the margin of the waters. The whole of them have a strong family likeness; their bodies are similar in form, in the distribution of their colours, and also in their manners. Cuvier divides them into two great genera, snipes and avocets, of which notices will be found under their respective names. See also the article Bird.

LONICERA (Römer and Schultes). A genus of deciduous shrubs, natives of various parts of the globe. They belong to *Pentandria* and to the natural order *Caprifoliaceæ*. These plants were formerly associated with the honeysuckles (now called *Caprifolium*), but as they differ in the shape of their flowers and habit of growth, they have been separated.

LOPEZIA (Cavanelli). A genus of perennial and annual herbs, natives of Mexico. The flowers are monandrious, and belong to the natural order *Onagrariæ*. These plants are very handsome when in flower, and are desirable for the green-house when fresh imported seeds can be obtained.

LOPHIREÆ. A natural order containing only one genus, and of that one species only, namely the

Lophira Africana of Banks, which is called in English catalogues, "the African scrubby oak," a native of Sierra Leone. It is a beautiful shrub, with terminal corymbs of white flowers, and a one-leaved permanent calyx. The leaves are long, entire, and leathery.

LOPHIUS—angler, called also fishing-frog, wide-mouth, gaper, sea devil, and a vast variety of other names, —a genus of very singularly formed fishes belonging to Cuvier's third family of fishes with spinous fins, namely, those which have the pectoral fins with pedicles, or something in the form of feet. They are the most characteristic fishes of the family, and accordingly they are placed at the head of them in the Règne Animal. The characters of the genus are, the skeleton partly cartilaginous, and thus approximating to that of the sharks and rays, though the fishes differ from them in many other particulars. The pectoral fins are supported as if on two arms, sustained by two bones, which have some resemblance to the radial and cubital bones of an arm, but which are really the wrist of the fin, which in those fishes is much more produced than in any others. The ventrals are placed much in advance of the pectorals; the gill covers and gill arches are enveloped under the skin; and they have no other opening posteriorly but a hole of moderate size for each placed behind the pectoral fin. This structure of the breathing apparatus is also an approximation to the cartilaginous fishes; and in consequence of the smallness of the gill openings, they can live a long time out of the water. They are exceedingly voracious fishes, have very wide mouths, and large stomachs, with great digestive powers, but the intestinal canal is very short. Three genera, or sub-genera, of them are found in Cuvier's great work. The greater part of them are inhabitants of the warmer seas, but one species, at least, is by no means uncommon on the British shores, both in the northern and southern parts, in the latter of which especially it often grows to a large size.

Lophius, properly so called, forms the first sub-genus; it is the characteristic one; and the one which is most common on the British shores, though there is another species, or at all events variety, in the European seas. The name lophius, which signifies a feather, or rather perhaps more strictly the shaft of a feather, is applied to these fishes in consequence of some very elongated detached rays, which are situated on the head. The head is of vast size in proportion to the rest of the body. It is very broad, but depressed, and armed with spines in many places, which give the fish a most singular appearance. The gape is very wide and far cleft; the jaws are armed with sharp-pointed teeth; and the under jaw is surrounded with a fringe, consisting of a number of detached beards or filaments. There are two distinct dorsal fins; and upon the head there are three curious rays, one behind the eyes, which may perhaps be considered as a ray of the dorsal fin, and other two more near the extremity of the upper jaw. These consist of spinous or bony rays formed internally of bone, flexible, but without any joints in their length, covered for the greater part with the common integuments, and plenteously furnished with nerves. The last and middle one terminates in slender points; but there is something peculiar in the termination of the first one, for it ends in a little forked penon, or flattened expansion of the most sparkling silvery lustre. The articulation of those two rays to the bone of the head is equally curious. The posterior one embraces like a fork the ridge of the bone; and thus, though it has a very firm articulation, and a free motion backwards and forwards in the mesial plane, it has comparatively little motion, or in fact none in the cross direction. The anterior one is differently articulated; for it embraces a loop which is formed on the bone, as if the two were a staple, and the eye of a bolt placed within that staple, so as to have free motion in every direction. These bones, though flexible, and partaking of the cartilaginous texture of the rest of the skeleton, are remarkably strong and also elastic, and they are furnished with a great number of muscles, forming altogether a very fine specimen of animal mechanism. The bases of these curious spines are seated between two spinous ridges, close by the sides of which the eyes are situated, of large size, and directed upwards. The integuments covering the gills form two sacs of ample dimensions, which bring the head to a shape very much resembling that of a frog in the tadpole state; while the body seen from above, is so narrow in comparison with the head, that it is not unlike the tail of a tadpole; and the pectoral fins bear some distant resemblance to the young feet of the tadpole in their early stage, and before the tail has disappeared. From the vast size of the head, and capacity of the sacs containing the gills, the pectorals are thrown to a very considerable distance backward, so much behind the ventral fins indeed, that they have the appearance of hind feet, though they really answer to the fore feet of footed animals. Notwithstanding the length and strength of their wrist bones, these fins are not very efficient in swimming. Indeed, as we have often had occasion to remark, the fins of fishes, with the exception of the caudal fin, are useful in directing their motion rather than in producing it. The vast head and comparatively small caudal fin of these fishes, make them but very slow swimmers; but the peculiar form of the pectorals, and the very advanced position of the ventrals, make them very expert at ascending or descending. They thus command the depth of the water rather than a wide range in lateral extent; and though their principal habit is that of bottom fishes, they very frequently come to the surface.

We have already mentioned the circumstance which enables those fishes to live for a considerable time after they are out of the water. Their pectoral fins also enable them to crawl about with more expedition than could be expected on the part of a fish, if we did not attend to the very curious structure of these ones. Some of the species which inhabit other seas, especially the muddy inlets from which the water ebbs away, have the power of leaping about like frogs They have attracted attention, at least in that species which is common in the European seas, from the earliest times; and the oldest naturalists call them indiscriminately by the names of frogs and fishes.

The Angler (*L. piscatorius*) is the characteristic species. It is of a uniform brown colour on the upper part of the body, with the membranes of the upper fins of a deeper tint; and that of the tail still more so. The under part of the body, and the ventral and pectoral fins are of a white colour. The fish is very singular, and far from being attractive in its appearance; but it grows to a large size, and its manners render it an object of considerable interest. It is found in the seas, upon most of the shores of the British islands, and also in those of the east of Europe,

including the Mediterranean and the Baltic; and thus many opportunities of observing it occur.

It is exceedingly ravenous, and most indiscriminate in its feeding; and the passage from its mouth to its stomach is so short and wide, that if the large mouth is opened, the contents of the stomach may often be seen, and live fishes taken out of it. Its fishing habit is, however, the most curious part of its economy; and it appears to make use of the little silvery pennon upon the anterior spine of its head much in the same manner as an angler makes use of a painted minnow, or other spurious bait. It lies in the mud at the bottom, and stirs that up by the motion of its pectoral and ventral fins. Many of the flounders, and other ground fishes, resort to any spot where the mud is stirred, because the stirring of the mud brings up those animals on which they feed. The stirring by the angler has this effect, and it also conceals the fish itself, the colour of which, with the exception of the penon, is by no means conspicuous. This penon is played in all directions just above the surface of the stirred mud. The smaller fishes approach it, and attempt to seize it as a bait; but the angler, from the structure of its fins, springs up with great velocity, and speedily lodges the beguiled fish in its capacious maw. This is a singular habit, and has been often descanted on; but perhaps the cause of its being more a matter of wonder than many other habits of animals which have passed without admiration, and indeed almost without notice, is the fancied resemblance which it has to the art of catching fish as sometimes practised by man. This resemblance is only fancied, however, and not real, for nature furnishes the angler with its rod and bait, and also with the instinct which guides it in the use of them, without knowledge or contrivance of any kind upon its part.

The following quotations, as given by Mr. Yarrell, from the manuscripts of those accurate observers, Mr. Couch and the late Colonel Montagu, contain some of the most characteristic traits of this singular fish: "It makes but little difference," says Mr. Couch, "what the prey is, either in size or quality. A fisherman had hooked a cod-fish, and while drawing it up he felt a heavier weight attach itself to his line; this proved to be an angler of large size, which he compelled to quit its hold by a heavy blow on its head, leaving its prey still attached to the hook. In another instance, an angler seized a conger eel that had taken the hook; but after the latter had been engulfed in the enormous jaws, and perhaps stomach, it struggled through the gill aperture of the angler, and in this situation both were drawn up together. I have been told of its swallowing the large ball of cork employed as a buoy to a bulter, or deep sea line; and the fact this implies of its mounting to the surface is further confirmed by the evidence of sailors and fishermen, who have seen it floating and taken in with a line at midwater. These fishes sometimes abound, and a fisherman who informed me of the circumstance found seven of them at one time on the deck of a trawl boat; on expressing his surprise at the number, he was told that it was no uncommon thing to take a dozen at once."

"When this fish is taken in a net," says Montagu, "its captivity does not destroy its rapacious appetite, but it generally devours some of its fellow prisoners, which have been taken from the stomach alive, especially flounders. It is not so much sought after for its own flesh, as for the fish generally to be found in its stomach: thus, though the fishermen reject the fish itself, they do not reject those that the fish has collected.

"A female examined measured three feet three inches; the breadth across the body, at the pectoral fins, fifteen inches; within the teeth, on the lower jaw, is a loose skin of a brown colour, like the back of the fish, forming a sort of bag, which probably assists in preventing the escape of its smaller prey. A male examined was three feet five inches long. When this fish was suspended by the head, the contents of its stomach were readily seen, and I perceived several cuttle-fish. The sexes are distinctly marked by external appendages, as in some species of Raia.

Another species of angler (*L. parvipennis*), is mentioned by Cuvier as being found, though much more rarely, on the coasts of France; and there is some probability at least of its having been seen in the Channel. It is of less size than the more common one, and has the second dorsal fin much lower; there is also a difference in the vertebra of the spine; the common species having thirty articulations, while this one has only twenty-five. Some other species have been enumerated by writers on the natural history of fishes; but they have been described from single specimens, which had been kept some time previously to their examination by the describers, and therefore but little dependence is to be placed on the accounts that are given of them.

Chironectes forms the second subgenus of these singular fishes. Like the anglers properly so called, these have five rays on the head, of which the first is slender, and furnished with a sort of crest or penon at the top, while the others are margined by a membrane, which often extends partially from the one to the other, and gives this part of the organisation their form of a fin. In the whole genus, indeed, those rays on the head are of the same consistence as the rays of fins, and they are articulated in the same general part of the body, namely, on the dorsal line, as produced along the middle of the head. Whether entirely free or furnished with membranes, they are therefore to be considered as portions of the first dorsal. The body and head of those fishes are both very much compressed; their mouths open vertically; and the gills, which consist of four rays in each, have no external opening, except a small hole behind the pectorals. Their body is often studded with fleshy appendages. Their air-bladder is of large dimensions; their intestinal canal is of mean length, and not furnished with cæcal appendages. Their stomach is of vast size; and many of them have the power of inflating it with air, as is done by the tetradons. On land their pectoral fins assist them in creeping, like a kind of feet; and they can perform this species of motion better than even the anglers. It is said that upon occasion they can live for two or three days out of their native element; and they very much frequent those floating banks of sea-weed which abound in the great eddies of the tropical oceans, nor are they found any where but in the tropical seas. They are much smaller than the common angler, the compression of their body is in the contrary direction, and their colours are more brilliant.

L. Histrio. This is a species not exceeding nine inches in length, of a yellowish orange, and mottled with brown. It is found in the tropical parts of both oceans, generally near the sea-weed already alluded to; and the singular antics which it plays in leaping

out of the water and on the surface of the weed, have procured it the name of histrio, or the actor.

Another species, or perhaps only the last-mentioned one in a different age, has been noticed as occurring in the Indian Ocean, and an account of it was first given by Commerçon. It is of a nankin colour, marked with bluish brown spots, and the anterior filament or ray on the head is divided into three, and all round its mouth is thickly beset with soft thread-like appendages. It is sometimes kept in vases in the same manner as gold fishes; and at times it remains in a position as if it were entirely dead, after which it suddenly throws itself into the most playful attitudes. In the experiments which have been made with it while in a state of confinement, a change of its manners, from living in salt water to living in water fresh or nearly so, has been attempted, and we believe in part succeeded. There are still some other small species in the tropical seas, but their manners present nothing that can be very interesting to the general reader; and the published accounts of them in general confound all the species with each other.

Malthe forms Cuvier's third subgenus. The fishes forming it have the head very broad and flat, especially where the sides are enlarged exteriorly by the sacs containing the gills. Their eyes are placed far in advance, and their mouth is of moderate size and protractile. Their gills contain six or seven rays, and open posteriorly by a hole below each pectoral fin. They have but a single dorsal fin, which is small and soft. Their bodies are roughened over with osseous tubercles, and there are filaments along the lines of the sides; but their heads are without the free rays which distinguish the true anglers. Among these may be enumerated the species which gets the name of the sea-bat, which is common in the warmer seas of America; and a few others which are met with also in the warmer seas, but they possess very little interest.

Although the genus *Lophius* is one of the most singular of the inhabitants of the deep, and though it does not appear that the structure, or at all events the use of the structure, and more especially the habits of the angler of Europe, are very closely represented in any of the others; yet the tropical ones, being fishes not used as food, and therefore not generally taken by the sailors, belong to those margins of the revolving masses of sea-weed which grow in the water without being rooted, and in the whole history of which there is something very peculiar, though the internal parts of them are not very easily explored. Those great masses of floating sea-weed are found only in tropical seas, and only then in the broad waters, where the action of the tides and the position of the land tend to produce a circulating current. The weeds get into the eddy of this current, which, both in the South Atlantic and in the North, occupies a very considerable breadth; and as this weed is living, it has no tendency to approach the land. It affords shelter for countless numbers of small marine animals; and these, in their turn, feed a number of fishes. Radiated animals also abound in it, and some of the long-winged sea-birds resort to it as to a rich pasture. To traverse the thickest of this weed in a ship would be a heavy, and for anything we know, a hazardous task. It would be heavy, because of the mere interruption of the waters, and also because many, both of the plants and of the animals, would be apt to adhere to a ship's bottom and multiply on it, to the great lessening of its progress through the water. It might be dangerous, for there are volcanic grounds in the neighbourhood of both accumulations, and there is no knowing how many discharges of volcanic matter may have been thrown up, and merely concealed by the surface. It is probable also that there may be coral formations in those very singular portions of the ocean.

LOPHOBRANCHII. The fifth order of the fishes in Cuvier's arrangement, the characteristic of which is that the fibres of their gills are collected in little round tufts, which are arranged in pairs along the arches. This character is a very marked one, as there are no fishes but themselves which possess it. Their gills are covered externally in the integuments, so that there is only a small opening for the escape of the water. The surfaces of their bodies are covered over with a sort of armour consisting of angular plates of shelly matter. There are but few genera, *Syngnathus* and *Pegasus* comprise the whole. The first contains three divisions, sea-needles, sea-horses, and another species which has no very characteristic English name, though pipe-mouth is the nearest approximation. They are fishes of very singular forms, all inhabitants of the tropical seas, and none of them of any value in an economical point of view.

LOPHOTES. A genus of fishes belonging to Cuvier's eighth family of spinous-finned fishes, or those which have the body of a lengthened or riband-shaped form. They have the head short, surmounted by an elevated bony crest, to the top of which there is articulated a long spinous ray; and the rest having a membranous margin, and along the upper part of the back nearly to the tail there is a low fin with simple rays. The caudal fin is separate from the others, but very small, the pectorals are of moderate size, and the ventrals are so very small, as hardly to be perceptible. The teeth are pointed and a little serrated, and the mouth opens upwards. The eyes are very large; the only known species inhabits the Mediterranean, where it is very rare. It is in that sea chiefly that we find the most singularly formed fishes, and some of them not met with even in the same latitudes of the open Atlantic, or indeed nearer than the Indian seas; and it is worthy of remark too, that there are some shells still found in the Mediterranean, which are not now found except there and in the Indian seas; and that many of the fossil shells met with in those deposits, which have been evidently formed by the Mediterranean at some time or other, are also more connected with the Indian sea than with the Atlantic.

LOPHYRUS (Latreille). A genus of hymenopterous insects, belonging to the family of the sawflies (*Tenthredinidæ*), distinguished by the beautiful bipectinated antennæ of the males, forming a large triangular brush; those of the females are serrated. The larvæ have twenty-two legs, live in society, especially upon the species of the genus *Pinus*, to the young plants of which they are occasionally very injurious. There are three British species, the type being the *Tenthredo pini* of Linnæus.

LORANTHEÆ. A small but very curious natural order of plants containing two genera *Viscum* and *Loranthus*, to which has been added *Aucuba* by Bartling and Richard. This addition is, however, not yet fully sanctioned by other botanists, owing to the uncertainty respecting the character of the fruit of the aucuba. The viscums have little or no beauty, but the

loranthus is among the most lovely of plants, hanging in rich clusters of scarlet flowers from the branches of tropical trees which "they often clothe with beauty not their own." The mistletoe of the Druids is supposed to have been the *Loranthus Europæus*, the common viscum (mistletoe,) never being seen upon the oak, while the loranthus inhabits no other tree. "If this be so," says Lindley, "the latter must have once existed in this kingdom, although now extinct." It has been suggested that all vestiges of their religion were extirpated with the Druids, which will account for the loranthus having disappeared wherever that religion formerly held its sway. The mistletoe may be introduced into the bark of a hawthorn or apple tree, by merely sticking the seed upon a smooth part of the bark.

LORICERA (Latreille). A genus of coleopterous insects, belonging to the family *Carabidæ*, and subfamily *Harpalides*, distinguished by having the intermediate joints of the antennæ clothed with long hairs. There is only one British species, *L. pilicornis*, a pretty active species of a brassy green colour, found under stones.

LORIPEDE (Poli.) A genus of molluscs, so named by Poli, but now united to the genus *Lucina*, of which they appear properly a species.

LORY (*Loris*). A genus of four-handed mammalia, very remarkable for the slender form of their bodies, and their small and lengthened legs. The head is round, at the same time that the muzzle is elevated, and the nose produced to its extremity. The eyes are round, very large for the size of the animal, and placed so near to each other, that they are separated by only a thin partition of bone. The nostrils open toward the sides of a glandulous muzzle, down the centre of which there is a furrow, and there is a slight division of the upper lip; the ears are rounded; the tail is wanting, or so short as to be hardly visible externally, though there are six vertebræ in it. The limbs of the loris differ chiefly from those of the lemurs in their greater length and slenderness; they have all five toes, forming a true grasping hand, and having the thumb opposed to the rest, that on the hind foot being far removed from the others. The nails are flat, with the exception of that of the first toe on the hind foot, which is in the form of a crooked claw. The teeth bear a considerable resemblance to those of the galagos; the upper jaw has two small incisive teeth on each side, separated from the other two by a vacant space; there is also one canine and six cheek teeth; but the first three are only false grinders. In the lower jaw there are three long and pointed incisors on each side without a vacant space like that in the upper; and as is the case in the lemurs, the canines of the lower jaw lock inside that of the upper, contrary to the form in most animals.

In the loris, but we believe not in the lemurs, there is a remarkable formation of the principal arteries which supply the extremities with blood, that is, the subclavians and the femorals. Both divide into a ramified plexus of small vessels, which inosculate with each other, and form a sort of labyrinth, by means of which the current of blood to the limbs is greatly diminished. But though it is highly probable that this compound form of the vessel occasions a much slower circulation in the limbs of those animals than if that vessel was entire, yet the volume of the vessels is large in proportion to that of the limb, and it is probable that the quantity of blood which it habitually contains is corresponding. It is certain that the motions of those animals are much more slow than those of any others with which we are acquainted, excepting perhaps the sloths, and their habit is altogether of a different character.

Though the loris agree in so many particulars with the lemurs, as have induced very many to give to the species which is figured in our plate along with the lemurs, the habits of the two genera are very different. They are both nocturnal, or, at all events, twilight animals in their feeding; but there is a remarkable contrast between the great vigour and rapid motions of the lemurs, and the feeble structure and creeping pace of the loris. The absence of a tail in the latter gives them an unfinished or mutilated appearance; and their slender limbs, long hands, and feeble joints, tend greatly to increase that appearance. The loris too are inhabitants of India and the Oriental Islands, while the lemurs are met with only in Madagascar; and it is worthy of remark, that the produced extremities and lengthened bodies of the loris give them some resemblance to the long-armed apes of the east. They are wholly climbing animals, reaching from twig to twig, whereas the lemurs are agile leapers. There are some very curious points in what may be called the physiological structure of the loris, chiefly in the female, which make them different from every other genus of mammalia; but the details of those peculiarities are interesting only to scientific naturalists, and even among them the use of this difference of structure has not been made out, so that in a popular point of view it is really of no use. There are two species at least which are known, and probably there are many others; for the forests which these animals inhabit are exceedingly close, and consequently difficult to be explored; and besides the nocturnal habits of the animals tend to make them less observed than if they were abroad on the branches during the day. The structure of their mouths is decidedly carnivorous; but still those which have been kept in confinement have not refused succulent vegetable matter. It is understood, that when in their native forests, their food consists chiefly of insects and small birds, upon which they are enabled to steal softly, and capture while reposing in the trees; because their motions are so slow and wary that they must occasion very little noise. Their large eyes indicate a strong power of sight, with only a twilight illumination; and the same extent of eyes renders them but ill able to bear the glare of the light, especially the strong light of a tropical sun. The closeness of the eyes to each other also indicates a forward motion toward an object which is in a state of repose; and this again forms a striking difference between them and the lemurs, which have the eyes at a considerable distance from each other, though not nearly so far apart as those animals which range for their prey, and course it by speed of foot. Indeed, to form a correct judgment of the difference in character between these two genera of animals, it is only necessary to examine the expression given to the two lemurs properly so called, and the lori or slow-paced lemur. We shall very briefly notice the two principal species.

The Slow Lori (*L. tardigrada*) is a native of India, and probably also of many of the eastern islands. It is of a greyish fawn colour, with a brown stripe down the back, and the space round the eyes

also darker than the rest of the body. During the day, and indeed at all times if it is fed in confinement, it is a slow and indolent animal, and seldom moves; and when it makes an effort at running either from danger or to its food, that effort is a very feeble one. It is by no means a vicious animal, and though it is not easy to stimulate its instincts, it does not appear to be so stupid as it is slow. It remains in concealment during the day, but as the evening closes in it begins to move, grasping from branch to branch, and watching around it with apparent eagerness. It is said to prey upon the ground as well as among the branches; and when it spies a prize on a large branch, or on the ground, it creeps along perfectly motionless till within a short distance; then it elevates itself on the hind legs, advances a little quicker, seizes the prey between the fore ones, and speedily grasps it to death. Some which have been kept as curiosities have fed upon milk and ripe fruits, but they always preferred birds and the larger insects when these could be procured.

The Slender Lori (*L. gracilis*). This is a much smaller animal than the former, and also more remarkable for the slenderness of its limbs. It possesses also some of the general characters which we have mentioned, though in greater perfection than the former one, such as the elevation of the point of the nose, and the projection of it beyond the upper lip; but we believe the two middle incisors are not so often undeveloped, or at all events wanting in the upper jaw, so as to occasion the vacant space to which allusion has been made. This species inhabits the island of Ceylon, and various other places in that neighbourhood; and the name is said to have been first given to it by the Dutch. Its general colour is brownish yellow on the upper part, and greyish on the under, with a reddish brown spot surrounding each eye, but without the dorsal line which characterises the other. Its size is rather less than the other species, being about that of a squirrel; its covering is remarkably soft, and it is altogether a very delicate animal. One which died a few years ago in the gardens of the Zoological Society measured between eight and nine inches in the body, five and a half in the hind extremities, and five in the fore ones, the difference being between the thigh bones and the bones of the arms.

The loris are altogether singular creatures, and whether we judge of them by their structure or their habits, it is not very easy to assign, with accuracy, their place in the system of the mammalia. As we have said, their chief resemblance is to the lemurs; but then the lemurs themselves stand alone as a group. It does not appear that these creatures bear much analogy to any others which are found in the eastern islands, and especially in continental India; and therefore we must regard them as in a great measure forming one of those detached groups which we now and then meet with, more especially in countries having great peculiarities of climate; and of which we can neither assign the proper place, nor point out the structural advantages, until we have obtained an internal knowledge of all the peculiarities of the climates and their causes.

LOTUS (Linnæus). An extensive genus of creeping herbs and under-shrubs, chiefly natives of Europe. Four or five species are found in Britain, where they are known as the bird's-foot trefoil. The flowers are papilionaceous, and belong to *Leguminosæ*. The loti resemble the clovers in their general properties, but do not seem to be so acceptable as food to cattle. The pods of *L. edulis* are esteemed in Candia and Barbary, and those of *L. Gebelia* are eaten by the Arabs, being dressed when young as French beans are in Europe.

LOUREIRA (Cavanille.) A genus of evergreen Mexican shrubs belonging to *Euphorbiaceæ*. They are treated as greenhouse plants, grow freely in a mixture of loam and moor earth, and are increased by cuttings.

LOUSE. The generic English name given to several small species of apterous insects, belonging to the order *Anoplura*, and family *Pediculidæ*, which are parasitic upon man and various animals, and distinguished by having the mouth composed of a short tubular proboscis or haustellum, by which they are separated from the bird-lice, *Nirmidæ*, which have the mouth mandibulated. Notwithstanding the disgusting nature of these insects, the writer on natural history ought not to be deterred from entering into a notice of their peculiarities, especially since, in several respects, they afford several interesting grounds of inquiry. Thus in respect to their situation in the systems of entomology, we find them a constant source of difficulty. They are entirely wingless, and the mouth in the species now under examination is rostrated, whilst in the bird-lice it is mandibulated; and yet the habits of the two groups are so identical, that this variation in the structure of the mouth (which in the true winged insects is considered as sufficient to warrant the establishment of the two classes *Mandibulata* and *Haustellata*) cannot be regarded as affording characters of a higher rank than those belonging to the family groups. Dr. Nitzsch, a celebrated German writer upon these insects, has, however, actually united them, from the structure of the mouth, with two distinct orders of winged insects, calling the former *Hemiptera-epizoica* and the latter *Orthoptera-epizoica*. Some authors again have regarded them as forming a distinct order of insects, which was named *Parasita*, whilst by others they were not deemed to belong to insects at all, but were placed with the *Centipedes* and spring-tailed insects, in a distinct class named *Ametabola*. Hence it is evident that the correct location of this group of insects demands an intimate acquaintance not only with this and all the other insect tribes, but also a just appreciation of the principles which regulate the distribution of the annulose sub-kingdom. Referring to our article Insect, where we have somewhat concisely entered upon this subject, we pass to the account of the chief species of *Pediculidæ*. Of these the *Pediculus humanus*, or body louse, is of a whitish colour, and almost destitute of markings. This species is very abundant in various parts of Europe, although rare in this country. It frequents the garments and bodies of persons of dirty habits, being exceedingly abundant in the lowest classes in Poland and Russia, Portugal, and Spain. The species which is most abundant in this country is the *Pediculus cervicalus*, or head louse, which is marked on each side of the body by a dark line, and inhabits the heads of children and dirty persons, piercing the skin and sucking the blood. They are easily extracted by a fine tooth comb, or are destroyed by rubbing calomel mixed with bears' grease into the roots of the hair. Its eggs or nits are small pear-shaped bodies, termed nits, which are attached near the base of the hair by a glutinous substance. Swam-

merdam and Leeuwenhoeck, two of the most celebrated of microscopic observers, have made the common louse the object of very elaborate investigation. The former tells us that notwithstanding the great powers of propagation of this insect, "it is no more than a jest that people say in sport that a louse may see its fourth generation in the space of twenty-four hours;" and Leeuwenhoeck, who put a male and female louse under a stocking which he wore day and night to favour their breeding, found that the female lays from fifty to a hundred eggs, and, computing the natural increase from what he had seen, he says that in eight weeks one louse may see 5000 of its descendants. It is requisite that the eggs should be deposited in a place that is warm and moderately moist to produce any thing, and hence many nits laid on the hairs in the night-time are destroyed by the cold of the succeeding day, and so stick for several months till they lose their external form. In feeding, a constant motion of the intestines may be perceived through the transparent skin, the blood rushing like a torrent into the stomach. We have in our article on the Locust shown that from what is recorded of the immense swarms of these insects, their appearance, as one of the seven plagues of Egypt, may be supposed to have been produced without any supernatural effort of Providence; and indeed their arrival is not recorded in the Holy Bible as the result of a miracle, but in the plague of lice the contrary is expressly said, that, by the order of God, "Aaron stretched forth his hand with his rod, and smote the dust of the earth, and it became lice in man and beast; the magicians did so with their enchantments to bring forth lice, but they could not; then the magicians said to Pharaoh, this is the finger of God." This brings us to notice, without, however, venturing to speculate upon the precise species, or several species, or even tribes of parasites, of which the Egyptian plague consisted, that the term *Phthiriasis* has been given to a disease supposed to originate entirely in attacks of the *Pediculi*. Kirby and Spence have collected much information upon this subject, and conclude their observations by doubting whether there be any real *Phthiriasis*, and "that it does not appear from any well ascertained fact that the species of *Pediculi* are ever subcutaneous;" and that, therefore, the death of the poet Alcman and of Phresydes Syrius, the philosopher, mentioned by Aristotle, must have been occasioned by some other kind of insect; for, when speaking of the lice to which he attributes these catastrophes, he says, that they are produced in the flesh in small pustule-like tumours, which have no pus, and from which, when punctured, they issue;' but, according to the more recent observations of Alt, published in his Dissertatio de Phthiriasis at Bonn, in 1820, it appears that another species, *Pediculus tabescentium*, is the real louse of this disease, which, as cited by Bürmeister, collect in great numbers upon the skin at particular spots, chiefly upon the breast, the back, and the neck—between folds of the skin, making the surface uneven, so that scale-shaped lappets of the epidermis peel off, beneath which the lice conceal themselves. Of the first appearance of these insects much difficulty exists, both positive and negative evidence being recorded of their non-contagiousness. We cannot, however, adopt the opinion of Bürmeister, that they must necessarily be the result of equivocal generation; and by whom it is supposed that the skin, which has precisely the same structure as the mucous membranes of the intestinal canal, gives rise to parasites peculiar to it. The *Pediculus pubis* (or *Phthirus inguinalis*, Leach), is a fourth species; and, according to Fabricius, the louse of the negro is a fifth distinct species, of a black colour, with a large flat head.

The *Aphides* are also called plant lice; the *Nyctiribiæ*, bat lice; the *Lepisma saccharina*, the sugar louse; and the *Oniscidæ*, wood lice.

LOVAGE. Is the *Ligusticum levisticum* of Linnæus, a large growing plant cultivated as a potherb. It partakes of the qualities of fennel, and is annually raised from seed.

LOVE APPLE. Is the *Lycopersicum esculentum* or tomata, of which there are three principal varieties, the white, red, and yellow fruited. These are all esteemed by Italian cooks and confectioners, and certainly make excellent sauces. The generic name is a bastard compound, signifying the wolfish peach, and like the English name, love apple, is meant to infer the deceitful character of the specious berries: in appearance they are more tempting than a peach, but as a fruit they are worthless.

LOVE LIES BLEEDING. Is the *Amarantus caudatus* of Linnæus, a tender annual border flower, seen in every garden.

LUCANIDÆ (Leach). A family of coleopterous insects, belonging to the section *Pentamera*, and to the subsection *Lamellicornes*, and comprising the various species of stag-beetles, or the Linnæan genus *Lucanus*, distinguished by the enormous size of the horny and toothed mandibles in the males, and by the rather long elbowed antennæ, which are terminated by a perfoliated club, and are composed of ten joints, the first being very long. The mandibles of the females are of small size, and hence the disparity in the appearance of the sexes is so great that it is only lately that the sexes of the great English stag-beetle have been discovered, Marsham having described the female as distinct. The lower jaws are slender and membranaceous, densely clothed with hair, and forming a kind of pencil, which are protruded by the insect for the purpose of lapping up flowing sap and other fluids, whereon the perfect insects feed. The mode in which the food of these insects is taken has been observed by Mr. G. R. Waterhouse, who communicated the following remarks to the Entomological Society. It appeared evident that their mandibles are employed in procuring subsistence, possibly by wounding the bark of young trees, in order to cause the sap to flow, upon which these insects feed. The male specimen of *L. cervus*, Mr. W. kept alive for several weeks, by feeding it with sugar and water; it also seemed fond of the juice of raspberries and other saccharine substances. For the purpose of lapping up juices or other fluid matter, it appears to have an extraordinary power of thrusting out the maxillæ, the terminal portion of which is extremely long and flexible, not unlike the tongue of a bee. It carefully avoided touching any thing with the antennæ, although these organs were kept continually in motion, as if for the purpose of feeling; if by chance they became smeared with sugar or any other matter, the insect immediately cleaned them by drawing them between the thigh of the fore leg and the underside of the thorax, in both which parts a velvet-like patch of hair is to be observed, which is well adapted for such purpose. That the mandibles were employed as above mentioned appeared evident, from the insect frequently biting the raspberry to wound it before it

applied the maxillæ; it also frequently attempted to bite Mr. Waterhouse's finger, without, however, causing a wound, and afterwards applied the maxillæ, but finding no fluid it renewed its attempts several times. —Ent. Soc. Trans., vol. 1, p. vi.

The lower lip is in like manner formed of two shorter but similar pencils, and the mouth is closed beneath by a large horny plate, of a semicircular or square form.

The perfect insects are found upon the trunks of trees, such as the lime, the elm, and the willow; they sit with the head much elevated, in consequence of the size of the fore legs. They appear about the middle of summer, the males flying about in the evenings after sun-set. We have, however, seen *L. cervus* on the wing in the middle of the day. The females are very sluggish, and seldom take wing. The larvæ of the common species, found in the rotten wood of oaks, willows, &c., are large fleshy grubs, nearly similar in form to those of the *Cetoniidæ*, and are supposed by some authors to have been eaten by the Romans, under the name of *Cossus*. In this state they live three or four years, at the end of which time they form a cocoon of chips of wood, glued together with a secretion which they emit, within which they are transformed to pupæ, and shortly afterwards to the imago state, when, notwithstanding the powerful and threatening aspect of the males, they are very harmless creatures.

The family comprises two sections, those with membranaceous and those with horny, toothed maxillæ, the latter comprising the exotic genus *Passalus* The majority of the genera are exotic, and nothing is known of their habits. The three British species compose as many genera, namely, *Lucanus*, *Dorcas*, and *Platycerus*. The two latter are distinguished from the first by the comparatively smaller size of the mandibles of the males. The *Lucanus cervus* is the largest of our British beetles, and is common in some localities in the neighbourhood of London. The male is often two inches long, of a black colour, with chestnut-coloured elytra. It is subject to considerable variation in size as well as in the number of the teeth with which the mandibles are armed. The female is considerably smaller.

LUCERNE. Is the *Medicago sativa* of Linnæus, a valuable pasture and forage plant, extensively cultivated in some of the chalky districts of England and France. Whether as green food, or as hay for horses, it is inestimable.

LUCINA (Lamarck.) A genus of bivalve molluscs, whose animal is but little known, except the species mentioned by Poli—the Loripede. These shells seem allied to the telens, by the formation of their hinges, particularly on account of the lateral teeth. They also, in many of the species, possess an angular depression distinctly marked, but they are never flexuous. This circumstance probably induced Linnæus to class them with his genus *Venus*, which seems to have been a refuge for numberless stray bivalves now established into distinct genera. This shell is suborbicular, inequilateral, with small pointed apices. The hinge very variable in different species, but usually with two divergent primary teeth, one bifid—these change or become obsolete with age: two lateral teeth, the posterior one nearest the hinge, two muscular impressions very widely separated, the posterior one prolonged into a small band, sometimes extending to the centre of the valve. De Blainville has included in this genus, this *Amphidesma* of Lamarck, and the genera *Fimbria* and *Corbula* of Cuvier, De France has described many fossil species.

LUCUMA (Jussieu.) A genus of South American fruit trees, belonging to the fifth class of sexual botany, and to the natural order *Sapoteæ*. Generic character—calyx in five parts; corolla bell-shaped, swollen in the middle; limb five-cleft; stamens inserted into the tube; style simple; stigma obtuse; fruit an apple from five to ten-celled, each cell one-seeded. These plants thrive in rich loam, and may be propagated by cuttings.

LUNARIA (Linnæus.) A genus of biennial and perennial herbs, natives of Europe; so called from bearing broad silvery dissepiments resembling a full moon. The flowers are tetradynamous, and the genus belongs to *Cruciferæ*. In English lists this plant is known by the name of "honesty."

LUNGWORT. Is the *Pulmonaria officinalis* of Linnæus, a British herbaceous plant found in damp woods. The leaves are speckled like human lungs.

LUPINUS (Tournefort). A genus of annual and perennial fine flowering herbs, mostly natives of America. The flowers are monadelphous, and the plants belong to *Leguminosæ*. The lupines need no description, being so well known. A few very fine perennial species have been introduced within these few years, which are among the gayest ornaments of the flower garden.

LUTRA—otter. A genus of carnivorous mammalia, belonging to Cuvier's second tribe, or those which are digitigrade, or walk on the toes; but which differ from the dog and cat families in the form of their bodies, which are long and flexible, and low on the legs, on which account they are sometimes called vermiform, or worm-shaped. This particular structure gives them great facilities in passing through small openings; and thus following prey which is not accessible to the other tribes of the order. In many particulars, the otter resembles the martens and pole-cats; but it differs in other respects. The characters of the teeth are: three false grinders in each side, both above and below; and a very strong talus or heel to the carnivorous tooth in the upper jaw. Their head is compressed, and their tongue is a little rough, or intermediate between that of the cat and the dog. But the chief particulars in which they differ from the martens and pole-cats, are those of the feet and the tail: the former being webbed and adapted for swimming, and the latter flattened horizontally. They are aquatic in their habits, and feed chiefly upon fishes, though they sometimes prey upon those smaller mammalia, which, like themselves, inhabit the banks of lakes and streams. They are all bold and strong animals in proportion to their size, their bite is very keen and determined, and they are resolute both in pursuit of their prey and in defending themselves when attacked. Though the teeth of the otters bear a very great resemblance, in number and in general structure, to those of the martens, yet the crowns of the cheek teeth are so formed as to be better adapted for bruising or grinding their food, than for cutting it. It must not be supposed, however, that this is decidedly an approximation to a less carnivorous habit than that of the martens; for though, from the form of their teeth, the otters could prepare vegetable food much better for their stomachs than the martens, the adaptation is chiefly to the nature of their finny prey, which, not being of so tough and fibrous a nature, is

more easily divided than the flesh of those warm-blooded animals upon which the martens and their congeners feed. The flattened tail possessed by the otters is common to all the four-footed mammalia which swim in the water, and pursue their prey there; and, unlike the tail of the cetacea, it is rather an organ of ascent and descent, than a propelling one, the forward motion being given chiefly by the stroke of the feet. We can trace a gradation in this respect as the animals are more and more aquatic; for the seals, which pass more of their time in the waters than the otters do, have the hind feet in great part united to the tail; and the cetacea, which are still more aquatic than the seals, have those extremities altogether merged in the tail. The otter's tail is covered with longer and coarser fur than the body; but there are, generally speaking, two kinds of fur, the one consisting of shining hairs which are longer and thicker than the rest, and generally of a brownish colour; and the other woolly, shorter, much thicker and finer, and generally greyish. The character of the fur appears, however, to vary a good deal with the climate. The otters of India, for instance, have the hair very rough; but in some cold countries, as for example in Kamtschatka, the covering of the otter is very soft and fine, and the skin is highly esteemed by the furriers. All the otters have the muzzle more or less developed; and mustachios in the greater number of the species, formed of a thick tuft of white or whitish hairs. The soles of the fore feet are quite naked; but in the hind ones the heel is covered with fur. The otter is not an amphibious animal, as is sometimes stated; for there are, in fact, no mammalia, and indeed no other animals, which are capable of breathing both air and water in the same stage of their existence; but the habits of the otter require that it should be much longer under water than most animals, and thus it requires to breathe less frequently. Otters of all species reside in burrows opening as near the water as possible, and very often concealed under a projecting bank. When they take to the water for the purpose of catching fish, they always swim against the stream; for the fishes, when reposing or waiting for food, always have their heads up the water; and thus the otter can come upon them unobserved, and make prize of them. It is often said that large pike and otters contend as to which of them shall eat the other; but though the pike is abundantly voracious, it is not so energetic, and does not bite so sharply as an otter. Otters are indifferent, in a great measure, both to cold and to moisture. Their fur has the property of the feathers of diving birds, in not becoming wetted; and as the greater part of their time is spent either in the water, or in cold and humid holes by the side of it, they do not know a very great change of temperature. They are thus found in countries which are comparatively cold; but it is understood that as the rivers freeze over, they retreat upon the unfrozen portion of the water; though when the frost is more than usually rapid and severe, they are sometimes frozen out; and this is the time when they are hunted with the greatest success, and also when their skins are the most valuable.

As there is much less difference of climate to an otter than to an animal which lives on the land, the coverings of the otters of all countries have more resemblance to each other than those of land animals. They are are all greyish brown, more or less dark on the upper part of the body, and they are generally white or whitish under the throat. For the reasons just mentioned, it is very difficult to find well marked distinctions of species in otters; and thus they who are fond of an excessive multiplication of species are obliged to call them after the countries in which they are found. We shall notice very briefly those species which are named.

The European Otter (*L. vulgaris*) is found in most countries of Europe, and it is the only species in this quarter of the world. Though short in the legs, it is a very long animal; the body of a full-grown one measuring two feet, and the tail nearly a foot and a half. Its general colour is blackish brown, with a white spot under the chin and a smaller one on each side of the nose. The nostrils are provided with an apparatus which prevents the water from entering when the animal is moving speedily along. This apparatus consists of a series of membranous valves, which are kept close by the pressure of the water; and that they may be so kept is another reason why the otter swims against the current. But though these appendages to the nostrils of the otter are a good temporary defence, they are only a temporary one; for if the otter is kept under water for any length of time, by being entangled in fishing nets or any other means, it is drowned with the same certainty as any other air-breathing animal, not by water getting into the lungs through the nostrils, but by strangulation from the want of the necessary stimulus of the atmosphere. The ears and eyes of the European otter are both very small, as a large size in either would be inconvenient; and we accordingly find that those mammalia which are still more aquatic in their habits than the otter, have the eyes smaller in proportion, and scarcely any external ears. But the eyes are the organs upon which such animals have their chief dependence in finding their prey under the surface. Ears are of but little use in letting what goes on under the surface be known to an animal which is also there; and nostrils, especially when closed by valves like those of the otter, are not more efficient. The small eye too is less liable to injury, or to be strained by the pressure of the water, than a large one would be; and the eyes of the otter are remarkably clean, and so placed as to be very commanding. The feet of the animal also answer well for their double purpose of swimming and burrowing in the earth. The feet of all animals which have the habit of diving under water, are short; and those of the otter, besides having this property, answer as mattocks with their fore claws, and as shovels, with spreading toes and strong ankles.

Their dwelling is sometimes in a natural cavity of the earth, but more frequently it is artificial, and with an opening at or under the surface of the water, a little below that part of the pool in which the fish usually lie. Though this dwelling of the otter is always in moist situations, the animal forms a regular nest of grass at the bottom of it, more especially against the breeding time. The period of gestation is about nine weeks, and the litter consists of four or five. The time when they make their appearance is generally about April, and the mother leaves them to shift for themselves in May. They are indeed not merely left to shift for themselves, but they are driven from the nest and its neighbourhood to find abodes and fishing grounds for themselves, but they remain in pairs, and attain maturity in the course of about two years. If taken

young, the otter may be tamed with less attention than many other animals, and it is curious that this is also the case with the seal, between which and the otter there are a good many points of resemblance. The food which they receive seems to have a considerable influence upon them; for if they are supplied with animal food, especially with their favourite food fish, at too early an age, they become sulky, disobedient, and even vicious; whereas, if they are suckled, which can easily be done along with puppies, or fed upon bread and milk, they are gentle and docile, and soon begin to show considerable attachment, and also some knowledge both of places and persons. It is a fact worthy of consideration, that the young, even of the fiercest carnivorous animals, are gentle and playful as long as they are fed entirely by the mother's milk; and if a portion of vegetable food is continued to them, their gentle disposition may be in so far confirmed into a habit. Even the cubs of lions and tigers, when very young, are as playful as kittens; and it is very probable that by continuing vegetable food to them, and breeding them again and again, with an increase of this food in every successsive generation, they might in time be brought to show the same docility as other animals which are ferocious in the wild state, but gentle and obedient in the domestic. It seems, from this fact, which has been well ascertained in the case of many animals, that the effect of animal food is to stimulate the creature fed upon it to hunt and kill that which supplies it; but that this propensity may be diminished by a different kind of feeding. Of course this can operate within certain limits only; because the nature of the food cannot alter the form of the teeth of the animal, and the food must always be such as that these can prepare it for the stomach. The otter, as already said, has the cheek teeth much more nearly of a vegetable structure than those animals which eat warm blooded flesh, and therefore the softening of its disposition by means of vegetable food can be carried to a greater extent. It is the same with the seal, which, as it feeds chiefly upon fish, as well as the otter, naturally has teeth of a similar description.

Various individuals, fond of studying the dispositions and habits of animals, have tamed otters; and M. Frederick Cuvier had several of the common European ones, which were very familiar; and they were fed almost exclusively upon bread and milk. From their obedience, and their showing no disposition to be predatory, he very naturally concluded that the fact of their being trained to catch fish, and bring it to their master, which is mentioned by various naturalists, is by no means improbable. It is indeed strictly agreeable to the analogy which we find in the dog, in trained hawks, and in all other animals which are employed to catch prey. This training for hunting must, however, upon the principle above stated, tend to keep up a much greater portion of the natural ferocity of the animal than if it were merely domesticated, and kept on simpler food; but still the examples of other animals are so many, and so exactly in point, as to leave no doubt that both the otter and the seal might be trained to fishing, and employed with great advantage. Otters are more partial to wild and sequestered places than to the thickly inhabited and highly cultivated grounds, where the banks of rivers are generally cleared to the water's edge; but still they are very generally distributed over all those parts of the country which are fit for their distribution; and they might easily be obtained anywhere in a domesticated state, if taken and trained where they breed, until domestication had produced such an effect on them, as that they would breed freely in that state. It must be understood, however, that it is domestication we are speaking of, and not mere confinement, for the latter always deteriorates the disposition of an animal, so that the most gentle dog imaginable may be altered to a snarler, if kept constantly on the chain for a sufficient length of time. In proportion as otters might be rendered valuable as fishers in the fresh waters, so might seals be rendered valuable in sea fishing; and as seals are found upon almost every part of the coast, much frequented by fish, there could be no difficulty in employing them. Indeed the seals themselves seem to give us a pretty broad hint as to the use that ought to be made of them; for tame ones are very apt to snatch up walking-sticks and other little matters belonging to their masters, and play about in the sea holding them up, as if to attract attention; but when this species of enticing failed in producing its effect, the seal would return with the stick, deliver it up after a little play, and then watch the first opportunity of seizing it again, in order to repeat the same trick. The seals to which we have alluded were, we believe, in great part fed upon bread and milk; and their extreme docility, and slight disposition to go a fishing on their own account, though very conveniently situated for it, being on a very small island, are very strong confirmations of what has been stated both of these animals and of the otter. Every one must be acquainted with the very amusing story of the "phoca," with which Monkbarns used so to torment the valorous Captain Macintyre, whom the phoca had rather ingloriously disarmed; and though there is perhaps no truth in the personal application, there is no question of the perfect accuracy as to the phoca itself.

We have mentioned these few particulars respecting the practicability of taming the otter and turning it to account, because the otter is a very hardy animal, very strong, and very bold and active both upon the land and in the water. It is an animal which could be employed in any climate or in any season; and as we have not such command over the stores of the water as we have over those of the land, every means by which this command, which is the command of articles the production of which costs us no trouble or expense, can be extended, are at all events deserving of a fair and complete trial. The same inducement has led us to add a few remarks on the seal, without which the notice of the otter would not be complete, as, generally speaking, the otter does not frequent the sea, though of course as it does not breathe water, salt water and fresh would be equally suitable to it.

But though the otter is thus susceptible of being tamed into a very harmless and tractable animal, it is very different in a state of nature, and the hunting of it is a matter of some danger as well as difficulty. It does not spring at the throats of men, or even of dogs, as is done by most of the carnivora which seek their food on land. Its mode of seizing its prey is by the part immediately behind the head on the back, and it retains its hold unless the piece to which it is attached is separated from the rest. This sometimes happens; and as wounds in the merely muscular parts are not fatal, and perhaps hardly painful, it is no very uncommon thing in rivers, where there are

many salmon and many otters, to find the former with otter-bites in the upper part of their backs. When an animal which catches prey by means of the bite has recourse to the same against an enemy, there is a similarity in the mode of applying it; and thus the method to which the otter resorts, when it is attacked, is to seize hold as firmly as it can, and retain that hold, but to lay hold simply of the part which is nearest to it. When taken by dogs, it is very apt to seize them by the fore legs, which are very sensitive, and retain its hold till the bone is broken; and in those parts of the country where the otter is looked upon as a formidable animal, it is said to do the same and persevere to the same extent in the case of human beings. It is further alleged, that experienced otter hunters put cinders in their boots, in order that the otter, in case of his seizing the boots, should be induced to mistake the crushing of a cinder for the breaking of a bone. That the otter, if hard pursued and in danger of its life, should bite the leg of a dog, or even that of a man, is highly probable; and when it does bite, it always bites very sharply; but that it should quit its hold upon hearing the snap of a broken bone, or any other sound, is so much at variance with the habits of the animal that it cannot be true. There seems to be as much truth in this as there is in the similar allegation, that the seal intentionally throws stones against those who pursue it on the shingly beaches; but there is certainly not any more.

There are some stories of alarm produced through fear of the otter, which, if they were in the hands of such a describer as Scott, might bear a comparison with the story of the phoca. We shall give the outlines of one:—A gentleman of the northern part of this island, equally eminent for learning, for humour, and for angling, but dashed a little with all with the prejudices respecting animals which reside by the highly picturesque streams of that part of the island, was one day threshing the water with his fly, and his zeal was rewarded by a trout of goodly size, which so excited him that he put it in his basket without depriving it of life. A friend and he had been a few minutes before talking of otters, of which some were known to inhabit the banks of the river in question, and the danger of their bite, and their proneness to give it, had been eloquently descanted on by the gentlemen in question. In the course of a few minutes his hook got fast in the herbage just by the margin of the water, and he lay down on the shelving and tangled bank in order to reach it: when he was fully stretched, the basket with the trout swung down a little, and the trout gave a violent wriggle. The axis of his body was nearly at an angle of forty-five degrees; and as his head was a little heavier than his heels, the heels rose in his effort to escape, and he fairly pitched a summerset into the river nearly chin deep in water, and with his face to the bank. The cause of this unexpected evolution and immersion, was a certain belief on his part, that the sound made by the wriggle of the trout proceeded from an otter whose strong hold he had invaded, and which was in the very act of fastening upon him in his defenceless position.

In times of abundance, especially when the salmon are ascending the rivers in high perfection, for the purpose of depositing their spawn, the otter is described as being dainty in its eating, and satisfying itself with the single piece which it can bite from the nape of the salmon, leaving the remainder of the fish to its fate; and it is also said that the people residing on the banks are aware of the time that this is likely to take place, and knowing also that the otter is a connoisseur in his fish as well as his morsel, they watch his motions, and obtain an excellent supply from what he has left.

It has been already mentioned that salt or fresh water is indifferent to the otter as an element in which to perform its operations; and accordingly, though it prefers the fresh waters in those parts of the country where these abound with fish, and in the salmon rivers above all others, there are other situations in which even the European otter resorts to the sea, and practises its fishing along with, and much in the same manner as the seal. This occurs in the northern islands, and in various other places; and it generally takes place at those times of the year when the animal is driven from the inland rivers by severe frosts, or by scarcity of food.

When it is expelled from the waters by storms of frost or snow, it can alter its habit and become predatory upon the land; and when it does so, it can range to some distance, approaching farmyards, where it kills small or young animals, and to rabbit warrens, in which last it is very destructive, as it pursues the rabbits through the intricacies of their burrows with all the facility of a ferret. It is then that the capture of it affords the best sport, because there is a run upon the land, and the hunters always endeavour to get between it and the water, if there is any hole by which it can enter, or any pool left unfrozen. When it gains the unfrozen water, the capture of it becomes no easy matter; for having so much more command of itself than even the most expert water-dogs, and being apt to seize them and keep them below longer than they can bear, it is difficult to procure it in any other way than by shooting. The time for doing this is when it comes up to the surface to breathe, or to "vent," as it is technically called; but this requires quickness, as a small portion only appears above the water, and that but for a short time. Altogether, and without any regard to the mercantile value of its skin, which fetches a considerable price, the otter is an interesting animal, as being the only one of its kind found in Britain, or indeed in Europe. It is true that some continental ones have been mentioned more marked with white spots than otters usually are; but as the spots upon them are not constant, either in size or colour, those which are more spotted can be considered only as accidental varieties. The flesh of the otter is not eaten at the present time, at least in this country; but in Catholic times it was used on meagre days, and during Lent, and may be so still in some Catholic countries; for in the systematic arrangement of animals according to the canons of that church, the otter is a fish.

The Sea Otter (*L. marina*), is about three feet and a half long in the body; but the tail is much shorter in proportion than in any of the other otters, being about fifteen inches in length. The general colour is a beautiful maroon brown, though in some specimens it is clouded with other colours; and the head, the neck, and the under parts of the fore legs are brownish silver grey. The skin of this animal is accounted the finest of all furs, both in texture and durability, and on this account it is the most costly of the whole, a single skin often bringing in the markets of China and Japan, where furs are in great request, no less a price than twenty pounds. The Russians,

and also the English, send annually to these markets a great number of skins. The pile upon them is almost entirely of the woolly character, remarkably close and soft; its colour is very beautiful, and its lustre quite metallic and very durable. Such numbers of these valuable animals are found in the seas around Kamtschatka, that it is often called the Kamtschatka otter; but it is not confined to the shores of that country, or even to the shores of Asia; for it occurs equally on the west coast of the northern parts of America; but it has not been met with on either shore of the Atlantic, or any shore but in the North Pacific. As an inhabitant of the sea it makes a greater approach toward the seal in its structure than the common otter does. The principal indication of which is, that the hind legs are much shorter and brought nearer to each other, and the tail is also shorter; its toes are also shorter, and the claws shorter by the webs extending nearly to their points; and the hind feet resemble in no small degree in their terminal parts the feet of some of the diving ducks. The fore feet also are but ill adapted for walking; and the whole characters of the animal are much more aquatic than those of the common otter, or indeed of any other known species. It is often at least seventy pounds in weight; but we believe its flesh is of little or no value as an article of food. There are sometimes very considerable differences in the colour, the skin being slightly waved with lighter shades, and the head and fore paws almost white. During the winter months it confines itself to the shores of the sea, or to the margins of the ice, in those places where the water along shore is frozen; but during summer it ascends the rivers, and enters the fresh water lakes. It is a monogamous animal; and the male and female are usually found in company. The period of gestation is not very accurately known, but it is supposed to be not shorter than eight months; and there is not more than a single young one at a birth. Its food consists chiefly of fishes and crustacea, the coverings of the latter being readily broken by its powerful teeth. It is also said to eat the more succulent kinds of sea-weed, which is possible, inasmuch as the greater part, if not the whole, of the genus can eat vegetable matter. This one differs so much from the others in its habits, that it ought perhaps to be considered as a separate section of the genus, rather than as a mere species.

The American Otter (*L. Americanus*) is very often styled the Brazilian otter, though that gives a false impression of it, because it is found in the rivers of North America as well as in those of South. It is doubtful, however, whether it extends as far to the north as otters are known to extend; for there is another species, or at all events a variety, in Canada, longer in the body, though not of larger diameter, than the species under notice; and there is also some difference in the formation of the tail, which indicates a more aquatic habit than that of the species under notice.

The American otter is rather larger than the European. Its covering is generally of a brownish fawn, colour a little bright on the upper part of the head, and darker towards the extremity of the legs and tail. The muzzle and the throat are of a whitish yellow. The colours are, however, subject to a good deal of variation, from dark yellowish brown to yellow on the upper part, and from yellow to nearly pure white on the throat. One distinction between it and the European otter, is its having no distinct naked muzzle, but merely a margin of naked skin round the nostrils.

Its habits are described as being more social than most of the otters; for small troops are found inhabiting the same places of the rivers, and it is mentioned that several females take up their abode and produce their young in the same nest. The place of the nest is a natural hole in the bank, or a burrow excavated by the animals themselves. It appears to have a very considerable resemblance to the European otter in its disposition. In South America it has been domesticated, in which state it eats indiscriminately fish, the flesh of land animals, and farinaceous vegetables; but when it had a freedom of choice it always preferred fish to either of the others. It showed some attachment both to the house in which it was kept and to the inmates, for it would go out into the streets and come back again of its own accord; and if it met with any of the people of the house which were familiar to it, it would follow them much in the same manner as a dog. This following was, however, a very laborious matter, for its legs are so short that its belly nearly touches the ground, and thus it is obliged to leap instead of walking, and very soon gets fatigued. It showed a disposition to play with the other domestic animals, whose sport with each other consists, in great part, of good naturedly pretending to bite. This, however, was a sort of operation which the otter did not seem to understand, for when the dogs pretended to bite it, it always bit them severely in return. It showed no disposition, however, to attack and kill any warm-blooded animal, excepting on one or two occasions; and this was perhaps more by accident than from any disposition to make a meal of them. The account of this domesticated one is given by D'Azzara, and therefore it is probable that it may have related to

The Chili Otter (*L. Chilensis*), which has been named and described as a species, though in reality it appears to be only a slight variety of the other. It is described as inhabiting the waters of Chili; being of a venous brown on the upper part, and yellowish or whitish on the under; measuring two feet four inches from the nose to the tail, with the tail one foot seven inches, and the circumference of the body nine inches and a half. We shall quote the more particular description of it from that given by Mr. Bennett before the Scientific Committee of the Zoological Society in January, 1832:—"The fur," says Mr. B., "is composed of hairs of two kinds; the inner woolly and thickly furnished; the outer silky, also thickly set, and completely concealing the inner. The colour of the fur of the upper surface is glossy brown on the head (where the hairs are comparatively short), and increasing in depth as it proceeds backwards, becomes blackish on the rump, and still more decidedly so on the tail. The lower surface of this member, for the extreme three-fourths of its length, is of the same colour with the upper; near the vent it becomes paer and assumes a reddish hue; and this colour is continued, with a slight cadescent tint, along the whole of the under surface, scarcely becoming lighter on the throat and lower jaw; the margin of the upper lip, the cheeks, and a patch under each ear, are of the same colour with the upper surface; of the mustachios, which are short, some of the hairs are yellowish, while greater part are bluish black; the legs are of the colour of the upper surface of the body, which becomes deeper on the feet; the whole of the silky

hairs exhibit that varying somewhat metallic gloss which is common to most aquatic mammalia."

Several other species or varieties of otters have been mentioned as occurring in one place or other of Central America; but most of them differ little from the more generally distributed species, except in size and colour; a mere list of them will therefore suffice.

The otter of Trinidad is about two feet three inches in length, and the tail measures a foot and a half. The upper part is bright brown, and the sides of the head, the throat, and the breast, whitish yellow; its fur is short and very smooth. It is probably nothing more than an immature specimen of the common American one.

The otter of Guyana is three feet and a half in length, and has the tail one-third as much. It is very bright brown on the upper part, with the throat and sides of the head nearly white.

The Carolina otter is rather larger than the preceding; blackish brown on the upper part, and with the sides of the head, extremity of the muzzle, and throat, greyish.

All the three, we believe, are described from mere museum specimens, which have no history farther than that they in all probability were brought from those parts of America after which they are named; and it does not appear that in structure or in habits they differ from that American variety whose history is better known; and indeed they differ so little in manners from the European otter, that any farther notice of them would be quite superfluous.

The Nir-Nayee Otter (*L. Nair*), is a native of India, over which it appears to be pretty generally distributed; though in that wide country there may be expected to be varieties of colour similar to those of the American otters. It is about two feet and a half long, with the tail one foot and a half. There is less of the fine woolly fur upon it than upon the otters of colder climates. The upper part of it is bright chestnut, lighter on the sides of the body than on the sides of the back; the under part, the throat, sides of the head, and over the lips, reddish white; there are two spots of the same colour, one placed above and the other below the eye, of a russet colour, and the extremity of the muzzle is the same.

The Barang Otter (*L. Barang*), is found in India, but more particularly in Java and the other isles to the south-east. It is sand brown on the upper part, has the throat brownish grey; the length of the body is twenty inches, and that of the tail eight. It is probable that this is an immature specimen of a larger species which is found in the same country, and which after all differs very little from that formerly mentioned.

The Cape Otter (*L. inunguis*), is of course brought from Southern Africa. There are some distinguishing characters between it and the other otters, the most striking of which are found in the feet. The toes on the fore feet are thick and short, and joined by very short membranes, they are more unequal in length; the first phalanx on them is soldered to the next in the second and third; and there are no claws on any of the toes except on two large ones on the hind feet. It appears, however, to live by fishing indiscriminately upon fishes and crustacea. It is larger than the European species, but very closely resembles that one in the structure of its teeth. The general colour of the body is chestnut brown, and the throat and point of the muzzle are white. It does not appear to differ much in its habits from the others, only the structure of the fore feet would lead one to suppose that it is incapable of digging a burrow for itself.

Such is a very brief outline of the otter genus; a genus, the species of which very much resemble each other, if we except the sea otter of the Northern Pacific. That one is unique, as it is the only one whose chief habit is marine; and it is peculiar in being confined to one locality, and also for the great beauty of its fur.

Altogether, the otters are very interesting to the student of natural history who wishes to investigate the adaptation of animals to the places in which they live. They are also remarkable for the very striking generic likeness which pervades them all, and not less for the variations of size and colour, which are almost the only distinctions that can be made between them, so as to form them into species. They are, therefore, exceedingly puzzling to those who place much reliance upon minute scientific arrangement; but they are not on this account the less inviting to the real student of natural history who can, with the exception of the sea one, find in the careful observation of any one of them, a very ample and very accurate representation of the whole.

LUTRARIA (Lamarck), Mya (Gmelin), Mactra of some authors. This mollusc was considered by Linnæus a *Mya*, and by more recent naturalists a *Mactra*; it is, however, perfectly distinct from either, and is more nearly allied to the *Anatina*, to which it may be said to offer a natural transition to the *Mya*, preceding the *Mactra*. This shell is inequilateral, transversely oblong, or rounded, gaping at the lateral extremities, hinge with one tooth, as it were folded or plaited in two, one side of which is plain, ligument internal and fixed in the hollow cavities of the primary teeth. The want of lateral teeth at once distinguishes these shells from the genus *Mactra*.—See the following article.

LUTRICOLA (De Blainville). In this genus of molluscs De Blainville has included the genera *Ligula* of Leach, and *Lutraria* of Lamarck. The most of them inhabit the European seas, three only being described from the Indian Ocean. De France has described several fossil species. In the system of Malacology this genus thus belongs to the first section of the ninth family *Pyloridea*, third order *Lamellibranchiata*, third class *Acephalophora*.

LUZULA (De Candolle). A genus of uncultivated plants found on waste ground, in woods, or mountains, and belonging to the natural order *Junceæ*, of which it form a very interesting feature.

LYCÆNIDÆ (Leach). A family of diurnal lepidopterous insects, distinguished by the smaller size or rudimental structure of the fore legs, the entire and simple claws, the posterior tibiæ with a single pair of spurs. The larvæ are broad and resemble wood-lice, and the pupæ or chrysalides are attached by a layer of silk at the extremity, as well as by a cord passing round the centre of the body. This family comprises an extensive series of butterflies of small size, delicate structure, and comparatively feeble flight; by which latter character, as well as by the entire claws of the tarsi, they are well distinguished from the *Nymphalidæ*, amongst which the "swift Camilla" and the high-flying purple emperor pre-eminently exhibit the superior activity of the last-named family. From the *Papilionidæ* and *Hesperüdæ* they are distinguished by

the more or less imperfect structure of the fore legs Of these insects, the small copper and the little blue butterflies are amongst the most beautiful and the most common of our English species. The rich metallic copper of the former, and the intense silvery blue of the second, cannot fail to have attracted the attention of every observer of nature, and the very beautiful manner in which the undersides of the wings are pencilled with black spots surrounded by white eyelets renders a more minute examination of these insects equally pleasing. Some of the exotic species are more dazzling in their hues. There are about twenty-five British species, composing three genera, *Lycæna, Polyommatus,* and *Thecla;* known to collectors by the equally generic names of the "coppers," "blues," and "hair streaks," and which are distinguished in addition to their colouring by the following characters.

Lycæna, Fabricius (Coppers). Eyes naked, club of antennæ not compressed.

Polyommatus, Latreille (Blues). Eyes generally naked, club of antennæ compressed.

Thecla, Fabricius (Hair Streaks). Eyes hairy, club of antennæ not compressed.

There are four British species of *Lycæna,* of which the *L. phlæas* is the most abundant; the upper wings of a fiery-copper colour, with black spots, and varying in expansion from an inch to an inch and a half. It is found continually during the summer, there being several broods in the course of the season. The large copper, *L. dispar* (so named from the striking dissimilarity of the sexes), is found in the fens of Huntingdonshire and Cambridgeshire.

LYCHNIS (Linnæus). A genus of annual, biennial, and perennial herbs, some of them bearing beautiful flowers, for which they are cultivated in the flower garden. They belong to *Decandria,* and to the natural order *Caryophylleæ.* They are all hardy except one, *L. grandiflora,* which is a native of China, and kept in the greenhouse or in a frame during winter. The cuckoo flower, *L. floscuculi,* of moist meadows, and the cockle, *L. githago,* of corn fields, are two well known English plants.

LICIUM (Linnæus). Evergreen shrubs, and climbers, found in various parts of the world, both tropical and extra-tropical. The flowers are pentandrious, and the genus belongs to *Solaneæ.* Those species which are natives of the south of Africa, are called the box thorn, and are almost hardy enough to stand in our well sheltered shrubberies, or against a wall. They thrive in loam and moor-earth, and are propagated by cuttings in the same kind of soil.

LYCOPERSICUM (Tournefort) is a South American genus, belonging to *Solaneæ.* It is the love-apple of our gardens, and an annual raised from seeds in a frame, nursed in pots, and planted out against walls or pales in the summer, to yield fruit, of which fine sauces are made.

LYCOPSIS (Linnæus). A genus of annual herbs, natives of Europe, and belonging to the natural order *Borragineæ.* In English lists, the *L. arvensis* is called wild bugloss, and was formerly known by the name of *Anchusa,* or *Nonea arvensis.*

LYCOPUS (Linnæus). A genus of aquatic weeds found in Europe; they belong to *Labiatæ,* and in English books the plant bears the name of water-horehound.

LYCOSA (Latreille). A genus of *Arachnida,* belonging to the division *Citigrades,* and distinguished by the position of the eyes, which form an oblong square, the posterior not being raised on foot-stalks; the first pair of legs is longer than the second, but shorter than the fourth. These spiders are mostly found on the ground, where they run with the greatest agility, residing in burrows which they have formed, and the sides of which they line with silk. Some take up their abodes in crevices of walls, making silken tubes, which they conceal on the outside with bits of earth or sand. In these retreats they pass the winter, and undergo their moultings. They form their eggs into a mass covered with silk, and which they carry about with them, attaching it to the underside of their bodies, guarding it most sedulously, and exhibiting the greatest concern when it is taken from them. The young ones when hatched still hold themselves upon the body of the parent until they are of sufficient size to take care of themselves. The type of the genus is the common *Lycosa saccata,* the *Tarantula* also belongs to it. See Tarantula.

LYCUS (Fabricius). A genus of coleopterous insects, belonging to the family *Lampyridæ,* but distinguished at once by the rostrated structure of the head. The species are very numerous, of singular form, and moderate size, being chiefly inhabitants of tropical climates. The very rare British species, *Lycus sanguineus,* is of the sub-genus *Dictyoptera* (Latreille), having the head very slightly rostrated. The species are found upon trees or flowers, and are generally of a red or yellow colour.

LYDA (Fabricius; Pamphilius, Latreille). A curious genus of sawflies (*Tenthredinidæ*), distinguished by the multiarticulate structure of the antennæ (in which respect it approaches the *Siricidæ*), and by the broad depressed body and flat head. The species are of a moderately large size, handsomely coloured, and very rare in this country. The larvæ live in society under a silken tent upon various trees, especially the apple and pear; they are destitute in this state of the false or prolegs by which the larvæ of the sawflies are so well distinguished. The writer has observed a species which in this state forms its habitation in a spiral manner, like some of the caddice flies observed and figured by Reaumur.

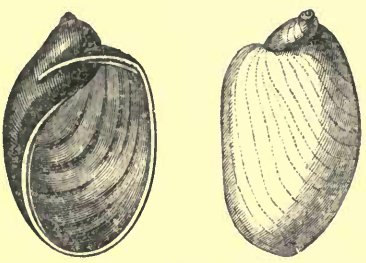
LYGÆUS (Fabricius). A genus of hemipterous insects belonging to the family *Coccidæ,* having the antennæ four-jointed, slightly thickened at the tips, the ocelli are distinct, the head narrower than the prothorax, which is trapeziform. This is a handsome genus of field-bugs, the majority being gaily coloured and exotic. The *L. hyoscyami* is one of the handsomest insects of the family, of a scarlet colour with black spots, and is found upon plants.

LYME GRASS is the *Elymus arenarius* of English botany; a genus comprising many species found all over Europe, some of them useful as pasture plants.

LYMEXYLONIDÆ (Nob.; Xylotrogi, Latreille). A very remarkable family of coleopterous insects, belonging to the section *Pentamera* and subsection *Serricornes,* having the head not posteriorly lodged in the prothoracic cavity, the body long, narrow, and depressed, the maxillary palpi in the males having the second joint dilated and branched, forming a complete brush, the antennæ short, the tarsi entire, the four posterior long and slender. These insects are found in old trees; their motions are extremely active. In the exotic genus *Atractocerus* the elytra are extremely minute. The *Hylecœtus dermestoides*

has been discovered this year (1836) in Sherwood Forest, on the 1st of May, on the trunks of old trees running very quickly, by Mr. P. Desvignes. The antennæ in this genus are compressed and serrated, but in the typical genus *Lymexylon* they are simple. Of this genus the best known species is *L. navale*, a single specimen of which has been taken in Windsor Forest by Mr. H. Griesbach. On the continent, however, this species is very abundant in the oak forests, and occasionally commits very great damage in the dock-yards of Sweden and France. The writer hereof possesses an undescribed species of this genus from New Holland, purchased from the collection of Mr. Haworth.

LYMNÆA (Linnæus, Cuvier). This well-known mollusc is abundantly found in our own rivers and ponds, particularly the latter, as it seems to prefer stagnant water to the running stream. It is not unfrequently two inches in length. The form of the shell is oval, turreted, or conical; substance thin, smooth, and the spire pointed, an ovate aperture extending widely from the front to the back; the edges disunited, the right side always sharp, the left with a very oblique plait or fold at the point of junction, between the columella and the remaining portion of the edge. The uniform characters of this genus



Lymnæa stagnalis.

render it difficult to distinguish the species, but fifteen or sixteen have been described as inhabiting Europe and America; two have been mentioned as natives of India: Africa and South America possess countless species, which remain unknown, from being too common to excite the attention of travellers—a circumstance constantly to be deplored in every branch of nature's productions; for were the same industry exercised in collecting the least attractive that now exists in obtaining the most beautiful, our knowledge of natural history would become immensely enriched, and many connecting links in the genera and species more satisfactorily accounted for. A naturalist, giving instructions to a young traveller in South America, requested he would collect for him every thing *ugly* in preference to the beautiful. This genus is so nearly allied to that of *Physa*, as to induce Sowerby to unite them; he does not think the latter being generally heterostrophe, or left-handed shells, of sufficient importance to warrant their division.

LYONIA (Nuttall). A genus of evergreen shrubs, separated from *Andromeda*, and discovered in North America by Nuttall. The flowers are decandrious, and the genus belongs to the *Ericeæ*. The plants are proper for what are called American borders, that is, formed entirely of moor-earth. They are increased by seeds or layers.

LYPERANTHUS (R. Brown). A genus of tuberous rooted perennials, belonging to *Orchideæ*, natives of New Holland. They are cultivated in pots of loam and moor-earth, and kept in a frame or greenhouse.

LYSIMACHIA (Linnæus). A genus of European herbs, belonging to *Pentandria*, and to the natural order *Primulaceæ*. In Britain they are known by the name of loose strife; and a small creeping one, *L. nummularia*, found in most meadows, is called moneywort, from the appearance of its numerous golden-coloured flowers which enamel the turf. This plant is sometimes kept in pots as a window plant, and is as such very ornamental.

LYSYNEMA (R. Brown). A genus of evergreen ornamental shrubs, natives of Australia. Class and order *Pentandria Monogynia*, and natural order *Epacrideæ*. Generic character:—calyx coloured and multibractate; corolla pitcher-shaped; segments of the limb beardless, turned or bent to the right; stamens below the germen; anthers horizontal; five scales round the germen; capsule with a columnar placenta. These plants thrive in coarse turfy moor-earth and sand, and are propagated by cuttings.

LYTHRARIEÆ, or SALICARIÆ. A natural order of plants, containing in the last published books eleven genera, and above sixty species. Most of these are very showy plants, particularly the genera *Lythrum* and *Lagerstræmia*, which are the representatives of the order. They are chiefly natives of temperate climates, on mountains, and among bushes. The order is divided into two tribes; the first is *Salicarieæ*, containing the genera *Peplis*, *Ammannia*, *Lythrum*, *Cuphea*, *Acisanthera*, *Lawsonia*, *Heimia*, *Nesæa*, *Decadon*, and *Grislea*; the second is *Lagerstræmieæ*, containing only the genus *Lagerstræmia*. *Lythrum* and its allies are herbaceous, rarely shrubby plants with tetragonal or subrotund branches, opposite, entire, glandless, and footstalkless leaves. The inflorescence is axillary, in cymes or spicate thyrsi; the calyx is persistent, with a bell-shaped tube, and cleft limb; the corolla is perigynous; stamens proceed from the tube of the calyx below the petals, and are variable in number; anthers are adnate, oval, and open lengthways; the ovarium is free, two or four-celled; style filiform; and stigma headed.

In the *Lagerstræmia*, the sepals are exactly valvate, the petals never absent, and the seed-coat expanded into a membraneous wing, in which circumstance this tribe differs from the *Lythredæ*, whose seeds are wingless.

LYTHRUM (Linnæus). A genus of annual and perennial herbs, natives of Europe and America; class and order *Dodecandria Monogynia*, and natural order *Salicariæ*. The *L. salicaria*, or willow herb, is one of the most beautiful of our British native plants, frequent on the margins of brooks and rivers.

MACLEAYA (R. Brown). A genus containing one species, imported from China, belonging to *Papaveraceæ*. It was formerly called *Bocconia* by Linnæus. It is a hardy plant, grows well in any light rich soil, and makes a fine appearance when covered with its large panicles of flowers; it is propagated by seeds or divisions of the root.

MACLURA (Nuttall). A genus of American trees, bearing monœcious flowers, and belonging to the natural order *Urticeæ*. *M. aurantiaca*, from the shape and colour of its ripe fruit, is called the Osage orange. This is almost a hardy plant, and does pretty well if planted against a south wall. Two other

species have been added to this genus, viz. the *Morus tinctoria* of Linnæus, or *Broussonetia* of Heritier is *Maclura tinctoria*, and the tree which yields the fustic wood, used in dyeing yellow; and the *Morus Plumiera* of Burman is now the *Maclura Plumiera* of G. Don. The first was introduced into this country, with a view to its becoming a useful fruit tree; but it appears our summers are not warm enough to mature the fruit.

MACLURITA (Lesueur). This mollusc has been separated from the genus *Solarium* by Lesueur, without sufficient grounds, as it is in no essential point different, the principal distinction is the circumference of the umbilicus not being crenulated.

MACOMA. This mollusc was so named by Leach, but has since been united to the genus *Venus*, from which it so little differs as not to warrant a separation.

MACROCERA (Meigen). A genus of small dipterous insects, belonging to the family *Tipulidæ*, and sub-family *Fungivores* of Latreille, having the antennæ very long in the males, being sometimes much longer than the entire body. The ocelli are three in number, and form a triangle. There are several British species, all of which are rare.

MACRODACTYLES—Long toes. The last of the regular families into which Cuvier divides the stilt birds or waders. The habit of these birds is that of frequenting borders of marshes which are thick with tangled vegetation; and the toes of the bird are admirably fitted for enabling them to support their weight upon such footing. In some species these lengthened toes have scarcely any connecting membrane even at their bases; but in others they are lobed, or bordered with web, sometimes entire along the border, and sometimes contracted at the articulations of the toes. The bill is usually more or less contracted laterally, and long and slender, but without that softness and sensibility of touch which characterise the bills of the snipes. The coots and rails are British instances of those birds; and the Jacana (to which article we may refer for some remarks on the general habits), is perhaps the most characteristic of the whole.

MACRODITE. A microscopic mollusc, so called by De Montfort, now arranged under the genus *Lenticulina*.

MACROGLOSSA (Scopoli). A genus of lepidopterous insects belonging to the family of the hawkmoths, having the spiral tongue very long, the body robust, terminated by a fan-like tail, the wings not glossy, and the flight diurnal. The type is the humming-bird hawkmoth (*M. stellatarum*), of whose habits we have given a short notice in the article Hawkmoth.

MACROPODIA. A genus of triangular-shaped crabs. See Maiidæ.

MACRURA or MACROURA—Long tails. A sub-order of ten-legged crustaceous animals, having the eyes placed at the extremity of footstalks, and the abdomen elongated, equalling in size the remainder of the body, and not concealed, but simply bent under the breast, and terminated by a fan-like apparatus or swimmeret, having also on its under side five pairs of small appendages or false legs, with two filaments at the extremity of each. The abdomen is always seven-jointed, the antennæ generally long and exserted, the outer foot-jaws long, and not entirely covering the inner parts of the mouth. The shell is longer and narrower than in the *Brachyura* or crabs, and generally terminated in front by a spine. These crustacea are marine, and do not quit the water like some of the land crabs.

The lobster, shrimp, prawn, &c., are examples of this sub-order, and which is divisible into five families, namely, 1. *Hippidæ*; 2. *Paguridæ*, or hermit crabs; 3. *Scyllaridæ*, including the scaly lobsters, *Palinurus*; 4. *Astacidæ*, or lobsters, and crayfish (see the article Crayfish), including the *Galatheæ* and *Porcellanæ*; 5. *Palæmonidæ*, or shrimps. See the articles Crustacea, Crab, Crayfish, Astacidæ, &c.

MACTRA (Linnæus, and modern authors). This mollusc, separated from the *Lutrariæ*, now constitutes a well-defined genus. They are marine shells, living in the sands, on the borders of the sea. Some species attain a large size; the substance is generally very thin, and covered with an epidermis. The form triangular, sometimes gaping a little backward, equivalve, inequilateral, either smooth or transversely ribbed on the exterior, the summits protuberant and slightly bent forward. The character of the hinge is very singular, and clearly distinguishes this mollusc from all other bivalves; on each valve, beneath the apex, is a compressed tooth, bent or angular, like two divergent pieces, at the side of which is a subcardiform oblique cavity, to which the ligument is attached; there are also two lateral teeth, compressed and inserted, one of them more or less near to the cavity of the ligument, and the other near to the primary tooth. In some species, where the cavity of the hinge is very large, the primary tooth is oblique and almost obsolete, but the lateral teeth always exist; in addition to the internal ligument it possesses also an external one, which constitutes another distinguishing character from other bivalves; the interior of the valves presents two muscular impressions, united by a marginal ligula, narrow, and but slightly marked on the back part. About thirty-five species are described; they are found in the seas of every country, but the fossil species are by no means equally abundant.

MACTRINA. One of Captain Brown's fanciful genera, only to be found described in his comparative arrangement of the systems of Linnæus and Lamarck, upon a *descending* scale of the latter.

MACTROIDES. A division of molluses well examined by some naturalists. To distinguish those of the confused genus *Venus*, whose characters resemble the *Mactra*, modern malacologists have now distributed them into more natural associations, the expediency of which is daily confirmed by the extended researches of naturalists, and the increased knowledge acquired by them.

MADDER. Is the *Rubia tinctoria* of Linnæus, an agricultural herbaceous plant, cultivated for the use of dyers. Madder is used as a dye-stuff, and also as a pigment. The madder-lakes, formed by precipitating the colouring matter from its infusion by alum, are, when carefully prepared, superior in tint to cochineal. Madder is not much grown in this country, although the climate suits it well enough, because it can be imported from abroad at a cheaper rate than it can be raised at home. Our chief supplies are received from Holland, France, Italy, and Turkey. It, like several other of the *Rubiaceæ*, tinges the secretions and excretions of animals that feed upon it. The urine and milk, and even the bones, become dyed red; and curious preparations are formed by feeding pigs alternately on madder and ordinary food, by

which means the constant deposition of osseous matter, and its constant removal, can be shown by the alternate layers of red and white in the bones, and the subsequent disappearance of all adventitious colour, when the use of madder as a food has been discontinued for a sufficient length of time. It may be proper to add, that the hardest part of the bones are coloured in a few days.

MADWORT. Is the *Alyssum saxatile* of Linnæus, a numerous genus of annual and perennial herbs and undershrubs natives of Europe. These herbs are, or were supposed to be, useful against the effects of the infection of canine madness.

MAGGOT. The name given to the footless larvæ of some species of insects. See the articles Grub and Insect.

MAGILUS (Lamarck). This most extraordinary mollusc, in its general appearance, might well be mistaken for a fossil substance, or petrified body. It is thick, ponderous, and resembling semi-transparent alabaster. The apex of this shell is turned round into a short oval spire, of about four whorls, resembling the form of the *Helix;* these, as the animal feels the necessity of extending its habitation, are filled completely with testaceous matter, assuming the appearance of a sculptured marble shell; the last whorl becomes prolonged by age in an irregularly undulating, but nearly straight direction, deserting its spiral turn; and, as additions are made to its length, the previous space occupied by the animal's body becomes successively filled. We have, however, upon one occasion observed several of these divisional portions merely separated from each other, without being rendered solid; this circumstance is of very rare occurrence. It is said that this tube sometimes extends several feet in length. This, by a parity of reasoning, may be possible; we have never witnessed examples even one foot long; and to all nature's productions in this or any other branch, a stage of perfection or completion of size is constantly observable, and seldom varies to any great extent; though the sports of nature are not unfrequent. The upper exterior part of this prolonged tube is convex, the lower side flattened, plaited, carinated, and somewhat angular, with closely set waved lamellar plates, much thicker on one side than the other; the interior rounded, smooth, and its lower side with a groove corresponding to the external keel. This mollusc is doubtless closely allied to the *Vermetus*, but yet nearer to the *Siliquaria*, from which it may be said only to differ by possessing a closed keel, instead of an open fissure. This shell, like the others mentioned, is not adherent, but merely enclosed in the madrepore which forms its habitation. The animal of this genus is quite unknown; but, like that of the *Siliquaria* and *Vermetus*, it is evident that it abandons the spiral portion of its shell in proportion as it increases in growth, augmenting the tubular portion, and filling up almost constantly the space previously occupied, while in its congeners a slight partition is only formed between the periods of distance, and forming as it were cells or chambers, which are never perforated as in the *Nautilacæ*.

This mollusc is found imbedded in madrepore; we have only found it in the *M. sinuosa*, commonly called the brain madrepore; in this it is buried to a considerable depth according to the size of the madrepore, which sometimes is enormously large, as may be witnessed by a magnificent specimen in the British Museum. In the early stage of the mollusc's development, no more than the few spiral whorls are imbedded, at which period a moderately long tube would reach the surface; but, in consequence of the growth of the madrepore being in a semi-spherical form, the animal of the *Magilus*, in order to keep pace with it, from a necessity of having an open communication to the exterior of its retreat, is forced to abandon its first intention of forming spiral whorls, which could never enable it to reach the surface, and by prolonging the last one attains its object, that of an exit at the nearest point. The waved lamellar parts distinctly indicate the periodical removals of the animal; but nothing is known of the age of this or other shells, from the impossibility of witnessing their birth and growth in any one instance. The *M. antiquus* is the only species known, and it is generally found in the madreporic formations of the Isle of France, and some parts of the Indian Ocean.

MAGNOLIACEÆ. A natural order containing five genera and thirty-seven species already described. The order is divided into two tribes, viz. *Illicieæ* and *Magnolieæ*. The first contains *Illicium* and *Drimys*, and the second comprises *Michelia*, *Magnolia*, and *Liriodendron*. The *Magnolieæ* and typical allies are splendid shrubs or trees, with simple alternate leaves, and convolute deciduous stipules, when young terminating the branches with a conical calyptra, like those of the fig, and when fallen leaving scars. The flowers are terminal or axillary; the flowers large, solitary, and often intensely fragrant—sometimes dangerously so. The sepals are deciduous, and nearly entire; petals from three to many; the stamens are indefinite and borne on a rim seated below the germen; the filaments are three, anthers long, two-celled, bursting longitudinally by clefts; the ovaries are many, in an imbricated series, each one-celled, one or more seeded, seeds sometimes suspended; the styles are short, and the stigmata simple.

The *Magnolieæ* are all highly ornamented. The hardy species from North America, and the more tender ones from Eastern Asia, are among the most interesting plants of our gardens. The *Illiciedæ*, like the preceding, are aromatic bitters; as examples, the *Drimys Winteri*, the *Ternus moschata*, and the *Illicium anisatum*, may be mentioned. The former yields the true Winter's bark, which was found so beneficial a restorative to the crew of Captain Winter's ship, who accompanied the circumnavigator Drake.

MAHOGANY TREE. Is the *Swietenia mahogani* of Linnæus. East and West Indian timber trees, of which great quantities from Honduras are annually imported into Europe for the construction of household furniture. Young plants are kept in our stoves as a curiosity, and are raised by cuttings.

"The Honduras mahogany is less beautiful than the Jamaica wood; and it is not improbable that they are the produce of trees specifically distinct. About twenty thousand tons of mahogany are annually imported into this country: and a few years since Messrs. Broadwood gave the enormous sum of three thousand pounds for three logs of mahogany, all cut from the same tree. The duty on mahogany produces a revenue of nearly sixty thousand pounds per annum."—*Burnett.*

MAHONIA (Nuttal). A genus of shrubs nearly allied to *Berberis*, natives of North America, belonging to the sixth class of Linnæus, and to the natural order

Berberideæ. They have been but lately introduced into our collections, and, if hardy enough to bear our winters, will be considered a valuable addition.

MAIDEN PLUM. Is the *Comocladia integrifolia* of Linnæus, a genus of West Indian timber trees, belonging to *Terebintaceæ*.

MAIIDÆ (Maiadæ, Leach; Crabes triangulaires, Latreille; Oxyrhinchues, M. Edwards). An extensive family of *Brachyura*, or short-tailed crabs, distinguished by the triangular or suboval form of the shell or carapax, attenuated in front into a sharp point, which is generally rough or spined; the eyes are lateral, the epistoma or space occupied between the antennæ and the cavity of the mouth is always of a square form; the claws of the fore-legs, especially in the males, large and long; the following legs are often very long, whence some of the species have obtained the name of spider-crabs; the two posterior legs are sometimes of a different form from the preceding. The number of segments in the abdomen is apparently variable, being often seven in both sexes, but in others the number is less, some of the joints (the intermediate) being soldered together. These crabs are inhabitants of the ocean, none having been observed in fresh water, nor upon the shores of the sea. All are found at great depths, and can only be obtained by means of dredging nets. Their motions, notwithstanding the length of their legs, are but slow, and they soon perish when taken out of the salt water. This family comprises the following tribes or subfamilies:—

1. *Macropodiens;* legs very long and slender; second and third pairs always much longer than the fore legs.
2. *Maiens;* legs of moderate size; second and third pairs not more than twice the length of the post-frontal portion of the carapax.
3. *Parthenopiens;* fore-legs much longer than the others.

This family comprises a great number of species, divided into many genera resting upon slight structural variations. The typical species is the *Maia squinado*, a large species found upon the southern coasts of Devon and Cornwall, where it is called the thorn-backed crab. Its shell or carapax is often to be seen stuck up in the fishmongers' shops of London as a rarity.

MALABAR LEAF. Is the *Cinnamomum Malabatrum* of G. Don. An East India tree, formerly the *Laurus Malabatrum* of Linnæus.

MALABAR NIGHTSHADE. Is a genus of cultivated plants in their native country, called *Basella* by Linnæus. It belongs to *Chenopodeæ*, and is a climber.

MALABAR ROSE. Is the *Hibiscus rosa Malabarica* of Kirby, a fine flowering evergreen shrub, a native of India, belonging to *Malvaceæ*.

MALACHITE. This beautiful mineral is in reality a green carbonate of copper. It is found in various forms, but never regularly crystallised, the octohedral variety being a pseudo-crystal derived from the decomposition of another mineral. Malachite occurs in the greatest variety in the Uralian mountains; there are also some fine specimens in Cornwall, though it is but rarely found there.

MALACHIUS (Fabricius). A genus of small but handsome beetles belonging to the section *Pentamera*, sub-section *Serricornes*, and family *Melyridæ*, having the palpi filiform, the anterior angle of the prothorax and the base of the abdomen furnished with a large vesicle capable of being retracted and dilated at will, and which the insect exposes on being alarmed, at the same time emitting a peculiar scent, which is evidently employed as a means of defence; the body is of an oblong and depressed form, and the males are distinguished by the irregularity of the joints of the antennæ, or by the extremity of each elytron being armed with a small spine or tubercle; this character is, however, found also in the females of some species. These insects are exceedingly active, and very voracious; they are found upon flowers, where they lie in wait for their prey, which consists of smaller insects. Two of the handsomest and commonest species are *M. æneus*, of a shining green colour, with the margins of the elytra broadly red (a quarter of an inch long), and *M. bipustulatus*, green with the tips of the elytra red (rather smaller than the preceding).

MALACHODENDRON (Cavanille). A North American shrub, forming a genus of one species, bearing handsome monadelphous flowers, and belonging to the natural order *Ternstræmiaceæ*. It has been long in our shrubberies, and known as the *Stuartia malachodendron*.

MALACHRA (Linnæus). A genus of tropical plants, mostly annuals, belonging to the class and order *Monadelphia Polyandria*, and to the natural order *Malvaceæ*. They grow freely in any light soil, and are increased by seeds.

MALACODERMA (Latreille). A division of coleopterous insects, belonging to the section *Pentamera*, and sub-section *Serricornes*, having the body of a soft consistence, with the elytra flexible, the head immersed in the prothoracic cavity as far as the eyes, the prosternum not advanced into a point behind nor into a flattened plate beneath the mouth. This is a group of beetles of very considerable extent, the species being generally of a moderate size, gaily coloured, and for the most part frequenting flowers. It consists of the following families—*Cebrionidæ*, *Lampyridæ*, *Telephoridæ*, *Melyridæ*, *Cleridæ*, *Ptinidæ*, and *Lymexylonidæ*.

MALACOLOGY. This term is now adopted universally by naturalists, and to our thinking very properly, as applied to the study and scientific arrangement of that portion of creation called *Mollusca*, or molluscs; it includes a description of all the molluscous animals, either marine or terrestrial, whose bodies are commonly called *naked*, possessing merely elementary portions of testaceous matter, internally or externally situated, a partial shield or calcareous protection to some vital organ, or a well defined completely formed shell, serving as a protecting retreat to its architect under circumstances of necessity or convenience. The name is compounded of three Greek words—μαλακος, ζωον, and λογος. This, strictly speaking, should be rendered Malacozoology; but a constantly used idiomatic contraction in the Greek tongue sanctions its being shortened to a more convenient length. Malacology therefore means a treatise or discourse on *soft animals*. It includes all the *invertebrated animals*, which have their muscular system supported by external hard parts, and do not possess an internal skeleton, or any *articulated* portions, corresponding with the *Exanguia* of old authors, a division perfectly in unison with the white-blooded animals of Linnæus; not that it was imagined these creatures possessed no blood, but in contradistinction

to those circulating red blood. In olden times these singular animals appear to have been but little known, and Aristotle, the father of naturalists, gives the name of mollusc to such only as were naked, and that of *Ostracodermes* to those clothed with a testaceous covering; the first he defines as creatures without blood, whose fleshy parts are external, and the solid portions internal, the converse for all the others.

Linnæus, adopting the same view, gives, with his admirable perspicuity, the following definition: MOLLUSCA; A. *simplicia, nuda absque testâ, artubus instructa*: TESTACEA; A. *simplicia domo sæpius calcario obtecta.* He and his disciples, merely attending to the characters of external configuration, lost sight of the natural affinities of these animals—affinities highly important to connect the chain of evidence in forming a system, and which can only be traced by a minute examination of the structure and functions of all the combined organs; a want of this care, for it can hardly be attributed to ignorance in that great man, has led to numberless errors and false conclusions; in the same genus animals were named respiring air, associated with others which perform the same function by means of gills in water; animals whose gills are like laminæ, or leaves placed *externally*, with those having their gills situated in an *internal* cavity. And with regard to his classification of shells, independent of their inhabitants, many anomalies exist that should not have escaped the generally accurate judgment of such a naturalist, but proving the little attention he paid to this portion of nature. Notwithstanding these errors (and what system can be free from them?) —notwithstanding the necessity of the present classification from the increased knowledge we have acquired, the Linnæan system will always remain a key-stone in the circle of natural history.

Fabius, Columna, Lister, Willis, Swammerdam, and others, vainly published anatomical descriptions of *Mollusca*, with a view to establish a systematic arrangement of them in combination with their shells; no one possessed courage to carry on the scheme they suggested. Linnæus does indeed mention, in the first editions of his Systema Naturæ, the animal before a description of the shell; but he confined himself to naming that with which the shell appeared to have the greatest connexion, and his genera of conchology are merely formed on the external configuration of the shell alone; in this he was followed by the greater portion of naturalists of the last century. Molluscs, as they are now viewed, may in general terms be thus described:—animals whose bodies and appendages of vitality are soft, and not *articulated*; they are enveloped in a muscular covering or skin, called the *mantle*, the form of which is extremely various in the different genera and species, and within or upon which exists what is called the shell, either univalve or consisting of one piece, bivalve or consisting of two pieces, or multivalve and consisting of more than two pieces, some without any rudiment of shell. These animals possess a perfect circulation of white or rather bluish blood, an aortic heart, with arterial and venous vessels, within which the blood circulates; they respire by branchiæ; the brain is a distinct mass, from which the nerves and *medulla oblongata* proceed; and there are ganglions in different parts of the body, that of locomotion being lateral; the senses vary; some of these animals possess distinct organs of sight and hearing, while others appear to be confined to the senses of touch and taste. They are for the most part very low in the scale of creation; but the *Sepia*, or cuttle fish, presents an extremely perfect organisation, since it enjoys all the animal faculties of seeing and hearing well, and moving from one spot to another with ease and rapidity, and of being consequently able to pursue and seize its prey with the utmost facility; others, on the contrary, live and die on the spot which gave them birth, and depend, during the span of their existence, entirely upon adventitious circumstances for their sustentation; each, however, let it always be reverentially remembered, performing an important duty in the scheme of infinite goodness and wisdom, far beyond our judgment to fathom.

It would be to us a delightful task to trace the march of intellect from the earliest writers on the natural history of this and other portions of nature down to the present time; to enumerate the various lights thrown upon its study by the unwearied exertions of learned men; and to sum up the moral and physical benefits mankind derive from it; but time and space prevent our doing so. We can, therefore, only sketch a very faint outline of the advance this science has made, in defiance of all the difficulties that surround its study and retard its progress, in the way that has marked all the other portions of the animal kingdom, since of those to whom an opportunity is afforded of seeing these animals, but a small number possess the requisite knowledge to give a correct description of their structure, and travellers' sights may easily be magnified into marvellous tales when resting only on the creative evidence of imagination. We, nevertheless, most earnestly recommend our readers, at all periods of life, to pursue a knowledge, always easily attained, of some one branch of nature, not only as an endless source of the highest rational enjoyment, combined as it were with the development of a new sense of feeling, but, as we firmly believe, beyond all other pleasures conducive to render them happier because better men, through the instruction every page of nature affords to those who are willing to read it in the simple language of truth and piety. How admirably has the poet said that there are

> Tongues in trees, books in the running streams,
> Sermons in stones.

But a mind unused to examine or reason upon natural facts, perceives neither beauty or novelty in the wonderful changes silently going on around us daily; their uniform progress having been from the beginning of time, is always coeval with ourselves; and, without a necessity for our active interference, the senses become imperceptibly reconciled to their regularity, an indifference is engendered to the phenomena of nature, they take place and pass away, leaving no impression behind them, when viewed, as they but too frequently are, as things of course, with which we have nothing to do. When, however, a spirit of scientific inquiry is roused, a taste imbibed for the investigationof nature's operations; when the energy of the mind is once applied to trace, as far as may be, the effects of general causes, to attempt an elucidation of some of the laws by which these are governed, every living thing then assumes a new aspect: at each step fresh matter for wonder and reflection presents itself; we behold all the mysterious effects of chemical combinations, all the powers of mechanical principles, every thing that governs matter or motion, exercised in nature to a degree of perfec-

tion, compared with which the proudest work of human ingenuity is at best but a pitiful imitation ; and we are thus taught to believe, upon the evidence of our known senses, that the most trivial difference in the uniformity of nature's economy is, and must be, the result of given physical powers, to which all parts of the machinery in some way contribute, under the guidance of the great Master's hand, variously stimulating the numberless tribes of animated nature, each after its kind, *not by chance*, but according to the predestined purposes of their existence, all subservient to vain-glorious man, and every one manifestly illustrative of the omnipotence of that supreme wisdom, which directs and governs the whole, ordaining a perpetual harmony of system, in order that the extinction of life shall not be felt, and the devastations of time become supplied by succeeding generations.

This not being our present purpose, we will pass over the monstrous stories of an era darkened by ignorance and superstition, though many of them, when divested of their fiction, give evidence of having been founded on natural observations, since confirmed to a certain extent: and we will take our starting point from that period when the greatest of all naturalists, Linnæus, formed his imperishable monument of nature's history, the Systema Naturæ. It would be consummate arrogance and affectation in us to deny that any other can be formed with greater accuracy, taken as an original whole ; but it is not in the power of man to define a complete, much less a perfect, system ; and we should be wilfully blind, or close our eyes to truth, were we not to attempt an improvement upon it with the immense facilities since afforded us, and by that extension of the human mind to which no bounds can be placed, though at last far from attaining all its bright dreams. To the present day, many exist who would deem it worse than treason to dissent from the laws of Linnæus, and bold must that man have been who first dared to throw off the shackles of prejudice and deeply-rooted early habits, in order to exercise for himself the dictates of reason, when they were in opposition to so great an authority. Such men were, however, found as naturalists ; and, though for many years the study of nature's productions was almost exclusively confined to the Continent, we must not forget, in the admiration so justly due to the illustrious names of Swammerdam, Fabricius, Pallas, Adanson, Müller, Poli, and a host of other eminent men, that we have Lister, Hunter, Munro, Willis, Leach, and many others of our own time, who lent their learning and contributed largely to the same good cause. As English naturalists, they must come in for their share of that information which has led to the mighty results, more recently communicated to mankind, of the subject we are now more particularly upon, by the unwearied and triumphant efforts of nature's chamberlain—Cuvier. Such men, like comets, are few and far between ; but their course is marked in more enduring characters, and the track they have pursued will never be effaced from the annals of science. To the gigantic mind of Cuvier, modern naturalists gladly cede the palm of superiority, and the period is not yet calculated when another shall eclipse his well earned fame.

He possessed, it is true, a rich store of other men's laborious research, with an education fitted to the proper use and understanding of that treasure ; but he commenced the labours of a naturalist under most adverse auspices ; these did not, however, deter him from his leading passion, and he finally became what he was, through a patient and wearisome course of new and difficult observations, aided by an enthusiastic love of his subject, and the well directed strength of a powerful mind, determined to exercise its own dictates, though they militated against the long established homage paid to previous authors, whom he, nevertheless always admired as his superiors. His conversations and intimacy with nature, if we may be allowed that trope, might well have rendered him vain-glorious ; but, on the contrary, his life, his writings, every thing relating to his biography, and the intercourse we happily enjoyed personally with him, prove him to have been an unassuming humble-minded man, open to conviction, and not despising information from the meanest source. This then is the man chosen by common consent as a guide for systematising our present but little understood order of natural history. The imperfection of the Linnæan system in this branch was manifest, and a reference to the article Conchology will point out some part of its errors ; but as it is no difficult task to find fault, though a very difficult one to amend, until within the last half century nothing beyond suggestions of improvement were cautiously thrown out ; till at length Cuvier, profiting by them, and undismayed by the difficulty of the task, determined upon remodelling the old system, forming on its ruins a new superstructure, which included the molluscous animals without a calcareous protection, as well as their more numerous relatives with one, clearly demonstrating the folly of making a separate arrangement of shells from their inhabitants, or forming a system of parts of the whole order, any more than might have been done with the scales of fishes, the feathers of birds, or other integral portions of the same animal, whatever its rank in natural science. In this he took nature for his guide, most ably following the indications she always presents, for a systematic arrangement of her works. Having already stated that we shall pass over the intermediate minor steps of gradual improvement, and alteration which had taken place prior to the present arrangement of molluscs, we will attempt to describe the system as it now stands, sanctioned by every enlightened mind, as the only true basis of Malacology. To do this it will nevertheless be useful that we should rapidly trace some of the most important corrections, or *innovations*, as they have been termed by the disciples of the old school.

Daubenton, in 1743, read a Discourse to the French Academy of Sciences, of which at that time he was not a member, pointing out a methodical distribution of the shells of molluscous animals ; in this he attempted to show that a knowledge of them was not sufficient to guide the systematic arrangement of their inhabitants, and remarked that a more extended examination of their anatomical structure was indispensable to form a more natural system of conchology, even according to the then established rule of Linnæan science, he did not, however, act up to his own suggestion, by pursuing these notions so justly formed.

In 1756, Guettard, a member of the same learned body, appears to be the first who acted upon the hint given ; and though his dissertation was supposed to be an implied satire on Buffon's writings, he clearly pointed out the necessity of having recourse to the animals constructing these dwellings, in order to come to a right conclusion respecting the dwellings themselves, he accordingly introduced many very important

corrections of the old system. These new lights furnished by Guettard may probably have determined d'Argenville to publish, in 1757, a new edition of his Conchology, adding a great number of badly executed plates of animals, under the name of *Zoomorphoses*.

In the same year Adanson applied Guettard's system in a much more extended point of view in his account of a Voyage to Senegal, naming, with great precision, all the external parts of the animal as well as those of its envelop, and drawing very philosophical conclusions on the relative connexion between them both; but, unfortunately for science, he only applied his arrangement to the shells of Senegal, and did not attempt to form a system generally upon that basis.

Another French naturalist, Geoffroy, profiting from the same hints thrown out by Guettard, and so ably seconded by Adanson, in his description of the terrestrial and fluviatile molluscs in the environs of Paris, 1766, gave an admirable definition of the animals as characteristic of the arrangement of their shells.

Müller, the celebrated author of the Fauna Danica, was the first zoological writer who adopted a similar principle in his description of terrestrial and aquatic worms; his system, although more complete than that of Geoffroy, is still very unnatural, and inferior to that of Adanson.

It is about this period that a change in Linnæus's Systema Naturæ, with regard to molluscous animals, became obviously necessary. In the nine editions of that work, he had not named the molluscs at all, the naked animals we now so designate being distributed as worms in his class of the *Zoophytes;* and such as were covered with a shell furnishing his third order of the same class, under the name of *Testaceæ;* but in his tenth edition, great augmentations were made; and in the twelfth, which may be considered the last that underwent the revision of that great man, many more were added. This, was published in the years 1766, 7, and 8; and it is to be remarked, ten years after the hints of Adanson had been thrown out, by which Linnæus doubtless benefited, he, nevertheless, in the characters of his genera confined himself to mentioning an analogous mollusc; and if the work of Adanson materially affected his system, it was only then exhibited by an alteration in his genera of shells, properly so called, without leading to any positive confession of the knowledge of their inhabitants being essentially necessary to his arranement. The impulse given throughout Europe by the labours of Linnæus, seconded to a great extent by the writings of Buffon, occasioned several naturalists to publish anatomical descriptions of molluscous animals.

Fabricius, Müller, and others may be cited, and, in in order to disturb as little as possible the long established school, every effort was made to reconcile the organisation of the animal with its covering.

Pallas may therefore be considered the founder of a new school, and of that new systematic arrangement which has progressively gone on in improvement till it now is acknowledged to be the best and the most natural. In his Miscellania Zoologica, 1766, he proves that Linnæus in the arrangement of his molluscous worms, had wandered widely from nature. That his subdivisions of shells, as admitted by the naturalists of his day, could not stand; in consequence of his having considered their configuration only, without a reference to the animal, he therefore proposed to unite the two as forming a more natural order.

Bruguiere, an author of modern times, who has contributed more largely than any other to the science of malacology up to that period, does not, however, appear to have reaped all the advantages he should have done from the labour of his predecessors, and though he has made some very necessary changes, he, for the most part, was contented to follow their general principles.

Gmelin, who published an edition of the Systema Naturæ of Linnæus in 1789, which was about the time of Bruguiere's writing on the subject of worms in the French Encyclopædia, although he had an opportunity of consulting all the newly-broached ideas on the subject, has scarcely varied in any very important feature from the twelfth edition of Linnæus.

But in 1791, the celebrated Italian physician and anatomist Poli, was the first to publish the genera of molluscs according to the organisation of their structure without any reference to their testaceous covering, which up to that period had only been partially effected in some genera; no one previously possessing either nerve or talent enough to propose such a plan as generally applicable to every similar creature; but he only confined his researches to the molluscs of the two Sicilies; he there divides the animals into three orders; under the name of *Mollusca brachiata*, he characterises all such as have numerous arms, including consequently the *Sepia* of Linnæus; in the second order, *Mollusca reptantia*, all such as possess the faculty of climbing by means of a large foot, and having a head and eyes like the common sail, and most of the univalves; and thirdly, the *Mollusca subsilentia*, including such of the molluscs as possess a large foot by which they are affixed or not, to rocks and submarine bodies, but constantly devoid of a head or eyes. This order included the bivalves and multivalves.

Thus, down to 1796, the science of malacology had been making progressive steps towards its present state, aided, as we have before stated, by the labours of other eminent naturalists in all parts of Europe; but as they had only worked upon the system of those we have shortly mentioned, they merely as it were assisted in navigating more easily the old vessel, without venturing upon a new model for themselves. From 1789 down to 1798, a period of nearly ten years, the science of malacology appears to have remained nearly stationary.

Cuvier, whose scientific labours, though fettered, had never been subdued by the convulsed state of political occurrences, then appeared on the stage, and commenced the foundation of the prodigious improvements he has since accomplished. Justly feeling, with those naturalists who had preceded him, that a natural and methodical arrangement might be effected of molluscous animals, upon the same principles as those which guided all other natural productions, namely, the study of their organic structure, he proposed the classification which now is received as the nearest perfection, by being the most closely drawn from Nature's precepts. He first of all imagined that molluscous animals should be placed a degree higher in the scale of creation than they had previously occupied, and precede those animals which were externally articulated, though internally without hard parts, such as insects. The next innovation on long established custom was, upon the suggestion of Pallas, to unite definitely under the classical name of molluscs, the Linnæan molluscous order of worms, with the testaceous order; considering the existence or absence of a calcareous covering as

not affecting such an arrangement, or only viewing it as a secondary point; he therefore formed a distinct class of the immense group to which he still continued the name of animals with white blood; subsequently named invertebrated animals. Looking in the next instance at the anatomical structure of these creatures, he divided them into three grand sections, naming them—*Cephalopods*, or possessing feet in the head; *Gasteropods*, as having feet in the belly; and *Acephalophora*, or being without heads. In the first he placed the Linnæan *Sepiaceæ*, adding some other genera, since reformed. In the second, and by far the the most numerous section, were included all such as had to that period been described, but separated according to the old-fashioned notion of naked molluscs and those with shells; and the third section was divided into five divisions, according to the formation of the shell. As this first attempt has since been considerably improved upon, we will not enumerate the different genera constituting these divisions, but proceed onwards in our rapid sketch of the progress of malacology. We have in this instance mentioned enough to prove that Cuvier pursued the plan Pallas had suggested, including also the alterations proposed by Bruguiere, Lamarck, and other of his cotemporaries.

In 1799, Lamarck read to the French Institute a programme of his new classification of molluscs. In this he acknowledges the labours of Bruguiere and Cuvier with regard to the animal structure; but he was from that cause obliged to multiply the genera by an addition of sixty-two, constituted from those they had enumerated in their works, with a few others not known to them previously. It is evident that Lamarck, following the track of Bruguiere and Cuvier, did not at first exercise that broad independent judgment which, in 1801, was exhibited in his work, "*Des Animaux sans Vertébres*."

In the same year appeared the work of Audobard de Ferussac, the elder, in which he also describes the genera, from an examination of the animal in relation to its habits: his plan, however, subsequently underwent great changes.

In 1802, Bosc, in a supplement to Buffon's works, admitted the necessity of these new changes; but he, nevertheless, retained the two Linnæan distinctions, or divisions, of the naked molluscs and those with a testaceous covering: in those he closely followed Bruguiere's method, but included all the generic subdivisions established by Cuvier and Lamarck. It is but justice to Bosc to acknowledge, that having had great facilities in examining molluscous animals in their native element, he has ably availed himself of the opportunity,—establishing some new well-defined genera, and introducing several facts in the natural history of these animals totally unknown to other authors.

In 1803, Draparnaud published a prodromus of the terrestrial and fluviatile molluscs of France, which did not appear until after his death in 1808; he also added some new genera, and particularly introduced the change of nomenclature with respect to the parts of shells, always viewing them as a part of the animal, and describing them as moving before the spectator, being, therefore, the first to abandon the Linnæan laws on that subject; otherwise his classification corresponds with Cuvier's system.

De Monfort commenced a work, afterwards completed by De Boissy (forming a portion of Sonnini's edition of Buffon), that, generally speaking, harmonised with Cuvier, and, like his predecessors, he introduced new genera, and altered the arrangement of others. The science of malacology is, however, greatly indebted to his researches, in having introduced a general distribution of the microscopic shells observed by Soldani, Von Moll, and Von Fichtel; he also proposed a great number of new genera, so ably constituted that they have been preserved in modern malacology, though under different denominations. His nomenclature for the most part being gratuitous, he did not attempt a classification of his genera with reference to the animals; and, like the very small molluses he principally described, his distinctions are so minute, that the more or less angular form of the aperture—the presence or absence of an umbilicus—were sufficient to establish separate genera. In the univalves, which was the only portion he had methodically classed, this is strikingly manifested, for, out of thirteen genera of chambered molluscs, which was all that other authors had described, he formed no less than 100—eighty-seven being entirely new, according to his plan; it is needless to add that his arrangement would have been interminable, and included almost as many genera as species.

Another work, embracing many new ideas, is the Analytical Zoology of Dumeril, published in 1806. In this he adopts the method of Cuvier, in placing the molluscs before insects; but he divided them into five orders, adding a new and ill-assorted one which he named *Brachiopods*.

In 1809, Lamarck, obliged by his distinguished post of Professor of Natural History, to follow the progress of science, and to point out every new fact connected with that study, proposed a new distribution of those animals, adding a class he named *Cirrhipods*, which, at the present day, may be considered as an intermediate link between the molluscs and the articulated animals. Keeping pace, therefore, with the new discoveries of Cuvier, Peron and Lesueur, Lamarck again, in 1812, published another edition of his work, greatly improved and enlarged. From that period during the three ensuing years, gradual advances were making towards completing a system founded on the anatomical structure of mollusca.

In 1815, Oken appears to have been the first who entirely abandoned the Linnæan arrangement in his system of malacology; but few new genera were added, and even those of Lamarck curtailed; but his work is remarkable for the changes he has made in substituting new names for old ones, and thereby adding to the difficulty of the study.

In 1817, Cuvier published *Le Règne Animal distribué d'après son Organisation*, a work which combined all he had previously written on molluscs, adding much valuable new information towards the completion of a natural system of malacology.

In the following year, Lamarck commenced the publication of his second edition of *Animaux sans Vertébres*, to which he added the previous information derived from the researches of other authors, and particularly a work of Dr. Leach on the *Nematopods* and *Cirrhipods*, &c., in which he characterised several new genera adopted by Lamarck, as were others suggested by Sowerby in the fossil genera, which in every instance are extremely interesting as connecting links of the great chain of natural affinities, marking the extraordinary mutations this planet has under-

gone, and furnishing evidence of facts which, without a knowledge of them so conveyed, would have rendered the geological phenomena of nature a far greater mystery than they now are. In this great work, Lamarck has very accurately described a vast collection of molluscs, and doubtless would have gone on to a greater extent, had not the loss of sight obliged him to depend more upon the descriptions of others than his own. To a naturalist, the loss of that precious sense must be fatal; but we can only say that the errors it has occasioned in some parts of Lamarck's work are less in consequence and fewer in number than might be imagined under such a cruel affliction. During the period occupied in completing this work, malacology had everywhere received an impetus, and many eminent men in various countries contributed their researches on this interesting subject. In Germany, the works of Schweiger and Goldfuss on molluscs particularly merit notice. In America, those of Say and Lesueur. In Italy, Rafinesque. In England, Donovan, Leach, Sowerby, and many others. But these for the most part applied their attention to the conchological arrangement of mollusca.

Leach, about 1821, commenced a description of English molluscs, based upon the anatomical structure of their inhabitants, and would doubtless have perfected his labours, had not a cruel malady for a time deprived science and his friends of that benefit. His views in all he did were philosophically correct, and we are happy to add, that his health being perfectly restored, we may yet hope to derive instruction from his writings, as a recent letter from him mentions that he is busily occupied in collecting and describing the entomology of Italy; he does not indeed say for publication, but we trust such is his intention. In 1822, Gray published, in the London Medical Repository, an article which, however, may be considered little more than a translation of Lamarck's classification, changing their denominations; his observations at that time on the opercula of molluscs, which he has more recently embodied, are extremely interesting and highly important in the study of malacology. De Férussac the younger, who had occupied himself principally with the terrestrial and fluviatile molluscs, with a view to extend and complete the work his father commenced, wished also to attach a general system of malacology to these molluscs, but we cannot admire the scheme, and it abounds with discrepancies. As a work of art it is a magnificent one, and equal to anything yet published in graphic verisimilitude. Having thus, with a rapid course, traced the outlines of improvement effected in malacology by naturalists, down to the period at which the system has taken a pronounced shape, by De Blainville and other writers, we will not stop to enumerate the subsequent valuable information derived from the detached labours of a number of eminent naturalists, too numerous to be here mentioned, whether as anatomists or zoologists; but in thus acknowledging the obligations of science to them generally, we trust we shall not be thought invidious in mentioning particularly the name of Mr. Richard Owen, Professor of Comparative Anatomy, R.C.S.L., whose early career as a zoologist is stamped with so much excellence, that well-founded hopes may be entertained of his becoming our English Cuvier, should health keep pace with his mental exertions in the study of natural creatures. A want of space, as we have constantly reason to regret, now fetters our wish to have made a more minute chronological history of the writers on that part of malacology which embraces descriptions of the animals only: and we must, therefore, proceed to give an outline of the system we have adopted as our guide, with some general account of the structure of these extraordinary animals comprised under the name of molluscs.

It is scarcely necessary to say that the mollusca are found abundantly distributed over every part of the globe's surface—in the seas, rivers, sands, forests, and plains. Their number is incalculable, and the form of their bodies is beyond every thing extraordinary, and would baffle any attempt at a description of most of them, with regard to a clear definition of any shape approaching mathematical symmetry; they, however, possess some general features which are fixed and constant. They are never *articulated;* generally of an oval form, more or less elongated; sometimes convex above and plane beneath, sometimes convex above and below; the sides often compressed, and others greatly attenuated. In a great proportion of the cephalopods, the upper part of the body is spirally rolled in the form of their covering, and some are so singularly constructed that no intelligible account can be given of their figures without seeing them before our eyes; but we never admit the unphilosophical term of a shapeless mass to any thing in nature, *form* resulting from *purpose*, and that defined by *matter*. A great number of these animals exhibit a distinct separation between the head and the body, as in the *Sepia*; it is less marked in the *Doris*, a specimen of which is here figured; and in some

Doris cornuta.

the head, properly so called, does not exist in a distinct form; from which cause they are called *Acephala*, or headless animals. The distinction of neck, chest, abdomen, and tail, is still less evident; the body presenting merely a mass united, or sometimes subdivided vertically, but never as it were split in a direction from the front part backwards. The bodies of these animals are very rarely furnished with locomotive appendages, properly so called in other animals; but they sometimes possess cutaneous expansions, more or less developed, which assist progressive motion, and it is only in the articulated molluscs that these parts assume a form more analogous to those of insects. The skin which envelops their bodies is constantly soft and spongy, so that it is contractile in every direction, in this is situated the colouring pigment, which is often of a vivid colour. It may be supposed that the mucous cysts, or concealed cells on the superfice of the skin are extremely numerous, judging from the large quantity of matter distributed generally over its surface; but it is frequently very difficult to discover them. In some species the mucous pores are more evident. No true hairs are found on these animals; sometimes, however, the epidermis of the shell is prolonged externally as it were, and presents a fringed or hair-like appearance, observable in some of the helices and bivalves. In some species of the *Chitons* this is very remarkable, for these calcareous horny points are frequently placed in small tufts on both sides of the body. As it frequently

occurs that the skin of these animals is larger than necessary merely to surround their bodies, or the visceral mass exactly, and that its plaits appear to envelop it, the name generally adopted for this portion is *pallium*, or the mantle, to designate the skin of molluscs, though in fact this does not always exist so disposed; so various is the general position of that mantle, that we shall not attempt a description of the differences, as it would lead us beyond our limits. The edges of the mantle vary exceedingly in form, some of them being lobated, or more or less digitated, the protection of which characterises the form of the *Pteroceras*, and other molluscs, familiarly said to have claws; but the most singular property of the mantle is that of secreting, in addition to the colouring, a cretaceous matter, whose accumulation and desication forms a protecting cover, or shell properly so called.

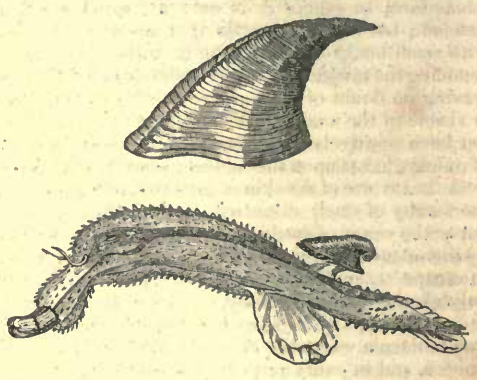
In the article Conchology we have explained, to a certain extent, nature's operation in this respect, illustrating it by the easily observed process of the snail, in the formation of its dwelling; our present object is therefore confined to the anatomical organisation of the animals constructing shells, without reference to the shells themselves in a conchological point of view. The apparatus and sense of touch appears to be seated in the tentacula, or tentacular cirrhi, with which the edges of the mantle are generally furnished; and it is probable, from a parity of reasoning, that certain tentacular appendages, occasionally in the form of a fringed membrane, as in the *Janthina*, may be considered as organs of touch, as well as serving for organs of locomotion. In some molluscs the organ of taste is not at all defined, as is the case with all the *Acephalophora*, in others it is only a lingual mass, ill defined; but in some species that mass is provided with small hooks and spines on its surface, closely resembling the tongue of some of the feline mammals, and leaving no doubt of the purpose of that organ; this is visible in the snail. The organ of smell has not yet been positively determined, and a great diversity of opinion exists upon the subject; some have thought, from the texture of the skin of molluscs, they possessed the faculty of smell dispersed over its whole surface; but as the sense of smelling can only be accomplished by the odour of the particle of matter smelt being free to escape through the medium of air, this sense is only given, in all probability, to such of these animals as breathe air, and is seated at the extremity of the true tentacula, where the skin is invariably softer, more smooth, and in every respect of a more delicate texture than any other portion of the animal's body; the nerves are also more numerously congregated at that part. The organ of vision does not admit of so much doubt as many other of the senses, because the connexion, cause, and effect, is more easily remarked and determined; the headless molluscs do not possess eyes, neither do that class called articulated molluscs; and here, as in every other instance upon which an opportunity of reasoning is afforded us, the wisdom of Providence is manifested most strikingly.

If the organs of locomotion are always distinctly defined by a true muscular fibre, visible on the internal surface of the skin, which is there disposed in a tendinous bundle, of a determined form and disposition of parts, and even sometimes is attached to the most solid portion of the animal's body, the numberless other contractile fibres with which molluscs are provided assist also, in all probability, to their locomotion; but as it is so difficult to see these creatures in their habits, considerable uncertainty exists as to the precise part of their body which serves as legs in all the species. In the *Cephalophora*, the name of foot has been given to a muscular disk, or round substance of greater or smaller thickness, situated at the extremity of the animal's body, and produced by a prolongation of the muscular fibres. In some molluscs, the so-called foot extends the whole length of the body, forming a kind of sole; by means of which the animal is enabled to climb, which, occupying the surface of the viscera, has occasioned them to be called *Gasteropods*, or *Reptantia*, meaning animals with feet in their belly; but in such species as from their form are specially rolled within their shell, and their congeners, the foot or sole does not cover the viscera, but merely extends from that part which separates the head, and may therefore be called the neck, which has occasioned them the distinctive name of *Trachelipods*, or having legs in the neck; the proportionate size, and even the form of this foot, varies very considerably, even in examples of the corresponding genera: thus, in the *Patella* it is nearly round; oval and very thick in the *Haliotis*; rounded in front, and gradually becoming thin on either side, in the *Murex*; ear-shaped in some of the *Terebra*, and a great number of the order *Cyclostoma* and in the *Conus* it is divided by a transverse groove at its anterior edge. All the species of paracephalous molluscs, without shells, are eminently gasteropod, but that is not the case with those possessing shells; they are not, nevertheless, trachelipods necessarily, although that most usually is the case; but a fact common to both is, that these muscular fibres are always so placed with regard to the shell, that they can be contracted to a greater or lesser depth within it, as well as the head itself, by means of a muscular bundle, denominated the muscle of the columella—because in spiral shells it is always attached to that part. The form of this muscle and its disposition differ considerably according to the form of the foot, and more particularly with respect to the configuration of the shells. To this columella muscle also, belongs the power of opening or closing the aperture of the shell, by means of its operculum, when that appendage exists. In the *Cephalopods* and *Paracephalophora*, which are sometimes provided on each side with numerous locomotive appendages, as in the *Sepia*, *Calmar*, and their congeners, and generally indeed in the *Pteropods*, or winged molluscs, these parts possess depressing or elevating muscles attached at their root to the back or the belly; but when these do not serve to perform locomotion, they are merely formed of a contractile skin, in which no muscles are distinguishable. In the acephalous or headless molluscs, in the centre of the abdominal part is situated a muscular mass, more or less thick, which, besides its external, possesses internal contractile muscles, and this mass is in them called the foot, similar to that occupying the lower portion of *Gasteropods*; the shape and size of this varies very considerably, till in some species no trace whatever of it exists, as in the oyster. This foot is attached more or less in front of the body, which depends upon the habitual position of the animal, but it can also be used in different directions, by means of true muscles divided into a greater or smaller number of bundles, directed towards different points of the shell, particularly backward, forward, and sometimes towards the intermediate space, as is the case with the *Onodon* and its congeners. This extensible foot sometimes as-

sumes the shape of a sucker, as in the *Nucula*; a lingual appearance, as in the mussel; in the *Venus*, the form of an arc; and in the *Chama*, the form of the human foot. Other muscular portions of the animal's body, in conjunction with that termed the foot, occasion by their attachment to the shells of bivalves what is called the muscular impressions, serving, when well defined, to guide the malacologist with considerable truth in determining the order of the animal they enclose. In the locomotive system of bivalve muscles, their mode of articulation, by means of an external, internal (and in some species both combined), ligament, that part must be examined with particular attention, as aiding or acting as an antagonist to the adductor muscles. It is formed of transverse horny fibres, which in their natural position connect the valves, but constantly tend to keep them open by their elastic nature, like a spring, occasioning the animal no trouble in opening its shell, and not requiring the body to be provided with another set of muscles for that purpose. This is a simple and beautiful provision of nature; the general wants of the animal requiring its shell to be more frequently open than closed.

A very singular fact, observable in the tendinous bundle of muscles forming the foot, is that some species possess the faculty of becoming agglutinated and attached to submarine bodies, serving as an external point of resistance or repose. This constitutes what is termed the byssus, that substance not being, as many authors supposed, a filamentous excretion, contained in a given gland, and spun out by the animal's foot, but it is a continuation of the fibrous muscles, one portion of which is living in the animal and possessing contractile powers, while the other, attached to the object serving to fix it to that spot, has become devoid of sensation, and incapable of feeling the injury it would otherwise have sustained by collision with different bodies, had its sensibility been preserved externally as it is internally. Another extraordinary provision of nature which we cannot here pass over unnoticed, which, however, wants the positive confirmation of the preceding one, is the apparent probability that the animal possesses the faculty of changing the position of its adductor muscles, in proportion as it increases in size; for if, in a shell not having attained its full period of maturity, this muscle was centrical, it must, to retain that position in the animal's body, move backward in its points of adherence when it attains a greater growth. This is illustrated in many bivalves; we will instance the most easily to be examined—the oyster, in which the muscular impression indicates a change of position very distinctly marked of the subcentral muscle, not that it need be detached all at once to effect this, but probably because an anterior arrangement of muscular fibres become detached as a posterior set are produced; the use of the one being no longer necessary, or kept in the activity of health, lose their energy and as it were die off. No certainty is yet acquired on this head, but it has given rise to much speculation, and various extremely ingenious opinions.

In the *Lepadicea*, no locomotive organs, properly so called, can well be admitted, they live and die on the spot which gave them birth; and the *Chiton*, in its locomotive parts, approaches very near to the true mollusc, the whole of the lower part of its body being occupied by a species of foot, very analogous to that of the *Patella*, &c., while its shell possesses as many double pairs of oblique muscles placed on the right and left sides as there are testaceous portions. The powers of locomotion depending always upon the necessity of existence under the various positions of animal life, it is evident, with regard to molluscs, that it must be extremely restricted in most, and even not necessary at all to many. Whatever creature is gifted with the greater number of senses, it also possesses the better organised muscular system to exercise the purpose of those faculties; thus, the *Sepia* roams at large in pursuit of that first of all necessities—food, while the *Ascidia*, possessing fewer of the senses, remains permanently fixed to submerged bodies. We may, as it were, sum up the nature of locomotive evidences in molluscs, and give a few conclusions drawn from such facts as have fallen under the naturalist's notice, incomplete and in many instances uncertain, resting only upon analogous reasoning, but satisfactory as far as such can be. Various kinds of locomotion exist in mollusca; some direct their movements by means of symmetrically placed appendages acting as oars, using them much in the same way as fishes employ the fins, and these organs sometimes enable them even to spring into the air to a considerable height, which is witnessed in the *Calmar;* a similar operation is said to be effected by some species of bivalves, whose expanded valves are employed as points of resistance in the water. Another kind of natation is occasioned by a very compressed foot alternately moving from right to left, as it is seen in the *Carinaria*, but this always takes place in a reversed position, that is, with the back beneath and the belly uppermost. A third, yet



Carinaria—the shell of its natural size—and a reduced figure of the animal with the position of the shell on it.

more singular, has been observed in the *Sepia*, *Calmar*, &c. This is performed by a sudden contraction of the envelope of the animal's body, by which the fluid contained at the moment of its complete extension is expelled, or spirted out, giving an impetus which is directed by means of the muscular appendages of the body in the direction required. Some molluscs float on the surface of the water, propelled as chance may direct by the caprice of wind or waves, supported by means of a vesicular apparatus, as in the *Ianthina;* and the *Argonauta* is elegantly described as having an inhabitant which navigates its frail bark by means of an extended portion of its mantle, and guided in its course by oar-like muscular appendages; a reference to that article will more fully explain this assertion, and the other still contradictory opinions respecting that mollusc, and the shell it inhabits.

Some terrestrial molluscs progress by lifting the anterior part of their body, and bringing up in tolerably quick time the posterior part or foot, at the same moment making a well marked step forward. A very large proportion of molluscs crawl on the surface of the earth, or in the water, by the aid of a foot or muscular disc, with which their belly is furnished; but this kind of reptation differs widely from that of reptiles; it is rather a species of gliding forward, produced by the rapid succession of the extremely minute undulations composed of muscular fibres, forming that part called the foot.

It results from this species of motion, by which every inequality of the ground or other substance is touched as the animal passes over it, that the advance is by no means rapid, and under any circumstance of excitation cannot be materially increased; though the slugs and others of their class, whose foot is very large, thick, and wide, get forward with greater despatch than might at first be imagined; and the absence of a shell to carry must doubtless render their motions more easy. Some, on the contrary, whose foot is always very large, as the *Patella* and *Haliotis*, move so slowly, and so seldom change their resting-place, that many naturalists have erroneously supposed them constantly stationary; respecting these, we have under their names pointed out another fact, that of the power they possess of adhering with immense force to the object upon which they rest. The *Hipponyx* and *Capula* remain fixed to one spot during life; and the foot, not being actively employed in them, is scarcely to be called muscular; it more nearly resembles the horse-shoe-formed muscle which attaches the back of the animal to its shell. The *Scyllæa*, whose foot is extremely narrow, and as if channelled, cannot without great difficulty move on a plane surface; but can with perfect facility and even speed, climb the stems and peduncles of marine plants; its progress is, however, completely sliding along them; this is, doubtless, assisted by the medium of water rendering the objects they are found upon smooth and easily passed over; to compensate for which the slugs are abundantly supplied with a lubricating fluid secretion, which enables them to slip over the minute dry substances that would without that wise provision encumber or clog their foot. The common grey slug, here figured, will readily explain this kind of locomotion.

Limax cinereus.

Those species of molluscs, which can ascend in water, do so by making the water a point of resistance; but they are then compelled to reverse their natural position. The shell is beneath, and the underside of the foot upwards; this is exhibited by the *Lymnæa*, *Planorbis*, *Paludina*, and others. This last mode of locomotion is but rare in the acephalous molluscs, though one or two instances have been given upon good authority; something analogous may be supposed to exist in the *Nucula*. Judging from the arrangement of the foot, the movement of this class is often totally confined to the inconsiderable expansion of their valves. With regard to locomotion in molluscs, generally, the first circumstance to be considered is the naturae position of the animal while in a state of repose, for it is only at that moment their food is supplied to to them in the water, particularly when the mouth of the animal does not possess extensible tubes; the expansion of their valves in a greater or smaller degree governing the quantum of food, or the convenience of receiving it: we have already explained that this is constantly effected without any effort on the animal's part, by means of the ligament or spring connecting the valves; the act of shutting the valves being effected by the adductor muscles acting as antagonists against this ligamentous fastening. Leach and some other malacologists have imagined that a part of the central adductor muscle was formed of an elastic substance in the oyster and other bivalves; but it is not confirmed by subsequent observations, and therefore seems doubtful. The family of the *Palliobranchiata*, or such as have their branchiæ situated on the internal part of the mouth, or the pallium, exhibit examples of genera in which, instead of a ligament, the two valves are united at their summit by a long elastic tube affixed to sub-marine bodies, being in some cases slightly contractile; the animal, however, enjoys no other movement than the opening and shutting of its valves, like other acephala. In the species of molluscs fixed by their shells or by a tube, these being the only motion possible, a very simple organisation of foot is either requisite or visible. In the other species more locomotion exists, though still to a very limited extent; they are not, in fact, fixed by the immediate contact of the shell with another object, but by fibres or a byssus; and though they have the power of fastening this dried muscle, and as it were anchoring themselves to a solid place by its assistance, yet they cannot voluntarily detach themselves from that fastening; the method employed to affix themselves is by means of the very long extensible foot, particularly characteristic in the byssiferous molluscs.

The *Tridacna*, *Arca*, &c, have also the faculty of attaching themselves to solid bodies by an agglutination of the foot; but, unlike the byssus, it is in mass, and not in separate fibres. In by far the greater number of molluscs without heads, the power of locomotion is more extended; the use of the foot in its proper office is, that of aiding their removal from place to place; some merely exercise it in ascending or descending the hole in which they have fixed their location, whether in wood, stone, mud, or sand; their foot being attached more anteriorly than in the other species, is more readily extended, and takes its point of rest at the bottom of the cell: this always takes place in the *Pyloridea*, whether tubular or not. All other bivalve molluscs, although they often live more or less buried in the mud or sand, can always quit it voluntarily, or move to any other spot; some perform locomotion by means of leaping, the foot serving as a spring, and acting in the same way by its contraction and sudden relaxation; from this mode of motion, the name of *Subsilentia*, or leapers, was given by Poli to the headless molluscs, but evidently erroneously; for if the greater part of the animals of this family of shells possess that power, the *Arks* and others do not, but are permanently fixed, and appear really to climb with their foot.

The *Chiton* moves in a crawling position by means of its abdominal foot, much in the same way as the *Patella*.

The *Lepas* and its congeners, as we have already stated, cannot quit the spot upon which they were born.

The apparatus for nutrition is much less known than that of locomotion; but it appears complete in all the molluscs, consisting of the organs of digestion, respiration, and circulation; a very small number of molluscs are able to seize their prey before introducing it into their mouths—these are the *Brachiocephala*, or such as have those singular appendages like arms, or tentacula, fixed at the top of the head; with these they lay hold of or entwine the living animal they are about to swallow. In molluscs, whose buccal orifice is furnished with teeth, they appear to possess the power of masticating or crushing their food as well as seizing it with them. When one tooth only exists in the upper part, it serves as a fastening to the object upon which the tongue acts; this is clearly exhibited in the common snail and other species of *Helices*. But little is yet known of the trunk or proboscis with which some molluscs are provided; the teeth they sometimes possess at their extremity, may possibly serve to drill holes in the shells, which contain their sustenance, and through them they suck the juices by means of their trunk. The use made of the spiral tongue in the *Chiton* and certain *Patellæ* is quite unknown, at least, with any degree of certainty; but little more is known of the manner the acephala derive their nourishment; it would appear that it is most generally in a molecular form, suspended in the water, which is conveyed to the mouth by means of the appendages surrounding that part; for they indicate no appearance of salivary or masticatory organs.

The *Palliobranchia*, assisted by their long labial appendages, must more readily seize their food, since they are capable of extending them beyond the shell, and moving them in every direction. Deglutition must go on as it is effected in the higher orders of animals, at least we know it does so in the cephalopods. With regard to the digestive organs of molluscs, that process is probably carried on very slowly; nevertheless, the slug and snail, which are those we can more readily observe, eat ravenously during an abundance of their favourite food, which would imply a very active digestion, as few creatures eat more than will suffice for immediate want. Digestion is, doubtless, in these as in other animals greatly assisted by the action of bile, which generally is abundantly supplied, to judge from the size of the liver, the number of vessels receiving it, and the size of the hepatic canals; in fact, the bile is often poured into the stomach itself, or at the pyloric orifice. If, as it appears certainly to be the fact, acephalous molluscs receive their aliment in a molecular or microscopic size, the action of bile must be very secondary, as digestion cannot require its assistance, and in this group of animals the liver is very inconsiderable. We know nothing certain respecting the chyle; but it is, doubtless, absorbed in the intestinal canals. The respiration of molluscs is carried on under similar circumstances with that of animals in a higher grade; we know that oxygen is absorbed by them from the air they live in; but whether solely by the organs of respiration is not so certain; indeed, it is extremely unlikely, the general envelope of their bodies being so absorbent; but as the organ of respiration contains a far greater number of vessels than any other part, the breathing of air must at that point be chiefly conducted. We know also by experiment, that those species furnished with a pulmonary cavity soon die when immersed to a certain depth in water, without it be possible for them to gain the surface; and, on the contrary, the species with branchiæ cannot live long in the open air, particularly when the branchiæ are exposed; but when these are internal, the animal can exist for a considerable period, by means of the moisture humecting them, and by its slow evaporation.

The mechanism by which the ambient fluid is brought in contact with the fluid medium, or blood of molluscs, is simple and well understood. In those species whose branchiæ are external (as the *Tritons*, &c.) the animal has only to swim in order to breathe; those, on the contrary, such as the *Pulmobranchiata*, where the respiratory organs are contained in a cavity—like, also, nearly all the paracephalous molluscs—the air or water is introduced or driven in by the dilatation or contraction of the cavity, and of its plain or tubular orifice, and these two effects are facilitated in all the species, particularly those furnished with a shell, by the extension or the contraction given to the anterior part of the body at which the apparatus is placed, and by its advanced position into the larger part of the shell, but in no one instance is there any regularity of inspiration or expiration. It does not even exist in the *Brachiocephala*, where the water, introduced into the cavity of the mantle in which the branchiæ are, assists, at the same time, for locomotion. The headless molluscs, which are all of them aquatic, present nearly the same mode of respiration, the labial appendages, by their continual movement, determining a sort of current in the water in which the animal is plunged. It may easily be distinguished in such species, the extremity of whose mantles is prolonged into two tubes varying in length, the water entering by the one beneath, and passing out by the other above; thus respiration takes place when the fluid traverses the branchial cavity. It is suspected that the effects thus produced on the blood which fills the pulmonary or branchial arteries are analogous to those of animals more elevated, but that cannot positively be ascertained, because there is no physical distinction between the arterial and venous blood of molluses. In the circulation of blood, the progress of blood through the veins seems nearly as slow as that of the arteries; neither have they any true pulsations, although the heart exhibits regular movements of the systole and diastole; they are, however, very slow, but can easily be seen in the acephalous and cephalous molluscs.

The mode in which nutrition is carried on in molluscs, by the aid of external and internal absorption, is not more known than in the other classes of animals: that which appears certain is, that these animals can support a long fast, particularly when their bodies are completely sheltered by means of a shell, of which the snail is an example and proof; neither does this animal, like many others which hybernate, possess any internal supply of fat, that substance not existing in any mollusc; what is so called in oysters being nothing more than a peculiar condition of the ovarium.

Molluscs possess the extraordinary power of reproducing in a very short time, under favourable circumstances, certain external portions of their body, destroyed by accident or other causes, which may easily be conceived with respect to the mantle and other parts; it becomes, however, less easy for

olfactory tentacula, and, above all, for the ocular ones, whose organisation is much more complex, but with regard to the animal's head, including the brain, such a thing is to us quite inconceivable, notwithstanding the solemn assurances of some writers to that effect. We have indeed been asked why the experiment was not made by ourselves, to which we reply, that it has been made by others; and when such men as Muller, Bonnet, and Spallanzani, entertain a contrariety of opinion on the subject, we feel no inclination to shake our conviction by useless cruelty and needless experiments. The functions of decomposition or exhalation in molluscs nearly resemble that of the higher animals; general exhalation, which is much more abundant in the aërial than in the aquatic molluscs, appears but little known; it is probably more passive than active. The particular exhalations constituting the secretions and excretions are rather abundant. We have already spoken of those which form the shell in such as possess it, as also the liver and salivary glands, employed in digestion.

The means of reproduction in molluscs is not known to us in its full sense, and the investigation belongs to the physiologist. Nothing whatever is positively known of the duration of life in molluscous animals, from the impossibility of watching their progress while in a state of freedom, surrounded by the accessories necessary to their development and preservation, but it may be inferred from the length of time necessary to mark their growth that they live long; dwelling also as they do in a medium, and in situations less subject to the changes of atmosphere or various causes that influence the existence of other portions of creation, it is but reasonable to conclude that the measure of their life is less acted upon by extraneous effects, and that they attain to greater ages in proportion to these advantages than any other branch of animated creation. We do know that they possess the power of multiplying their kind to a countless extent, and wherever that exists in creation, great tenacity of life is generally observed as being necessary to keep up the useful purposes they are destined to perform, which invariably are more numerous than in those animals which multiply their race slowly and in small numbers. No species of molluscs, even of the most perfectly organised, exhibit any positive appearance of sympathetic associations, or the slightest mutual attachment, beyond each instinctively seeking the most favourable situations for their development, growth, and comfort.

We pass over that part of the physiological structure of these animals but little understood, and only interesting to a class of persons who will seek it from higher authorities than ours: we will, however, describe some interesting facts regarding the eggs of molluscs, founded upon the observations of long experience, and many of them not generally known, from the same cause that has and ever must retard the progress of our knowledge in this department of nature—we mean the difficulty of watching their operations in their native element. The eggs of nearly every mollusc are mucous, and more or less of a horny texture, but in some of the terrestrial species (the *Bulinus*, *Achatina*, *&c.*, for example) they are covered with a calcareous shell, rendering them in appearance similar to those of birds, and of some reptiles. They are sometimes cast or laid in a congregated free mass, in which they are united in several ways; but sometimes they are deposited singly, and attached to marine bodies by means of a stem or pedicle, which occurs in the *Buccinum*, *Purpura* and its congeners, and the females of the ovoviviparous molluscs lay their eggs in small numbers during the season of fine weather. In the eggs, here figured, of

Eggs of the Argonauta.

the animal found in the *Argonauta argo*, they resemble a bunch of grapes. In the terrestrial molluscs the eggs appear always sessile, often separated, or merely laid in a heap, and often united by a viscous matter which forms them into a mass. These eggs are generally deposited in situations the most favourable to their future development, and though a very small number of molluscs appear to entertain the slightest kindness for, or take the least care of their progeny, some such feelings may be said to exist in the *Voluta gondola*, the young of which, according to Adanson, are gathered together during some time in a fold of its foot, probably as they quit the oviduct. The janthina, also, deposits its eggs around the parent shell; common snails lay theirs invariably in favourable situations for their best attaining maturity, and the more easily meeting with a supply of naturally wholesome food the moment that want is experienced by a new state of vital existence; and the mollusc always found in the *Argonauta* constantly deposits its eggs at the bottom of the shell. The *Balani* possess the power of placing their eggs by means of the long trunk which terminates their oviduct; but most mollusca lay their eggs by hazard, and the viscous matter usually surrounding them enables their position to be stationary on those spots in which they were first excluded. Various experiments have been made clearly establishing the great vitality of the eggs of molluscs, some of which, after having been five months exposed to the burning sun of a tropical climate, and others to the artificial heat of an oven, and repeatedly dried in it, have not lost the property of future development.

Of the habitat of molluscs, they may be said to exist in every part of the globe, buried in the impenetrable depth of the sea—on the surface of the earth,

Testacella haliotidea.

and even one species, the *Testacella haliotidea*, here figured, *under* the ground: some of them are to a certain

extent amphibious, being capable of breathing air by the organs of respiration, yet living in water which they rarely quit voluntarily, such as the *Lymnæa planorbis*. The greater number constantly inhabit salt and fresh water, being incapable of existing out of it; these distinctions are anatomically defined in the aquatic and terrestrial species, possessing a particular structure of respiratory organ; but it is not so easily observed what characters distinguish such of them as possess branchiæ of the same structure, and are capable of existing either in salt or fresh water with the same ease, or only in the one or the other. The location of marine molluscs is extremely various; a great portion of them live on the sea-coast, on rocks, in the sand, or at the embouchure of rivers; these are called *littoral* species; others are only to be found at a distance from the shore in great depths of water; these are called *pelasgic*; others, as we have already stated, float on the surface of the waters, or attached to various submerged bodies. Others live in the sand or mud; some make a dwelling in wood or stone. But it is almost needless to observe that the terrestrial species are much less variable in their habits, and that it is generally in moist places that they are most plentifully found; some, however, seek a dry soil for their habitation, and, under the disadvantageous circumstances to their comfort of too much heat or too great cold, they conceal themselves under ground, in the holes of trees, or other sheltered spots, where, during the noxious season, vitality is for a season partially suspended; and they hybernate like some others of the animal creation, remaining in a state of torpor the whole time, from which, however, they may be roused, though the experiment ill-conducted would occasion instant death.

The species of nourishment necessary to the existence of molluscs varies according not only to the nature of their formation anatomically, but greatly also with respect to their localities. They subsist either on animal or vegetable substances, dead or alive, fresh, or in a state of putrescence; but each species, each genus even, and yet more certainly, each family, confines itself to one or other of these nutriments. All the known CRYPTODIBRANCHIATA, the *Sepia*, *Octopus*, &c., seek their food in living animals, which they tear to pieces, by means of the hard parts of their mouth; and in that state probably swallow them without further mastication. The SIPHONOBRANCHIATA, the *Murex*, and its congeners, appear all of them to be carnivorous; it is not likely, however, that they often swallow their prey whole, they may suck it by means of their toothed trunk, or otherwise reduce its substance, but they cannot masticate it, being unprovided with true organs for that faculty. The ASIPHONOBRANCHIATA, *Trochus*, &c. seem to be less generally carnivorous, perhaps not at all so, taking their food, either animal or vegetable, in a putrid state, their proboscis-formed trunk being more adapted to sucking than masticating, this is certain with regard to the terrestrial *Cyclostoma*. The PULMOBRANCHIATA, *Lymnæa*, *Physa*, &c., are, on the contrary, decidedly phytophagous, or vegetable feeders; they cut and masticate the food they subsist upon in small pieces, which they swallow by slow degrees; they possess a mouth provided with one tooth of a cutting shape, to which is opposed the lingual mass; it is however asserted that the *Testacella* swallows whole worms, drawing them gradually into the intestinal canal. The CHISMOBRANCHIATA, *Sigaretus*, &c., with the MONOPLEUROBRANCHIATA, and *Berthella*, probably feed in the same manner as the asiphonobranchia, since they possess no appearance of teeth in the mouth. The PTEROPODS, *Atalanta*, do not appear to have the power of mastication, for the above reason, and merely take their food by suction. The same may be said of the CYCLOBRANCHIATA, *Doris*, &c., and even generally of the POLYBRANCHIATA, *Glaucus*, &c.,

Glaucus Fosteri.

though in this last order there are some genera, such as the *Tritons* and *Scyllæa*, in which two jaws exist,

Scyllæa pelagica.

acting laterally like scissors, enabling them consequently at least to cut or separate their food in small portions. The NUCLEOBRANCHIATA, *Carinaria*, *Pterotrachia*, appear to feed upon small animals; the CERVIBRANCHIATA, *Patella*, probably do the same, but the greatest portion of their nourishment is most likely derived from decomposed matter. In all the class of *Accephalophora*, *Terebratula*, *Lingula*, &c., the same mode of feeding is obviously necessary, since their mouths, being entirely soft in all its parts, cannot make the slightest impression on any substance possessing consistence, which seems to confirm the idea that they only subsist upon animal or even vegetable particles, resulting from things, in a state of decomposition, conveyed by the fluid element which enters into the cavity of the mantle destined for respiration; neither is it impossible to conceive that they may derive a great portion of their nourishment from the innumerable microscopic animalculæ existing in the water they inhabit, which, being of the greatest softness, require no masticatory process for preparation as food.

From the nature of the aliment, and the very different circumstances under which it is obtained, it is equally evident that molluscs must employ various methods of supplying the first want of nature. Those species which, like the *Sepia* and even the *Testacella*, prey upon fugitive animals, pursue, catch, and destroy them; when impelled by hunger, some wait for their victims, lying in ambuscade, displaying a bait or temptation formed by some portion of their weapons of destruction, and exercising in this operation a degree of what is termed instinct, very similar to that of animals of a more exalted grade in creation.

Others who subsist upon living objects, in situations where their prey from local habits or necessity are to be found constantly situated, penetrate the shell by drilling a hole with their toothed proboscis, and have consequently but little trouble in seeking a commensurate supply of nutriment; and with such as are not permanently located to one spot, the trouble is somewhat greater; but when once attained, a supply of food lasts a considerable time, and other objects are not far distant to replenish the store. Molluscs living upon animal or vegetable decomposition, no doubt discover it by the sense of smell or feeling, and have also but little trouble in finding it. This is the case with those which, like the greater part of the slugs, feed upon vegetation, in a more or less solid state of life; with these it only requires their being cut into small portions and swallowed. In short, for all the species whose nourishment depends upon molecules of matter, or invisible minute animated beings, no necessity exists for the labour of searching after them, the customary motion of their organs producing a vortex, into which the food is drawn, and probably swallowed with the fluid itself, as it flows through the animal's structure.

The diseases of molluscs cannot any of them either be studied or accounted for beyond the general conclusion—that a want of proper food or accident has occasioned a disordered state of action. The first must very rarely occur in an element teeming with animation, adapted to the immediate supply of that imperative necessity; the latter, also, is less likely to happen, from the strong defence nature has wisely provided, to secure them from external injury, or the attacks of enemies. Both these events, as we have shown, do nevertheless occur; and thus, by the laws of nature, one animal becomes the prey of another.

In some bivalve molluscs, which are the most frequently known to us as articles of food in our markets, a visible difference exists in what we term their state of growth and condition of appearance; they have even some of them their season, but we can in no way satisfactorily explain what peculiar state of disorganisation they labour under, or why indeed any moment of time should render them better than another, except that period which in oysters has been ascertained to be the time when the office of reproduction is in activity; and they, like all other creatures, suffer from its operation.

In the *Sepia*, and the first class of the *Cephalopods*, we have shown that they possess a more perfect system of organisation than any other of the molluscs, not only with regard to the development of animal senses, but also as respects the exercise of them, it being a well established fact that they use occasionally what in the higher orders of creation would be termed *cunning*, in attracting and seizing their prey. The intelligence they exhibit decreases, in proportion as the animals of this tribe descend in the scale of organisation, till it arrives ultimately at that point when it cedes to a mere mechanical operation, and is only confined to the opening or shutting of the valves of their shells, as in the oysters and other numerous species of that type. The general sensibility, or rather susceptibility, of the molluscs—that is, the sense of touch—is strikingly manifest in all of them, every portion of their structure being most delicately formed, so as to receive the slightest impression, externally applied, and different from that state of relaxed or unexcited period of repose they enjoy, when not actively employed in the exercise of their several functions; but this sensibility is more particularly situated at the edges of the mantle, which are very often furnished with tentacular organs, of exquisite susceptibility; these are clearly distinguishable in the conchyliferous *Paracephalophora*, and also in the two lobes of the mantle of all the *Acephala*. The oyster, for example, may be observed to close its valves, merely by a sudden impulse being given to the water in which it lies. This sense becomes less apparent in many species, whose exterior envelope being always exposed, is less tuberculous; and in those whose skin is more or less hardened by exposure, it is scarcely to be observed at all.

A friend, whose modesty will not allow us to name him, but whose scientific knowledge we have more than once gladly availed ourselves of, well knowing its accuracy and judgment, has favoured us with some facts connected with this subject, founded upon repeated experiments and the most certain data; with his permission we here insert the result of them:—"The form of the mouth, so called, in molluscs, varies extremely in its character, and it requires some experience in these singularly organised creatures to distinguish it at all in many species. Nevertheless, it always exists in some form or another, depending greatly upon the figure of what we may term the lips, or surrounding muscles, these also possessing no given permanently fixed character, except as regards generally each species; they are, consequently, very different in the distinct classes or groups. In the most perfectly organised, the *Sepia* for instance, these lips resemble a folded circular membrane, of great delicacy, pierced in the centre, and symmetrically fringed at the edge. In the *Tethys*,

Tethys leporina—lower and upper sides.

the *Doris*, and the *Patella*, the lip forms a thick semicircular band, and at the centre of its lower side the opening of the mouth is placed; this is sometimes carried out laterally, and forms a tentacular appendage. In the *Triton*, the front edge of this thickened band is dilated and fringed, forming a membranous curtain varying in its size; sometimes these lips are prolonged into the shape of a cup or glass, at the bottom of which is the tongue, or trunk, this is the case with the *Conus*. Within these lips, which are contractile in every part, and closing many of them like the opening of a bag drawn together, there are found in some species hard or corneous portions, which the

French naturalists have erroneously called jaws; they are more properly to be designated teeth, performing their functions, and their structure and mode of formation are exactly similar to teeth. In the *Sepia*, these teeth act in direct opposition,—in the *Triton*, hori-

Triton Hambergii.

zontally, in which case they are then surrounded at their base by a thick circular muscle, pressing them against each other when acted upon by the animal in feeding. In the common snail, there is only one tooth notched at its top, and it appears to serve as a purchase, upon which the lingual mass or tongue of the animal acts, not possessing any muscles to give it action of itself, and remaining stationary for the time required by the animal to eat, or rather lick the object affording it sustenance, for which purpose the tongue is admirably adapted, being thickly set with small corneous bristles somewhat hooked, and of the character of the tongues of the feline race. In ripe fruit or other vegetable matter, this fact is clearly demonstrated. In the *Bulla*, the hollow internal cavity of the mouth, the upper part or palate is armed, like the tongue, with minute corneous teeth. The headless molluscs have no appearance of teeth whatever, but the aperture of their mouths presents the character of a lip, which is often prolonged into a tentacular appendage."

In the classification of molluscs, so as to form a system of malacology, by the proper distribution of their species, the same rules may be applied as with every other type of animated nature; it is quite clear that nothing short of the whole organisation of any animal can guide a naturalist in pronouncing the proper order, class, or family, to which it belongs, by affinity of parts; and that the external characters of the organs in these creatures must equally furnish their distinctive positions in a systematic arrangement, as with animals more exalted in the scale of creation. In malacology one great distinction may, however, be drawn; the general organisation of the animal is often well characterised by the form of its shell, and that indication has induced many naturalists of the old school to imagine a knowledge of the one sufficient to acquire the other; but this error we have endeavoured to rectify in the article before us, and we will now add some further proofs of the fallacy of that opinion, and of the necessity of taking many other objects into consideration, to which end we cannot do better than quote extracts from the opinions of Cuvier, Lamarck, and other naturalists, who have founded, and brought to its present state of perfection, the system of malacology; but we shall only do so where those opinions concur, and are sanctioned by living naturalists, as the differences that have, and must always exist on matters but little known and difficult of access, could not either interest or instruct that class of our readers whose minds are only dawning to a love of the study of nature and the Almighty giver of life; such as have advanced more deeply into that delightful pursuit, having overcome its first difficulties, and seeking to discover more from the inexhaustible store it presents to an inquiring mind, must either look for assistance in the detached labours of scientific men who are pursuing a similar course, or strike out for themselves an untrodden path: our pleasant task is ended, when we have, to the best of our ability, amassed together everything we deem usefully instructive in this branch of natural history, and condensed it to the smallest space capable of conveying our meaning, or that of the high authorities we have quoted.

A consideration of the precise spot or particular country inhabited by molluscs can be of very little importance as a guide in their classification, as their locality is not indicative of the form of the animal or its scientific arrangement. We cannot, like the good old Izaac Walton, say, while walking by the river side, here we will rest and take a shell of such a description, as he was wont to say of a chub or a trout, without having a previous knowledge that such things were to be found at that spot. The peculiar kind of subsistence these animals require cannot either have much influence, because, though it is possible to imagine a certain correlation of organs visible, and the structure of the digestive apparatus more or less modified for some one particular alimentary substance, that never is the case, as far as every examination or reason can extend, and we have indeed a proof that no such provision of nature exists, since we find species essentially carnivorous, as the *Testacella*, of the same order as the slug, which is completely herbivorous. The existence or absence of a calcareous protection or shell, is evidently of very considerable importance to a scientific arrangement, since that constitutes a well-defined apparent external character; a knowledge of them will, however, furnish proofs, though the exceptions are not numerous, of conchyliferous animals being of the same genus as others completely divested of shell, such as the *Bulla* and the *Lobaria*, the *Bursatella* and the *Dolabella*.

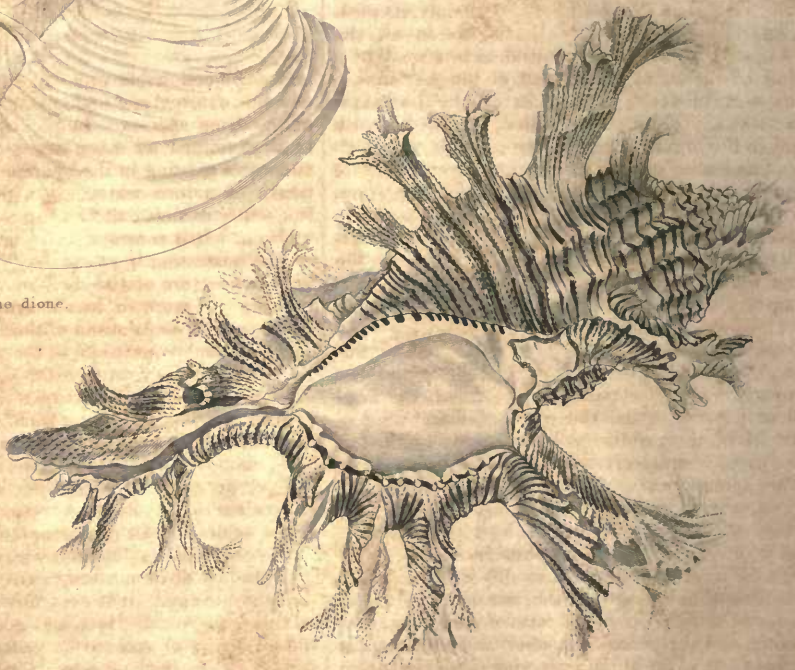
The particular form of the animal's body, where the visceral portion is more or less spirally elongated, is also of very little importance, as we have seen examples of the snail, in which the whorls were drawn out like a watch-spring, not touching each other in their convolutions. The lobes, cirrhi, and other appendages, which border the mantle, are not very important to consider, if we except the order *Lamellibranchiata*, where a consideration of the tubular lobes, by which the mantle is prolonged backward, present extremely useful characters. The animal possessing a perfectly or imperfectly formed head, or none at all, constitutes the different divisions of the first order of malacology; but these characters are not always very distinctly defined. The form, position, and number of the tentacular appendages of the head, present a more essential and certain character to study in the establishing a classification of molluscs; some anomalies are nevertheless observable and altogether inexplicable; in the *Carychium*, for example, the true tentacula gradually disappear, while other animals of the same family have them strongly produced. The position of the eyes is a consideration of some consequence, but probably less so than the tentacula, nevertheless it forms no constant guide, as genera of their family, and even species of the same genus have subpedunculated eyes, and others have them sessile. The principal organ of locomotion, that is the foot of the animal, and the natatory appendages, are of very considerable value in classification,

Helix Labyrinthus.

Spondylus longispina.

Pteroceros scorpio.

Chione dione.



Murex Roseus.

from their position and shape; and their characters being external, it is not surprising that they are so frequently and so advantageously employed in malacology.

A better guide still might be found with regard to its importance in many essential points of consideration, that is the armature of the mouth, either at its orifice or in its interior, because that would immediately enable the naturalist to pronounce, with considerable certainty, the nature of the animal's habits of feeding in general, but the difficulty of the examination has doubtless deterred the most able zoologists from using it more frequently as a law of arrangement in the system. Another character, still more preferable possibly with regard to its great importance, because it accords extremely well with the form of the shell, may be drawn from the position, the form, whether symmetrical or not, and even the structure of the organs of respiration. But here again, unfortunately, it requires no small anatomical skill to employ this character, though they are most frequently nearly external, and the shell, where it exists, peculiarly adapted to their protection. But the part of organisation in molluscs, perhaps as important to consider as almost every other, is the generative apparatus composed of the two sexes, but separate in that structure of each, united both of them in one sex, or only existing in females; here again the examination is entirely anatomical, and very difficult to apply to a system of malacology.

The form of the *testaceous covering* of molluscous animals is certainly extremely important as an accessory guide to the malacologist; it must, therefore, be well considered, and taken in its various grades of useful information. The first consideration we would point out is the number of pieces or parts which enter into its formation, univalve, subbivalve or operculated, bivalve, tubivalve, or multivalve. Secondly, its position on the animal's back—dorsal, as in all the CEPHALOPODS—dorsal and ventral, as in a small proportion of the same order, and of the ACEPHALOPHORA—or bilateral, as it is in all the LAMELLIBRANCHIATA. Thirdly, the indices it furnishes with regard to the organs of respiration; that is, the existence of a channel or tube at the anterior extremity of the aperture in univalves, or of a gaping or separation, more or less considerable, of the posterior extremity in bivalves. Fourthly, the information it affords respecting its connexion with the muscular system of the animal, which constitutes what are termed the muscular impressions, simple in univalves, and only visible in the *Patella, Haliotis, &c.*; more or less complex in bivalves, and formed, as we have explained, in this article, by one, two, or even several adductor muscles, one or more retractor muscles of the foot, the marginal or parallel ligula, the mark of attachment of the edges of the mantle, and backwards by the impressions of respiratory tubes. Fifthly, the form, whether symmetrical or not, which determines a similarity or a variation in the parts of bivalves. Sixthly, the form of the aperture in univalves, and the manner in which each side of the columella or its vitreous deposit contribute to form and modify it. Seventhly, the ligament and hinge of the two portions of bivalves, that is the position and form of the ligamentous fastening, and the position, number, and shape of the so-called teeth of the hinge, observing particularly that each true species of mollusc has its special and almost constantly undeviating form of hinge and teeth, as in the *Arca Noæ* and the *Glycimeris*, here figured, in

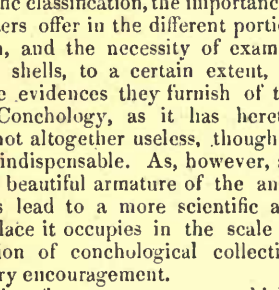
Arca Noæ.

which a different arrangement for example is visible. Eighthly, a very important and strongly defined character, now more extensively consulted from being better known through the light Gray and other modern writers have thrown upon it, is the presence or absence of an operculum, its form, and, most particularly, its structure; this furnishes, whenever it is known to exist and can be examined, a clear, strong,

Glycimeris.

and unobjectionable proof of the class of molluscs, which is external and undeviating in all its characters of the same species. In the numbers of shells we have examined we have never found any of those anomalies existing in the operculum, or those singular freaks of nature which other portions of molluscs frequently exhibit; their characters are simple and uniform. It is constantly attached to the foot of the animal possessing it, at the upper or lower side, closing the aperture of the shell completely, either at its opening, or more or less internally distant from it. Some authors—Adanson of the number—have considered it analogous to one of the valves of a shell, but its position, with regard to the animal's body, decidedly contradicts that opinion: the two valves of a bivalve are placed one on each side of the animal's body, in almost every instance, while in the operculated molluscs, the shell alone, dependent on the mantle, occupies its dorsal side constantly, and the operculum never has any connexion but with the upper or dorsal part of the animal's foot, sometimes at the angle of its junction with the pedicle of the body, rarely at its posterior extremity, and most frequently midway. It is evidently the product of the skin which covers the foot, and is, doubtless, an excretion of horny or calcareous matter, but how a plain surface of an oval or circular shape can produce a matter whose molecules are spirally rolled or laid on a flat surface, often with great regularity, sometimes

forming many turns or evolutions, and constantly alike in number in the different species of molluscs, is a question not easily to be answered with any degree of conclusive satisfaction; we might quote several opinions of high authority, but as they are contradictory, and resting upon the speculation of ingenious theories rather than upon anatomical data, we consider them foreign to our present purpose, which is to point out well-established facts, and not to launch into doubtful ones. The subject is, however, worthy of the naturalist's serious consideration, and we shall be happy to find this suggestion worked upon by those whose leisure will permit them to pursue it; and, in that study, much interesting information may be gleaned from Mr. Gray's publication on the subject, which we will not mutilate by abridgment here. The operculum of shells must not be confounded with a calcareous covering put on under peculiar circumstances by molluscs, to guard their bodies by closing the aperture of their shells, as it totally differs in its formation of parts, substance, and position, with regard to the animal, it is distinguished by the name epiphragm, and is very often seen during the winter on some species of *Helix*. Ninthly, the combined form of the shell, the proportionate length of the spire, and the shape of the opening in univalves, with its direction, and various shaped parts, as in the *Columbella mercatoria*, here figured. In bivalves,



Columbella.

the proportions of the valves on either side, their markings and sculpture, and even their colour, the presence or absence of an epidermis, with any other clearly defined distinction of its whole appearance.

According, therefore, to this rapid detail of the considerations necessary to guide the malacologist in distinguishing the various molluscs, with a view to their scientific classification, the importance their relative characters offer in the different portions of their organisation, and the necessity of examining attentively their shells, to a certain extent, in order to assist by the evidences they furnish of the animal's structure, Conchology, as it has heretofore been termed, is not altogether useless, though it is not by any means indispensable. As, however, an examination of the beautiful armature of the animal may in many cases lead to a more scientific acquaintance with the place it occupies in the scale of creation, the formation of conchological collections should receive every encouragement.

The basis of an arrangement which now embraces both them and their wonder-working architects, must be founded on the general form of the animal's body, the distinction of a more or less well-defined *head*, or of none at all, and the organs of respiration which modifies the shape of the shell, observing, always, that the same configuration of shell sometimes, though rarely, is represented by very distinct genera; this, for example, is exemplified in the *Haliotis*, whose form exists in the pulmobranchiata, in the cismobranchiata, and in the otidea, is the same with the patelloid, turriculated, and other forms. These are the principles that have guided Cuvier, Lamarck, and their disciples in the classification of molluscs, and formed that system which is now universally adopted by naturalists of the present day, or at least such of them as have kept pace with the extended knowledge of the age we live in, and the surprising facility given by accurate, elegant, and cheap publications in every branch of it. Before we proceed to give some outline of this system of malacology, we will shortly state some of those principles by which the distinction of species may be facilitated—a part of the science by far the most difficult in all the types of animal creation, but particularly that under present consideration, arising greatly from the circumstance of the shell having been made the only guide for their distinctive separations or divisions, and the determination of making them contribute to the cause, without overturning altogether the Linnæan school, in so far as its principles could consistently be adopted, and made conformable to the far different view now taken of this subject.

In the construction of a system, the great master, Cuvier, has distinctly laid down some general rules, to which it will be well always to attend, though they are not always applicable; in objects like the present, our knowledge does not extend far enough to pronounce without doubt on the singular structure and less known habits of molluscs, we must therefore approximate the species carefully and consistently, according to the most obvious external organisation in relation to the habits of the animal; should these agree, one principal step is gained in forming a genus; and the smaller differences form an after-consideration, and establish the basis of consistent sub-divisions.

Cuvier says, "That the formation of systems is the object of natural history, properly so called. Anatomy receives them as it were ready made. The latter takes its first direction from the former; but it is not slow in reflecting back the light it has received. By applying a system of natural history to comparative anatomy, we are speedily enabled to discover whether it deviates from the path of nature. The object of every good method is to reduce a science to its simplest terms, by reducing the propositions to the greatest degree of generality of which they are susceptible. A good method must, therefore, be such as will enable us to assign to each of its subdivisions some qualities common to the greater portion of the organs. This object is to be attained by two different means, which may serve to prove or verify each other; and that to which all men will naturally have recourse, is to proceed from the observation of species, to unite them in genera, and to collecting these in a superior order, according as they find themselves conducted to that classification by an examination of the whole of their attributes. The second, and that which the greater part of modern naturalists have employed is, in the first instance, to fix upon certain basis of division, agreeably to which, beings, when observed, are arranged in their proper places. The first mode cannot mislead us; but it is only applicable to those beings of which we possess a perfect knowledge; the second is more generally practised, but it is subject to error. *When the bases that have been adopted remain consistent with the combinations which observation discovers, and when the same foundations are again pointed out by the results deduced from observation, the*

two means are then in unison, and we may be certain that the method is good.' "

We will proceed to explain shortly the system we have now adopted as our guide in malacology, and it will be necessary to point out some general principles to assist in discovering the distinctions of species, the most difficult part of all the branches of natural science, but most particularly in this above the others on account of the shell having so long been considered the only guide for the distinction of species; and as before remarked, the indications given by the structure of the shell must supply the information we want, where the anatomy of the animal is totally unknown, as for instance the *Aspergillum*, here figured, is classed as following its congeners, the *Gastrochæna*, *Clavagella*, and others of the family *Pyloridea*, from characters common to all of them; though it is difficult to assign any reason or use for the perforated holes in the disc of its lower end, without they are to give a passage to the fibrous muscles of the animal's foot, in the character of a byssus, by means of which the animal affixes itself to submarine bodies, in a situation more or less vertical, the smaller extremity of its tube above, and the head of the animal downwards; this is at present merely conjectural, the animal not being known. The species of any one series of animals cannot correctly be determined without taking into consideration the anatomical structure of the apparatus of generation, and particularly its accessory parts, although a strict coincidence may exist or not in the other parts of organic structure. These latter are not always so essential from the dubious circumstance that they are frequently only observable in such parts as cannot be called organs possessing an use, but no functions such as shells. This principle may be rigorously applied to mollusca, since all the true species that physiologists have examined in a very large and numerous genus, the *Helices*, for example, there has always existed some important difference in the generative organs of course much more marked in the separate sexes, as is evident also in the *Murex*, *Buccinum*, &c.; those distinctions are additionally defined by the size of the shell, which, in the females, is always of a greater capacity than that of the males.

Aspergillum.

Adanson, who has devoted much time to the study of molluscous animals, assures us that even other parts of the animal, such as the lobes, and the appendages of the mantle, vary considerably with age, the period of the year, and consequently the shell also, whose differences are not confined to the colour, its being smooth or rugged; its thickness, its size, the development of its various bands or tubercles; but that they extend likewise to the form of the opening, and the proportion of other parts. If, therefore, the sex or age present an evident influence in determining the distinctions of molluscous animals, and consequently their shells, it is not less evident that in appreciable circumstances may influence, in a smaller degree, the animal; and in a larger degree, the shell, whose colour, proportions of size, and different parts, vary remarkably in different examples of the same species. This may be observed in the *Helix nemoralis*, *Lymœa stagnalis*, and others we have an easy opportunity of examining in confirmation of this fact. By a parity of reasoning, we may readily imagine, that a variety of circumstances, to a certain point appreciable, such as climate and locality, have decidedly influenced for a series of time, and almost as it were upon fixed principles, the succession of individuals of the same species, in their size, colour, &c., and even in the form of their opening, and the peculiar characters of their superficies, compared with others precisely of the same genus, living for centuries in an opposite locality. This may be termed the geographical distribution of species, very marked certainly in many instances, but, in truth, not really affecting a scientific arrangement; for it invariably happens, that when these varieties are assembled, we find them range insensibly with each other, and thus form but one family. This is exhibited in the *Ceritheum*, whose species differ so greatly in their external form, but all possess the same generic characters of structure. A most interesting but difficult scheme might be formed of these insensible gradations in every reign of natural history, proving indubitably the unity of general purpose, exhibited in them all, according to their peculiar duties and stations in the scale of animated nature.

Ceritheum.

A minute examination of living molluscs is also indispensable to the geologist, as it mainly guides his conclusions in furnishing a good natural guide in resolving the problem of the analogous strata of secondary and tertiary formations. The connexion between molluscs and the geological structure of the earth is extremely manifest and highly important, for without seeking to ascertain here the difficult fact, whether shells have borrowed from inorganic matter their bases, or, as we think, contributed to effect the marvellous changes produced on the surface of the globe by their decomposition and masses in various stages of existence; one thing is quite clear, that the manner in which these deposits are made, differs essentially in various places, and under various circumstances, according principally to the habitat of molluscs; whether beneath the sand, or mud, or free in the bosom of the deep; thus, the oyster in all countries forms beds and banks of various extent and thickness, horizontally placed, in which at this moment they remain precisely similar to the position they occupied in former ages, and almost without any other admixture of different bodies; this fact is less evident in many other of the mollusca; but all the genera of molluscs living in the sand or mud, vertically placed, must of necessity form beds of their spoils, since the increase of number is made by a deposit of the newly-born *above* the parents, who in course of time become buried by their own offspring, and,

by rendering the distance between them and their source of food too great to be reached by the limited extent of their organs, are thus starved to death, these shells, which were when living *vertically* placed, assume gradually an inclined position by the superincumbent weight and the undulating action of the water, are filled with sand or any other matter in which they lived, forming those vast beds of fossil shells which are everywhere existing in the earth's formation, unbroken and even preserving all their delicate characters. Other molluscs, whose motions while living are unconfined by any thing but local convenience or other circumstances inducing them to remain within a limited range of locomotion, are not ever buried in the sands permanently; and their shells after the animal's death, becoming the sport of the winds and waves, are indiscriminately rolled from one spot to another, or broken against the rocks and corals of a submarine world, until they are reduced to molecular portions, in their turn assisting in forming new strata, in which the law of specific gravity is manifest, the heavier portions forming the most dense beds, the lighter being uppermost; thus keeping up that compensating plan of infinite wisdom, which has established that all things created shall for a time perform their several functions of creation, then pass away, yet continue under other forms, to be necessary to succeeding generations, each of their kind whether animal, mineral, or vegetable.

We shall not, perhaps, be deemed visionary in saying, that it is by these beds, these deposits of calcareous matter, which in a long series of years, and the continual pressure of others above them, combined with the tendency of inorganic molicules, to solidify, and even crystallise, that many rocks have been formed, which now present no trace of their ancient organic structure. On this subject we promise our readers some interesting information, under the article POLYPUS, in which the coral formations will be described, and found strictly illustrative of our present geological view of the earth's formation, neither must the sceptical advance an opinion of the impossibility of such being the fact by the limited number of molluscs we know of, since they form but a trifling portion of those we know nothing about, or have only seen a few of, amidst the countless myriads with which the depths of ocean teem, whose spoils of former races have accumulated slowly but surely during the lapse of ages, beyond the power of man to calculate with certainty. Molluscs exist, and ever have existed, in all portions of the globe, no part of it being without its tenants, whether on the surface or beneath its elements,

> Where the pool
> Stands mantled o'er with green, invisible
> Amid the floating verdure, millions stray;
> Each liquid too, whether it pierces, soothes,
> Inflames, refreshes, or exalts the taste,
> With various forms abounds. Nor is the stream
> Of purest crystal, nor the lucid air,
> (Though one transparent vacancy it seems,)
> Void of its unseen people.
> Let no presuming impious railer tax,
> Creative wisdom, as if aught was formed
> In vain, or not for admirable ends.
> Shall little haughty Ignorance pronounce
> His works unwise, of which the smallest part
> Exceeds the narrow vision of her mind.

Their numbers consequently depending upon the range of locality; and though we should feel disposed to assert that species of the same family are probably to be found in almost every climate—such as the *Sepia* and its congeners—they certainly are far more numerous in some countries than others, being naturally influenced like every other animal by those circumstances most conducive to its development, growth, and life.

As our knowledge of this interesting class of animal existence becomes daily more and more unfolded, we have in the same proportion increased cause to adore the inscrutable wisdom which has dictated their formation, and given to them important functions, all tending ultimately to benefit mankind, and acting unseen in their operations, beyond such as must be ascribed to them in common with creatures more elevated, but not more useful, in the scale of nature. We have slightly digressed from the plan we had proposed; but the animal and its testaceous covering being so intimately united in our point of view, we could not pass over the one without mentioning the other. We said that the true principles of malacology might be best founded upon a certain organic structure, but in this as in every other part of systematic arrangement, the task must rest with experienced zoologists, and very properly so, as systems are intended for masters, more than disciples, as *a whole*, though indispensable to the latter as an authority and instruction, in matters where knowledge can only be derived from such sources, generally unaccompanied by an opportunity of judging their correctness beyond a very confined portion of the subject. There is another well defined character upon which the French naturalists particularly have founded their system of malacology, it is more easily examined, and presents the most satisfactory conclusions with regard to the present possibility of classing the naked with the clothed mollusca, under one general distribution of classification. It is the *Respiratory Organs* of molluscs; from which the denominations of the different orders derive their names. in the system we have adopted, as the most natural and most complete yet formed, harmonizing too with the characteristic structure of the shell wherever it exists. As it is obviously necessary that a work like the British Cyclopædia must be based upon some generally acknowledged system, as applicable to the different branches of natural history it explains, we have determined upon that which is universally now followed by writers on malacology, having found their judgment fully corroborated by our own experience; and though as we have and shall continue to point out anything not strictly correct, or any new ideas that subsequent information and daily discoveries enable us to mention; it is taken altogether, as perfect in its principles, and as good in its classification as it can well be, for no system can be quite so, or indeed ever complete; the very nature of our inquiries leading to new results, and carrying on those of other persons to a far greater extent than they had observed or had mentioned. The late eminent Dr. Woollaston once told the author of this article that steam, and the application of its powers to mechanical purposes, was but in its infancy, and mighty as its operations now are, they give promise of becoming yet more prodigious. So with regard to the application of science to the development of nature's powers, we are but in our infancy; and all that the united wisdom of man has yet effected, does not amount to a calculable portion of the infinite wisdom displayed in the smallest mechanism of nature, we can only go on, sifting, sorting, and selecting, by actual investigation, and close analogous reasoning, approximating

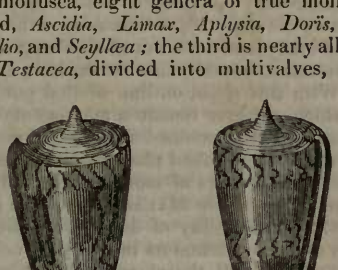
as it were all things living to something like a given scale of structure; but the mystery of mysteries cannot, ought not to be discovered, for if it could, man would cease to be what he is, and become coequal with his Divine Creator.

We will here take an opportunity of remarking that we do not affect to be able to throw many new lights upon this science, being ourselves but students, and the result of many years study of this branch of Natural History has only tended to render us more modest of our own abilities—more humble in suggesting an opinion sometimes adverse to that of our fellow-labourers in the same field, but, nevertheless, we feel it our duty to take advantage of their discoveries, and, by actual examination or analogous reasoning on our part, to verify the truth or point out the inaccuracies that have existed; indeed, were this not done, mankind would remain stationary in their knowledge, and the mind unexercised, would sink into a sickly state of apathetic feeling, inconsistent with its nature, disgraceful to its attributes in a higher order of enjoyment, that of looking up with reverential awe to God the author of all, confessing with humility that there is "good in every thing." In the different articles of malacology, under their alphabetical order, we have pointed out any discrepancies that our experience enabled us to verify, but we trust we have done so without that acrimony which unhappily but too frequently tinctures a difference of scientific opinion; and we honestly assert that, in so doing, it has not been from a spirit of self-conceit, or a wish to erect ourselves into censors of other men's understandings, but with a view of diffusing encouragement—a spirit of emulation, as far as in us lies, to the study of Natural History—smoothing the difficult path that leads to an acquirement of its principles—thus rendering it not only more in accordance with nature's laws, but more inviting to nature's admirers by its simplicity. Entertaining, too, a firmly-rooted conviction of its utility in promoting the great end of Christianity, and of its affording a never-ceasing source of worldly gratification, perfectly compatible with every man's more important duties of life in the relative stations of society. We have, indeed, in our times witnessed melancholy examples of miscalled philosophers, whose writings exhibit extraordinary proofs of mental powers, and the no less moral perversion of them: such are happily rare, and a certain antidote to the poison of infidelity can be always readily found by those who truly seek it:

> "Each shell, each crawling insect, holds a rank,
> Important in the plan of Him who framed
> This scale of beings,—holds a rank, which lost,
> Would break the chain, and leave behind a gap
> Which nature's self would rue."—*Lepidoptera Britannica.*

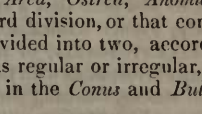
Having in our article Conchology promised to give some account of the system of Linnæus, compared with that now more generally, not to say universally, adopted, we cannot do otherwise than redeem our pledge, without however occupying our pages in the present place with an uninteresting detail of classes, orders, genera, and species, much better exhibited in a tabular point of view. It is also to be remarked that in every article relative to malacology, we have invariably mentioned the grounds upon which the Linnæan school must be abandoned in modern classification. We shall now, therefore, but very briefly state, that Linnæus, having formed his system of conchology upon the forms of the shells with which the mollusca are most of them covered, without reference to the animals themselves, but very few molluscs, properly so called, of our time, were either examined or described by him. During the first nine editions of the works of Linnæus, he has not once mentioned molluscs, the animals now so designated being distributed, the naked species in his order *Zoophytes*, class *Vermes*, or worms, and such as were clothed with a shell, for the third order of the same class, under the denomination of *Testaceæ*. In the first he only distinguished the genera *Tethys*, with that he classed the *Holothuriæ*, *Limax*, and *Sepia*, which he placed close to the *Hydra*. In the second, which was not even at that time divided into univalves and bivalves, he characterised the genera *Patella*, *Cochlea*, in which where included all the turbinated univalve shells. *Cypræa*, *Haliotis*, and *Nautilus*, for all such as he afterwards called univalves, and under the name name of *Concha* he comprehended all the bivalves. He, nevertheless, also classed among his *Testaceæ* the *Ascideæ*, under the name of *Microcosmus*.

In the tenth edition of Linnæus, some augmentations were made, but the last during his life, the twelfth edition, the class *Vermes* are divided into five sections, in the second of which, under the denomination of mollusca, eight genera of true molluscs are described, *Ascidia*, *Limax*, *Aplysia*, *Doris*, *Tethys*, *Sepia*, *Clio*, and *Scyllæa*; the third is nearly all devoted to the *Testacea*, divided into multivalves, bivalves,



Conus generalis.

and univalves,—the first containing *Chiton*, *Lepas*, and *Pholas*; the second comprised fourteen—*Mya*, *Solen*, *Tellina*, *Cardium*, *Mactra*, *Donax*, *Venus*, *Spondylus*, *Chama*, *Arca*, *Ostrea*, *Anomia*, *Mytilus*, and *Pinna*; the third division, or that comprising the univalves, is subdivided into two, according as the spire of the shell was regular or irregular, acute or obtuse, as here figured in the *Conus* and *Bulla*. The genera



Bulla.

included were, *Argonauta*, *Nautilus*, *Conus*, *Cypræa*, *Bulla*, *Voluta*, *Buccinum*, *Strombus*, *Murex*, *Trochus*, *Turbo*, *Helix*, *Nerita*, *Haliotis*, *Patella*, and, by a remarkable singularity, the genus *Teredo*.

In characterising these genera, Linnæus merely al-

luded to some analogous naked molluscs, to which he imagined the shell must have belonged. If the more philosophical arrangement suggested by Adanson, with which he must have been acquainted, had any influence upon the changes this edition proves him to have made, it was but to a small extent, and that principally in the greater number of genera of shells, and a better description of the affinities of species; but the animal portion benefited but little, for we see among his mollusca the *Aphrodites*, *Terebellæ*, and the *Lernæa*, which are *articulated* animals, associated with the *Holothuria*, *Asteria*, and *Echinæ*, which are *radiated* animals. In the classification of his genera of *Testaceæ*, the anomalies are far more numerous; we will not recapitulate them, as they will be found in the alphabetical distribution of this work. In short, every thing tends to prove that Linnæus was not properly impressed with a knowledge of the mollusca, or only deemed them an object of secondary consideration. With regard to conchology, Linnæus has created a nomenclature remarkable for its general accuracy and perspicuity; but, as we have had occasion to remark, in common with some of his greatest admirers, a language sometimes disgracefully offensive to modesty, and not to be sanctioned at any period in civilised society. It will be observed that the system of Linnæus has been as much assimilated as possible to malacology; his genera constantly preserved, though more naturally approximated, and the names of species, in many instances, not at all changed, though in this instance considerable reformation has taken place. With this slight outline of that portion of a system which will ever remain a monument of human industry and talent, combined with a rapid view of the changes which have taken place by the indefatigable researches and writings of more modern authors, we take leave of the article MALACOLOGY, once more repeating the impossibility of doing full justice to the subject or to its commentators in the space necessarily assigned us; we will, therefore, only take credit for having endeavoured to condense within our limits all that appears instructive, and, more particularly, indispensable to the student than to the scientific master, who, having already overcome the first difficulties, creates others for himself, resulting from the new light his understanding has received. Thus, no boundary can be fixed to knowledge: it were easier to circumscribe the current of the winds and tides than check its outspread: all that can be done is to turn it to useful purposes and a wise end.

It may be well to add here that a subtype has also been formed by the French naturalists, and called by De Blainville MALENTOZOARIA, or articulated molluscs. This group corresponds with the Linnæan system of multivalve worms, omitting the genera *Pholas* and *Teredo*, which are LAMELLIBRANCHIA. It contains two well distinguished classes, whose species are inhabitants of the seas of all countries, either fixed to submarine bodies, or possessing a free range. The first of these classes has evidently a considerable resemblance to the bivalve molluscs, as far as regards its calcareous envelope, in which, by examination, portions may be found analogous to those of the *Pholas*, and even to the tubular portions of other genera, which circumstance probably induced Linnæus to class that genera with those, as well as from the position of the head being downwards. There are also some resemblances, not to call them affinities, with the *Entomozoaria*, in consequence of their possessing *horny-articulated* locomotive appendages, generally branchial at their base, becoming, towards the mouth, true denticulated corneous jaws, upon which account they have been placed in this subtype as an intermediate passage to, or connecting link with, the *Entomozoaria*. The second class of this subtype has an evident connection, in many respects, with the *Cephalopods*; in fact, the animals possess the power of ranging freely and of climbing like them, and although no apparatus of special sensation has been discovered, the general configuration of their bodies is extremely analogous to that of the *Phyllidiæ*, as there is, for example, a masticatory process, not very dissimilar to the *Patella*; but the most important difference may be remarked in the articulated disposition of the back of the protecting shell, and of the bundles or tufts of hair-like bristles; these, however, are each of them tubular, and doubtless acted upon by distinct muscles, as feelers or weapons of defence: the median termination of the intestinal canal resembles the animals of some of the *Chetopods* of the *Entomozoaria*, and, among others, the *Aphrodites*. Thus, it may be said, that the passage from the *Malacazoaria* to the *Entomozoaria* is effected in two series from the *Acephalophora* to the *Heteropods* by means of the *Nematopods*, and the cephalous molluscs to the *Chetopods* by the *Chiton*, so that the two classes united in this subtype of molluscs are necessarily very different in themselves, but essentially conducive to illustrate the chain of natural gradation from this division to the next immediate one of nature, according to the position they now hold in the scale of creation. In the first class of the subtype, the first is that of NEMATOPODA, Cuvier, and Lamarck's CIRRHIPODA; it includes, first family,

Conia radiata.

Lepidacea, second family *Balanidea*, of which the *Conia radiata*, here figured, is an example. Second class POLYPLAXIPHORA, contains the genus *Chiton*—Lamarck's *Oscabrella* and *Chitonellus*.

MALACOPTERYGII—jointed fins. The second section into which Cuvier divides the true fishes, and which consists of three orders, the principal distinction of which is the arrangement of the ventral fins. The grand character of the division is that of having the rays of the fins jointed or composed of several pieces. Those fishes are very numerous, and comprise some of the most valuable genera, both of the fresh waters and of the sea. A list of them would be uninteresting as well as long; and therefore we must refer to them generally in their alphabetical order.

MALACOSTRACA (Leach). One of the primary divisions of *Crustacea*, having the shell or carapax of a hard calcareous nature, and comprising the crabs, lobsters, &c., forming the first subsection *Podopthalma*, with the eyes on foot-stalks; and the wood-lice, &c. (*Isopoda*, *Amphipoda*, &c.,) forming the second subsection *Edriophthalma*, having the eyes sessile. See CRUSTACEA.

MALAY APPLE is the *Eugenia Malaccensis* of

Linnæns, a fine ornamental tropical fruit-tree, cultivated in its native country. The flowers are icosandrious and the plant associates with the *Myrtaceæ*.

MALCOMIA (R. Brown), a genus of annuals, several of them very pretty ornaments of the flower garden. They belong to *Cruciferæ*, and one species has been long known as the Virginia-stock seeds.

MALENTOZOARIA.—See MALACOLOGY, of which it forms the subtype.

MALLOW is the *Malva* of botanical authors; a genus of plants found in every quarter of the globe. The European species are mostly annuals. The South American are for the most part under shrubs; and the African, especially those found at the Cape of Good Hope, are evergreen shrubs. They are all easily increased.

MALPIGHIACEÆ. A natural order, containing above thirteen genera, and nearly four score species. They are all tropical, and consequently are kept in our stoves in light loamy soil, and propagated by cuttings.

The genera included in this type, are small trees or shrubs, with apposite or alternate leaves, in general with stipules, and without dots or punctures. The inflorescence is axillary or terminal, solitary or aggregate, often racemose, the pedicles having bractes, and sometimes articulated, and the flowers regular and united.

The calyx five-sepaled, slightly connected by their claws, often glandular and persistent. Corolla is of five petals, which are free and inserted below the germen. The stamens are definite, seldom less than ten; the filaments free or connate; the anthers erect, roundish, two-celled, and opening lengthwise by chinks. The germen is formed of three united carpels, one or several celled; ovules solitary or pendulous, the styles distinct or connate, and the stigma headed. The fruit is succulent or dry, three or one lobed and celled, the seeds solitary, with or without albumen.

Of the uses or properties of these plants, there is very little known; several have fragrant flowers, and the bark of some is bitter and astringent. The fruit of the Malpighia is eatable, and commonly known as the Barbadoes cherry. That of *M. glabra* is esteemed in the British West Indies and on the American continent. *M. saccharina* is the sugar plum of Sierra Leone, and is brought in great quantities to the market in Freetown; and *M. punicifolia*, the bark of which is astringent, and the fruit when preserved delicious, yields a gum resembling gum-arabic. *M. urens*, *setosa*, and several other species, have leaves thickly armed with stinging hairs, like those of the *Macuna pruriens*, its fruit is insipid, but the bark is astringent.

The order contains the following genera:—Tribe 1. *Malpighia*, *Byrsonima*, *Bunchosia*, and *Galphimia*. Tribe 2. *Gærtnera*, *Thryallis*, and *Asicarpa*. Tribe 3. *Hiræa*, *Triopteris*, *Tetrapteris*, *Bannisteria*, *Heteropteris*, and *Vittmannia*.

MALTHINUS (Latreille). A genus of coleopterous insects, belonging to the family of *Telephoridæ*, and distinguished by having the elytra shorter than the abdomen, and consequently not covering the wings when folded; the last joint of the palpi is ovoid. These are small active beetles frequenting flowers, and often of a pale colour, with yellow tips to the elytra. There are about a score British species.

MALVACEÆ. A natural order containing twenty-two genera, and above three hundred and ninety-one species. Some of the most splendid flowering plants belong to this order, as the *Althæas*, the *Sidas*, and the *Hibiscuses*. Many are esculent and nutritive, and almost all are innocuous. The *Gossypium* which furnishes the cotton wool of commerce is found in this order, and many are medicinal as well as dietetic. They are herbs, shrubs, or trees, with alternate simple leaves, petiolate, stipulate, and for the most part covered with stellate down. The inflorescence is axillary or aggregate, and the flowers regular and united. The calyx is five-sepaled, supported by larger or smaller bractes; a torus surrounds the base of the germen, and bears both the petals and stamens. The petals are equal in number with the sepals, and are exserted alternately with them. The stamens are indefinite, filaments monadelphous, and the anthers one celled, kidney-shaped, and burst transversely. The germen is formed of several carpels set round the axes of the flower, more or less distinct, and one or many seeded. Styles equal in number to the carpels, distinct or united, and the stigmata variable.

Botanists arrange this order in two divisions. The first has the calyx double, and contains, *Malope*, *Malva*, *Nuttallia*, *Ketaibelia*, *Althæa*, *Lavatera*, *Malachra*, *Urena*, *Pavonia*, *Malva viscus*, *Lebretonia*, *Hibiscus*, *Thespesia*, *Gossypium*, *Redoutea*, and *Lopimia*. The second division has the calyx simple, and comprises, *Palavia*, *Cristaria*, *Anoda*, *Periptera*, *Sida*, and *Lagunea*.

MAMMALIA, (animals which suckle their young with milk, furnished by the *mammæ*, or teats, of the females). These constitute the most characteristic order in the animal kingdom, and have the system of sensation most perfectly developed. In common language they are termed quadrupeds, or four-footed animals, but this term is not correct, inasmuch as all birds, and many reptiles and fishes, have four extremities, analogous to those of the mammalia, though differing from them in various particulars, according to the modes of their action and the elements in which they live. Linnæus was the first who applied the name mammalia as a general expression for them; and no name could have been more happily applied, inasmuch as it is common to the whole, and can be applied to no other animals whatever. It was long thought that the ornithorhynchus of New Holland, which has the mouth formed like the mandibles of a duck, and a single opening to the body as in birds, formed an exception to this general law; but more careful observation has shown that this animal suckles its young with milk, as well as the more characteristic mammalia.

All the mammalia have a double heart, with two ventricles for propelling the blood, on esystematic or propelling it over the whole body, and the other pulmonic, or sending it to the lungs; and they have also two auricles as appendages to the heart, one for receiving the blood from the lungs and transmitting it to the systematic ventricle, and the other for receiving the blood from the system generally, and transmitting it to the pulmonic ventricle. The blood of all is red and warm, but differs in its temperature in different species. It is aerated wholly in the lungs, and not partially by air cells or the coats of the arteries as in birds, and it is more minutely distributed over the system than in any other class of animals. They have also the nervous system, upon which, as we usually suppose, sensation and animal intelligence more immediately depend, much more developed than any other animals; and therefore, though there are great

differences among them, they are, taken altogether, much more intelligent, docile, and capable of training, than any of the other animals.

They are also the animals which are most useful to man; and, if the expression may be allowed, they are most kindred to him. They bear a part with him in his labour, their flesh supplies him with his best food, and their covering furnishes him with his warmest and most wholesome clothing. They also show attachments to man which are not shown by any other animals; and many of them have their affection unshaken by even very severe chastisement.

Mammalia are also more easily studied than any of the other classes of animals. They, generally speaking, are, like ourselves, inhabitants of the surface of the earth; for though a few live habitually in the water, a few others under ground, and a few others still make their way through the air by means of flying membranes, yet the characteristic locality of the whole mammalia is the surface of the ground. Generally speaking, too, they do not retreat into holes and hiding places, as is the case with most ground animals of other orders; they come out openly, and in the majority of instances, to the day, so that their manners are much more easily studied than those of any other animals.

The mammalia have accordingly attracted the attention of mankind in all ages. We find some of the most beautiful allusions to their habits in the writings of the prophets and poets of the Jews, which leave not the least doubt that, whether they had a regular system of the natural history of mammalia or not, they were well acquainted with the nature of the animals.

That the Greeks and Romans, and other civilised nations of antiquity, paid great attention to this department of nature there is no reason to doubt, though the fragments of their science which have been handed down to us are very imperfect, and in many instances ridiculous. We must not, however, blame them altogether for this; for the greater number of their works are lost, and of the few that remain the major part have been vitiated by the ignorance of transcribers. It was somewhat unfortunate for the science of the ancients that their language was an object of study in the middle ages, and at the first revival of learning, when the world was destitute of anything worthy the name of science. The consequence has been, that transcribers have greatly vitiated the works of the ancients, and they have vitiated none more than the works on natural history; for they have in many instances so blended together the fanciful allegory of the poet and the true story of the philosopher, that they have turned the whole into something approaching to the ridiculous. Notwithstanding the great learning, and the pure and commendable spirit with which the Sacred Volume was rendered into English, in which form it has probably communicated more real knowledge to the people of this country than all the other volumes that ever were written, it is to be feared that there was a sad deficiency on the subject of natural history, and that many of the animals as well as the plants which are called by names familiar to us, are not the same species which we call by those names. These, however, are matters which, though they must be regretted, cannot be repaired.

Among the ancients, the name of Apuleius stands high as an investigator of the animal kingdom, and of the mammalia in particular; and it is reported of him, that he not only encouraged others to bring to him animals of all kinds, in order that he might study their structure, but that he himself made many long journeys for the same purpose. These works are lost, however, as are those of most of the earlier students of nature; and this is much to be regretted, because it is possible that some of those races of mammalia which are now extinct, and found only monumental in the dust, may have been living at the time when those ancients composed their treatises. Of the ancients whose labours are partially known to us, the foremost in respect to the mammalia are Aristotle the Greek and Pliny the Roman; the former a most acute thinker and original inquirer, and the second a very laborious but credulous compiler. When we think of the labours of Aristotle in the field of nature, we cannot help associating with his name that of Alexander of Macedon, who perhaps more truly deserves the name of "great" than any conqueror that ever drew sword. Trained under the Stagyrite, and deeply imbued with that love of knowledge and of nature, and that high tone of feeling which such a tutor was calculated to inspire, the Macedonian hero always sought to benefit as well as to conquer; and though other things are said of him, it is true that he lost his life by a marsh fever, when occupied in a careful investigation as to how the fens in the neighbourhood of Babylon might be drained, and the navigation of the Euphrates improved, so as to admit vessels of burden to his favourite city.

When, on the death of Philip, Alexander set out on his grand Asiatic expedition, his philosophic tutor declined the hardships of a camp, and preferred the philosophic ease of a residence at Athens. But under these circumstances the pupil and the preceptor did not forget each other; for there perhaps never was monarch so zealous in promoting science as Alexander. He employed, at an enormous expense, and in all parts of the world over which his sway or his influence extended, many thousands of persons, for the purpose of collecting animals and transmitting them to Aristotle, in order that that eminent philosopher might render his account of the living world as complete as possible. Every one knows of the severe penalty under which Alexander forbade his army to kill or even disturb the peacocks of India; and it is also pretty well known that our first tolerable account of the animals of that most abounding land was attained by him and his followers.

There is in the popular mind a strong prejudice against Aristotle; and in so far as his philosophy of the mind was concerned, this prejudice is well founded. But we must not blame Aristotle for this, we must blame those who blindly followed him when he ought not to have been followed, and made his philosophy occupy a place which, in the nature of things, it could not with justice occupy. Without revelation there could have been no proper system of intellectual philosophy, because the nature and the existence of mind are revealed truths; and therefore to set up Aristotle in Christian colleges was exactly the same kind of absurdity as it would be to set up the idols of the Greeks in Christian churches. But these matters have nothing to do with Aristotle as an observer and describer of nature; and in so far as these are concerned, to us unquestionably he is the father of the science, and as such entitled to our warmest gratitude. There is every reason to believe that as

they now appear, the works of Aristotle are really vitiated; because, while in one place they display the most cautious and scrutinising philosophy, where, to a less powerful mind, there might have been the most ample scope for romance, they in other places display abundant romance and absurdity upon subjects where it would not have required the genius of an Aristotle to see the truth. It is pretty evident, however, that the present order of his writings is not the original one in which they were given; and there is reason to suspect that many spurious passages have been interpolated both by ignorant and by designing transcribers, and also that much of the sterling matter has been lost in the course of time. These evils are no doubt much increased by the circumstance of Aristotle not being really the author of these works which have been handed down to us under his name. He was too much occupied in study for being an author; and thus he himself committed but little to writing; and accordingly, the works which bear his name were compiled after his death; in addition to which, they were subsequently mangled by a host of commentators.

Under all these disadvantages we must view the labours of this illustrious expounder of nature; and even then all that has come down to us is a mere fragment. He is understood to have composed fifty volumes or books on the history of animated nature; but of these only nine have been preserved. He lays down in his writings certain points of difference and resemblance observable among different animals, and then notices historically, and in detail, their general relations and characters. The sensible characters he deduces from the size, colour, and other external characteristics of the animal; from the number and position of its members, their dimensions, movements, and forms, with their comparative analogies or discrepancies; and illustrates his statements by numerous examples. His remarks also on their modes of life, their general economy, and various functions, seem to have been the result of the most accurate observation; and some of his positions which we once considered either fabulous or erroneous, have, on mature investigation, been found to be in perfect accordance with the phenomena of nature. He is believed to have been engaged in the dissection of animals, either with his own hands or by an assistant; and when the versatility of his talent, his unwearied diligence and research in acquiring an intimate knowledge of his subject in whole and in detail, is taken into account, it is not to be wondered at that many of his observations should stand the test of the strictest scrutiny, and that the student of natural history should still approach with reverence the relics of a system of which this great man may be said to have been the founder.

In point of eminence among the ancients, Pliny stands next to Aristotle; but he was a genius of very different character; for if Aristotle may be styled the father of inquiring and scrutinising naturalists, Pliny equally deserves the name of the father of compilers; and upon every branch of knowledge connected with nature, we are indebted to Pliny for a vast number of valuable observations, which otherwise would have been lost, so that one knows not whether most to admire the original acumen of Aristotle, or the second-hand laboriousness of Pliny. The variety and extent of his information is proved by the numerous host of authors whom he quotes; and he himself tells us that his materials were extracted from two thousand volumes, which circumstance gives one some idea of the extent of his reading. The preface or dedication of his celebrated work addressed to Vespasian, though not altogether devoid of pedantry and conceit, exhibits every internal symptom of genuineness; but the first book, which consists of little else than a table of contents and authorities, is of a great deal more questionable authenticity. In one point of view the work may be considered as perfectly methodical. It begins with a general survey of the universe, embraces a geographical account of the terraqueous globe, of the history of man, of aquatic and terrestrial animals, of vegetables and minerals, of medicine and the arts, together with a vast variety of collateral and incidental subjects; and the entire production, even in some of its less interesting parts, is interspersed with anecdotes and philosophical reflections of at least a very pleasing character. It is true that large portions of the work can be considered only as compilations from the productions of others; but its general arrangement, as well as some of the details, together with its bold and nervous style, stamp the performance with an originality and dignity of execution. The style, however cannot be said to be either so pure or correct as it is bold and nervous. There is a striking combination of scepticism and credulity manifested on some occasions; but the marvellous stories recited by the author are generally founded on the testimonies of others; while those matters which have come within the scope of his own personal observation, are faithfully described, and there does not seem to be the least intention on his part to lead the reader astray. Some of Pliny's assertions also, which were formerly viewed as fabulous, have been corroborated by more recent observation and experience.

Oppian, in his poem of Cynegeticon, describes the manners, dispositions, and economy of many of the quadrupeds, which he introduces in lively colours; and though the nature of his work does not admit of anything like systematic observance of order in their classification, he shows an intimate acquaintance with the principle on which this ought to be based. He generally rejects those stories which are tinctured with the marvellous, though a poet of a fanciful imagination.

Ælian wrote a treatise "On the Nature of Animals," consisting of seventeen books; but it is totally destitute of arrangement, and outrages every principle even of nomenclature and truth of description. Indeed, the only subject the writer seems to have had in view is, to exhibit the manners of animals with relation more or less aimed at the moral qualities of mankind; and with a few undeniable facts he mixes up a variety of fictitious matter. He however, takes care generally to quote the authority on which he gives these fictions; and is at some pains to impress upon the reader his own want of faith in them.

In the dark ages which followed the downfal of the Roman empire, and buried the human mind for a long time in the very depths of superstition, natural history was as much neglected as any other of the sciences. Among the most celebrated of its restorers, it would be injustice to pass over the name of Conrad Gesner, whom the celebrated Boerhaave styles "a monster of erudition;" naturally feeble in body, and rendered still more so by his experiments, the life of this illus-

trious man must have been a life of pain and sorrow. It was also a comparatively brief one, for he died, in the forty-ninth year of his age, a victim to the plague. But notwithstanding the painfulness and the brevity of his life, Conrad Gesner was one of the most extraordinary men whom the annals of the race contains; and what he did under severe bodily sufferings and pecuniary privations, may serve to put to shame hundreds of pretended philosophers who dwell at ease, live in plenty, and repay the advantages which they enjoy by doing nothing. The feeble body of Gesner did not prevent him from exploring the Alps; and though he was often obliged to write for his bread, he contrived to establish and support a botanical garden, and in addition to this, he was the first who established a regular museum of natural history. He contrived to collect a most valuable library, and amid all his difficulties to keep employed a painter and engraver to record his own personal discoveries. He may, in fact, be said to be the modern father of natural science; for it was under him that natural history, degraded as it had been during the middle ages, rose to the rank of a department in philosophy. The works of Gesner are exceedingly voluminous, and would astonish many of the small authors of modern times, who deem the production of two or three little volumes an effort. Among the rest of his works there are four folio volumes on the history of animals, compilations in great part, but combined with a commentary, which shows that Gesner had made himself master of all that had been handed down from earlier times upon the subject; and though his accounts are in many instances blended with fable, they are always amusing, and generally speaking instructive.

Gesner had a contemporary every way worthy of him in Aldrovando, who was Professor of Botany in the University of Bologna. This eminent man devoted his time and his talents, and expended his fortune, in the advancement of every department of natural science; and he did so with a zeal and perseverance to which there is scarcely any parallel in the annals of philosophic investigation. He visited many countries for the express purpose of becoming acquainted with their natural productions, in order that he might describe them faithfully as they exist in nature; and in order that the results of his labours might not be lost, he employed, for at least thirty years, some of the most eminent draughtsmen and engravers of Europe. His collections in natural history were most extensive, and laid the foundation of that museum of natural history which is still one of the chief attractions of the university of which he was so great an ornament. Though his classification is in many respects faulty, and his accounts of animals are often vitiated by fabulous and superstitious narrations, yet in general his descriptions of whatever came under his own notice are exceedingly correct; which clearly proves that the errors and absurdities in his works are not faults of himself, but of the times in which he lived. His works, or at least the works which bear his name, amount in all to thirteen folio volumes; but he is answerable for only six out of the thirteen, for the remaining seven were compiled from his manuscripts after his death. As is the case with Gesner, so Aldrovando was in a great measure a compiler; and there is no doubt that both the one and the other, in many instances, sacrificed their own judgment to the absurd taste of the age. That taste then ran strongly upon the implicit copying of ancient authorities, without inquiring as to whether the statements of those authorities were founded in reason or not. This fetter of the understanding was no doubt at first sacerdotal; and the priests of an unreasoning and therefore unmeaning faith, finding that they had succeeded in chaining down the human mind in matters of religion, naturally laboured to do the same upon every subject in which thinking is concerned. This was the fatal moral and mental slavery of the middle ages; and, for breaking the fetters of this slavery, the religionist and the philosopher are equally indebted to Luther and his illustrious compeers. It could hardly indeed be otherwise; for those who, from the most worthless motives, stood between their fellow men and the revealed word of God could not fail to stand between them and the God of nature as exhibited in his works. Those times have, however, happily for the world, now gone by, and it behoves us to be tender of the errors and frailties of those who aided in breaking the fetters.

In noticing those by whom the knowledge of the mammalia has been promoted, it would be injustice to pass over the name of Johnston. He was a Polish physician, but travelled over most countries of Europe for the purpose of examining the animals which they contain, though the works which he has left recorded are in substance little else than abridgments of those of his predecessors.

At this period of the history of the science, we, however, come to a name which it is impossible for any lover of nature to pronounce without the highest veneration—the truly illustrious John Ray, the real father of natural history in Britain. Ray devoted fifty laborious years to the study of natural history, more especially zoology, and peculiarly the mammalia; and whatever he touched was touched with the hand of a master. His Synopsis is the first regular and philosophical system that appeared; and in proportion to the knowledge then attainable, we may perhaps say that it could not have been better. Ray was a thorough and searching philosopher, and at the same time a most admirable master of language; so that his brief descriptions often contain more than the laboured and lengthened details of more modern authors. Ray too studied nature in the proper spirit, and of all the works which have appeared expressly upon the subject of natural theology, there is perhaps none equal in purity of spirit and depth of philosophy to Ray's "Wisdom of God in the Works of Creation." It is perfectly refreshing to revert to such a man, and we know not where the lamp of natural history can be so purely or so successfully kindled in the young, as at that unextinguishable radiance which this most illustrious of British naturalists has left behind him; nor would it be fair to omit that Ray was as zealous for the civil and religious liberty of man as he was for the true knowledge of nature. He suffered, and suffered severely, under the mental bondage of a most illiberal and bigot reign; and perhaps no expression of triumph is more sincere, and at the same time more touching, than that which John Ray expressed because he had lived to see the revolution in 1688; and what adds to its value is that it was as pure as fervent, for John Ray neither sought nor received, nor in all probability would have accepted any office of emolument, or any favour from any government upon earth, how much soever he might have admired its principles. It is one of the proudest

boasts both of England and of natural history, that John Ray was an Englishman and a naturalist.

Many minor names appeared in the interval; but we can scarcely pause to notice any between Ray and Linnæus. This was a man of the most sterling merit; and though his system is not exactly applicable in the present state of knowledge, it is unquestionably before the age in which it was written; and though many parts of the writings of Linnæus are fanciful, and some of his names and classifications more poetic than natural, one cannot help admiring him as one of the most successful labourers in the field of natural history, and one whose very errors have been lights to show the truth, after those structural peculiarities of animals which were but ill known in his time had been illustrated by others.

Subsequent to Linnæus, we have to mention naturalists, or at least writers on natural history, of a very different class; but yet who, though they perhaps did injury to zoology as a science, promoted the love of it among the people generally. At the head of this class we must place Buffon, whose fascinating volumes are so well known to most readers. That the style of those volumes is very inviting must be admitted, and the assistance which Buffon received from Daubenton, especially in the anatomy of the mammalia, gave considerable value to that part of the work; but unfortunately Buffon was quite wild as a theorist, and, generally speaking, his speculations are of the most visionary nature, and even where his observations are valuable there are no means by which they can be generalised, so as to turn their value to account. Pennant was a most laborious observer, or at all events, describer; but he brought to his work a deal of credulity, and freely gave to the world whatever he himself believed. Shaw, of the British Museum, was not much better, if indeed he was as good; but his situation gave him various opportunities of being the first introducer of new subjects to the attention of the world, though he was loose in his nomenclature, and equally so in his descriptions. Goldsmith, and the rest of that class, who, though fascinating writers, must be acquitted of any general knowledge in natural history, may be passed over with little notice. That they promulgated much error and absurdity is perfectly true, but perhaps it is equally true that the charm of their writings has invited to the study of nature many persons who otherwise would have remained ignorant of it. In more recent times the science of zoology generally, and that of the mammalia in particular, have been more fortunate, because the structures of the animals have been studied at the same time with their manners; and comparative anatomy and physiology have gone hand in hand with description, so that the functions of the different animals and the places which they hold in nature have been ascertained with a very great degree of precision. The establishment of zoological societies has contributed greatly to the promoting of correct knowledge with regard to the mammalia; and perhaps there is no society which has done more service to the cause of science in this respect than the Zoological Society of London. Its committee of science is composed of some of the most accurate observers and the most skilful comparative anatomists and physiologists of the age; and as their labours are carried on purely from love of science, and not with a view to any personal emolument or aggrandisement, they are the more meritorious.

In noticing the different labourers in this department of natural history, it would be unjust to pass over the late Baron Cuvier, one of the most eminent men perhaps that ever devoted himself to this or to any other science. Profoundly skilled in anatomy and in animal mechanics, Cuvier analysed the subject down to the ultimate principles; so that while his arrangement of the mammalia is the most simple that ever was propounded, it is at the same time the most profound; and though it would be injustice not to state that there are in Cuvier a few trifling errors in the details, the wonder is that his view of animals is at once so brief, so comprehensive, and so accurate. We shall not enter farther into the progress of the science of the mammalia, or the notice of those by whom that science has been promoted, for the names in these latter times would fill volumes; and our object is merely to show the general interest which the subject has attracted in all ages. In order to be as brief and at the same time as perspicuous as possible, we shall arrange the few observations which we have to make on those interesting animals under different heads.

Sect. I.—General Structure of Mammalia. Though, in one or other of their species, the mammalia are adapted to every locality on the globe, from the margin of the snows on the mountain top to the free range of the wide ocean; and though in consequence of this there is necessarily a great diversity of structure among them, so that each may be fitted for its own locality in the best manner possible; yet there is a general type which runs through the whole, and distinguishes them from all other animals. This type is not confined to the mere external shape of the animals; for it runs through every part of them; and the solids, the soft parts, and the coverings of the mammalia are all easily distinguishable from those of any other animal. This general type is, however, much more easily understood than described. It is difficult to give expression to it without falling into the description of some particular species, and by this means rendering it inapplicable to others. Still it is necessary that every one who pays any attention to those animals (and who does not pay attention to them?) should have at least a general knowledge of their common structure, in order to judge of such individuals as may present themselves, and to perceive how finely their varied structures are adapted to their several habits in nature.

All the mammalia are symmetrical animals, divisible upon a mesial plane into two sections, which are the exact counterparts of each other, the one turned to the right hand and the other to the left. Some of the internal parts are not exactly divisible upon this plane, because these are soft, and often bent and convoluted, so as not to be divisible exactly upon any plane into symmetrical parts; but all the external parts, and generally speaking all the solid parts, of the structure are thus divisible. If the part is single, the plane passes through the centre of it; but if it is double, the two portions are situated at equal distances from the plane. It passes through the centre of the head, dividing the nose and mouth equally, and having an eye and an ear on each side of it. It passes through the centre of the spinal column in the back, and through the middle of the sternum or breast bone, and that of the abdomen on the opposite side; or, as we say, speaking with reference to the general position of mammalia, the under side of the animal.

If the vertebral column terminates in a tail, which it does in most of the genera, though not in them all, the mesial plane also divides that to its very extremity. In walking animals, when on level ground the mesial plane is perpendicular to the horizon; and it is in this plane that the progressive motion of the walking and the swimming mammalia is performed. If the foot is only a walking foot, and cannot lay hold or be brought to the mouth of the animal, or perform some other peculiar function, then the foot has comparatively little motion but that of being extended forward or drawn back in this mesial plane. Thus it is of importance to attend to this plane in the animal structure, because it presents us with the simplest view which we can have of the mechanical action of an animal. When we say "mechanical," we must not be understood as having the least intention to revive the old error of supposing that animals are machines; though the moving of any organ of an animal, and the progressive motion of an animal itself, are, when considered simply in themselves, purely mechanical; and we leave the mechanism of the matter behind us, and come to the essence of the animal, when we consider the impulse by which the organ or the whole animal is put in motion. With this explanation, the words "animal mechanics" may be used with the strictest propriety in describing both the general structures of animals and their adaptation to general habits, and the particular structures of organs and their adaptation to specific uses in the economy of the animal. In doing this, while we leave the subject of animal life—the unseen spring which puts the machine in motion—out of the question, the structure of the mammalia becomes one of the best studies that we have in practical mechanics; and though it is impossible to find out the precise use of every little peculiarity in the forms of the parts of animals, yet we always find, that when the animal is properly grown and in vigorous health, it exhibits a perfect model of mechanical economy. Every part of it is strong enough for the office it has to perform, and heavy enough for possessing the requisite stability in the performance of it, and this, not only in the ordinary circumstances of the animal's life, but also under a very considerable extent of contingency, so as to make it bear up against those changes in nature which appear necessary for the welfare of the whole system. But, at the same time, no strength is wasted, and no member is overloaded. The active principle of the animal has, therefore, in the organisation, the most extraordinary machine which we can imagine; and this machine is self-supported and self-moving, grows from an embryo by its own vital energy, and is capable of reproduction. Keeping out of view, in the mean time, the vital action of the animal, and also those instincts or impulses which stimulate it to the various external actions which it performs, we may say that the mechanical action of an animal in general consists in moving the weight of its own body, or of some part of it. Many animals, no doubt, do carry other things besides their own weight, in a state of nature as well as in a domestic state, but the natural cases of this are so few, and the fact itself blends so naturally with the consideration of the animal moving its own body or the parts of its own body, that this general action may be held as including the particular one.

Although, as we have already said, it is difficult, if not impossible, to form a general notion of the structure of the mammalia by referring to examples; yet when we consider that the moving of its own weight, or of itself and some supplemental weight, is the principal action of all the mammalia, and, with the exception of those which have flying membranes or swimming paws, all mammalia take their motions from the earth, or from some other solid, as a fulcrum of resistance, we have one step toward the adaptation of the whole structure of the animal to the performance of this action.

The motion of the animal must, of course, be either slower or quicker, taken in the general habit, which may in all cases be said to consist in seeking food, though there are many animals which move slowly when feeding, but which are yet capable of very swift and long continued motions; but when even this is the case, the animal has always some second purpose which is necessary for its subsistence or its safety. In many cases, the food of the mammalia, and especially that of those species which congregate in large herds, is seasonal in many places, and although mammalia cannot migrate over long distances and cross seas, as the birds can which make their passage through the air, yet there are many parts of the world where wild mammalia are under the necessity of making pretty long seasonal journeys, as is the case with the antelopes and other animals on the borders of the deserts, and, generally speaking, in all countries which, from periodical rains, are very fertile at one season of the year, but burned up with drought at another: all animals which are placid in nature are swift-footed, though when browsing on a good pasture their motions are comparatively slow.

Another necessity which animals of the same kind have for swift motion is, that they may be able to escape from their enemies. Many of them, when pushed to extremities, can defend themselves with great resolution, but still the general means of safety with them is flight; and the predatory mammalia, which are set over them in a state of nature to regulate their numbers, are all liers in wait, and not followers of their prey by swiftness of foot. The additional powers of motion with which mammalia are endowed for the purposes of migration and safety, are characters of the particular race however, and not of the general structure, so that we may consider slow motion and quick motion in the natural and usual mode of finding their food as two limits between which the simple and general motion of all mammalia may be considered to lie.

It must not, however, be supposed that the quick-moving animal performs more motion upon the whole than the slow-moving one; for it will generally be found that the continuance of the motion is inversely as the rapidity of it. The beast of prey, the lion or the tiger for instance, springs at once on its victim with the swiftness of an arrow, and it feeds ravenously, so that in a very short time its hunger is satisfied, and it lies down and dozes in a state of perfect inaction, until it is again aroused by hunger. The grazing animal, on the other hand, when it is on a bare pasture, grazes all day long, and proceeds constantly onward with a comparatively slow motion.

We might expect some difference, not merely in the structures but in the textures of animals, which vary thus much in their most general action, and we accordingly find that such is the case. The bones of the animal which makes the violent momentary rush upon its prey, and then reposes, are harder and heavier than those of the slow-moving animal. They

also bear, generally speaking, a less proportion to the quantity of flesh; and the flesh, including all the membranous and cellular tissues, as well as the muscular or fibrous parts, is much more hard and compact. The flesh, for instance, of an old ox, or an old sheep, which has been left nearly to nature in a suitable pasture, is tender and juicy, while that of an old lion is as tough as cables.

There are great gradations in this respect; and perhaps the instances which we have taken form nearly the extreme limits among the more characteristic mammalia; but we invariably find that as the animal approximates the typical one, which moves vigorously but briefly, there is a spareness and condensation in all the soft parts; and that in proportion as it approximates the opposite type, the soft parts become the more relaxed.

We find this exemplified in almost every species of domesticated animal, and man himself does not form an exception. There is no instance in which this is more remarkable than in the horse—an animal which is so obedient to breeding and training, that horses may be reared for almost any specific purpose to which such an animal can be applied, from the utmost speed of the racehorse, the more continued but less rapid motion of the hunter, to those unwieldy horses which appear to feel the burden of their own weight. It is not meant to be said that the whole character of the animal can be entirely changed to any single purpose, and thereby unfitted for every other, for no training can acquire so perfect a command as this over an animal; but still it is true that proper skill in the selection of the breed and in the training, can make the animal better adapted for some one particular purpose than for any other, and far better adapted for it than any other animal not trained in this particular manner. It is indeed this susceptibility of training, and consequent adaptation to a great number of purposes, which renders the horse so superior to all others as a working animal. The ass is stronger, more hardy, and more healthy; and the camel and the bullock can undergo fatigue under a load which no horse could endure; but when it has been said of these animals that they are efficient beasts of burden the tale of their whole history is told.

There are some of the elements wanting in order to perceive physiologically how those general changes in the animal system are brought about; and the chief one is our ignorance of the origin of animal motion. As we shall afterwards see, we can reduce it to a very simple fact, namely, that of the shortening and the thickening of a fibre; but though there have been many hypotheses upon the subject, we never can say why, or by what means, this shortening of the fibre takes place. We are certain, however, that it exhausts the animal in proportion to the rapidity with which it takes place, or in proportion to the quantity in a given time; but we have no means of estimating the strength of the original impulse in which this effort originates, because the impulse is not matter, and therefore we can only see its effect in the change which it produces on matter.

It is highly probable that this is a point upon which we shall never obtain any knowledge, and that we must content ourselves with the simple fact which we can observe; and this, though it is a little humbling to our pride, is of some advantage in pointing out the limits beyond which, if we attempt to use words, those words can have no meaning.

It is not necessary to point out particularly the more conspicuous external parts of the mammalia, for every one is familiar with them in some species, and, as we have said, there is a common type, or general resemblance that runs through the whole, but which admits of very considerable variety in all the individual parts. A head, a trunk, or body as it is usually called, and four extremities or limbs, are the chief parts; though in some species, especially those mammalia which swim, the posterior legs are united with the tail, forming a sort of fin; but this fin, even where most perfect, is never like the fin of a fish, any more than the membranes of bats and other flying mammalia resemble the wings of birds. When we consider those swimming and flying appendages of an animal of this class, we always consider them as departures from that which we take as the proper typical form of mammalia; and that, for example, though a whale lives in the sea, and is a most efficient swimmer in that element, yet that it is not the model of a sea animal, but a land one adapted to an aquatic habit. So also, though we find the bats in many instances incapable of motion upon the ground, while they fly readily, though heavily and in a flutter, yet we do not consider them as the characteristic inhabitants of the atmosphere, which range there with freedom, and buoyant and elegant flight. The owls have too many soft feathers in proportion to their weight for being graceful fliers; but still if a bat and owl are seen on flight at the same time, the flight of the owl is beyond all comparison more graceful than that of the bat, and the animal appears to be far more in its element.

We do not mean to say that it actually is so; for the whale in the sea, and the bat in the gloomy cave, are just as much at home and as beautifully adapted to their situations, as the wild deer on the mountain or the eagle in mid-air. We must, however, take some distinctions which are more general than those of single species, before we can get anything like a an index to the facts of natural history, or to serve as an artificial memory to bring them to our recollection when they are necessary; and therefore we must take some one species, consider it as typical, and distinguish the rest according as they vary from this type.

This is a part of the subject upon which a good deal of caution is necessary, because the selecting of a particular type is our work, and not the work of nature; and whenever we mix our own work with nature's work, we always stand in jeopardy of laying too much stress upon our own, and giving it an importance to which it has no claim. We ought distinctly to bear in mind that our systems of arrangement are not knowledge, any more than words are thoughts; but the system and the words are alike necessary for the purposes of communicating; and it is our fault if we lose the substance in our vain attempts to catch the shadow.

It is not so necessary to mention this precaution in the case of animals generally, and in that of the mammalia in particular, as it is in the vegetable world; for the vegetable, rooted in the soil, must summer and winter in the same spot; and as whatever must naturally abide the blast is always tempered by nature to the blast, the vegetable is far more under the controul of external circumstances, and therefore subject to far greater variations of structure, than any animal, and more especially than the mammalia, which have much more acute sensation to warn them

of change, and many more resources in escaping from it than any other animals. Hence, it has chiefly been in the vegetable world that this yielding to circumstances in the individual plant has been verbally magnified into a sort of doctrine of transmutation, whereby, through the operation of a certain occult power which has been gratuitously conjured up, under the somewhat mystical name of development, roses may, in their initial state, be changed into thorns (meaning of course the spines on rose-trees); and, in certain more elementary states, that which might have been developed into a sea-plant, is developed into a land one, and the reverse.

It has also been maintained in the case of animals, that there is a progress from the very simplest; that from those which appear to have no distinct organs, and which can be readily propagated by dividing their bodies, up to the most perfectly organised animal, namely, the human body, there is a progressive development; and it is inferred, and sometimes in great part said, that, between the earliest rudimental embryo, and the full growth of the animal, or rather our first perception of it as an organised body, it must pass through all these successive developments. They do not of course fix the particular period of time during which the higher animal, as we may call it, is in the same condition as each of the lower ones through which it must come in the successive stages of its development. They do not, for instance, fix upon the precise minute at which a horse, which is afterwards trained to the turf, and wins the Derby or the Oaks, is a snail, a black-beetle, a tortoise, a penguin, or any thing else; neither do they actually aver that those developments take any measurable period of duration between the very earliest embryo and the final development of the specific animal; but there is a sort of dreaming belief upon the subject; and as dreams are said to occur only when the party is neither asleep nor awake, those philosophic dreams—or to speak more correctly, those dreams about philosophy—are more mischievous than one would be apt to suppose; for they will neither allow the error which they involve to slumber in oblivious repose, nor bring it so completely before the awakened mind, as that it can be detected and exploded.

This is not the way of dealing with nature; and though we cannot be too orderly in the arrangement of the facts of natural history, in that order in which the one shall most easily bring the other to our recollection, and where the connexion shall point where the new one is to be discovered, all system beyond the facts is mischievous; for it is an attempt to work without any materials. We can trace many of the mammalia up to a very rudimental state; and in that state it does not consist of so many organs visible to our observation, or is it composed of parts apparently differing so much from each other as these; but still whatever characters it has, are characters of its own species and not of any other; and as the progress of its development (we may with perfect propriety use this word when speaking of the evolvement of an animal by the principle of animal life in itself, for this is identical with the animal); as this progress advances, we find invariably that the characters approximate more and more to those of the full-grown individual of the same species, unless under circumstances where we can at least understand how there may have been a deviation from the typical form, so that the individual may appear mutilated or monstrous; but it never does, nor can we suppose it ever could, assume the characters of any other species.

This is not exactly the place at which to speak of deviations from the typical forms of species of mammalia; but we are to bear in mind that the young during the period of its growth has to work against the pressure of the atmosphere, and that of the parts by which it is surrounded; and also as there are no two individuals of any species absolutely alike, there must be differences of development in the different parts, arising from differences of strength and tone in the young vessels, of which we can have no very perfect knowledge. All this not only may be, but must be, and probably is so in the case of every individual animal, though the common cement is generally too early and obscure for us. This, however, is only part of that play of the system which prevails throughout the whole of nature, and without which, indeed, the operations of a working world could not be carried on. We shall not in the mean time, however, further prosecute this subject of diversity and occasional deformity in the individual animal with sufficient power to counteract the order of nature; but we shall briefly advert to those component parts of the structure which are common to all mammalia.

It is not our intention, because it is not necessary for the purpose of natural history, to enter into any minute chemical exposition of the substances of which the bodies of animals are composed The elements, in the ultimate form to which they have been simply analysed, are carbon, oxygen, hydrogen, and nitrogen, with various alkalies and salts, and some slight quantities of metals. These are differently compounded in different tissues or textures of the body; but no connexion has been traced between the different chemical constitutions of the parts, and their different uses in the economy of the animal.

Cellular membrane may be considered as the fundamental structure of the bodies of all the mammalia; and that which holds all the other parts of the different organs together, whether their consistency be hard or soft. This, as its name imports, consists of a multitude of small cells united together; and it is found coating the most minute fibres of the muscles, as well as ramified through the whole substance of the bones; neither is there any vessel within the body of an animal which is not embedded in this membrane. Sometimes the cells are of considerable extent, and readily filled with foreign matter; as in the case of those surrounding and separating the muscles, and also in many of those in the internal parts of the body upon which fat accumulates; but those which surround the blood vessels are compact, with the cells nearly obliterated. It does not appear that this cellular membrane, or tissue, performs any distinct function in the animal, but is more in the character of a cement by which different parts are united together. Our next object, therefore, is shortly to notice the organs of motion.

These consist of two classes—movers, and substances immediately moved, though the moved substance very often carries the mover along with it. The movers, or active parts in the body which originate particular motions, and produce all the varied actions of animals, are muscles, to which there are various appendages, more numerous indeed in the structures of the mammalia than in those of any other class of animals. These are cartilages, tendons, and ligaments, which answer the purposes of

cords and other working tackle which connect the muscles with that which they move, or give direction and security to the motions.

The parts moved, and, generally speaking, the fulcra or points which give resistance so as to produce the motion, are the bones; and as they are the most permanent part of the animal, those which give stability and consistency to the whole, and which determine its general form and principal modes of action, it is desirable that they should be first understood; because the greater part of the action of an animal may be said to consist in moving or changing the positions of the bones. In doing this we shall first very shortly notice the general structure of bones and their appendages; and then take a very brief view of their number and arrangment in the human body; as that body, by not being adapted to any peculiar locality or kind of action, which is the case with the bodies of almost all other animals, is perhaps the best which can be used for this very general purpose. In treating of the bones and other parts of the animal structure which have no general English names, a few technical words are unavoidable; but we shall use them as sparingly as possible, and, generally speaking, accompany them by explanations, when such appear to be necessary.

Bones and their appendages.—Bones are very differently shaped, according to the purposes which they have to answer in the motions of the animal; and their shapes are often so peculiar, that to us they are unaccountable. But in every case where the complete use of the bone has been ascertained, it is invariably found that in shape, in strength, and in quantity of matter, the bone and also every individual part of it, are perfect, nor could an improvement be imagined by any device whatever. The bones of the limbs are nearly cylindrical, and they are comparatively straight, though those which are most loaded with muscles have generally a peculiar curvature, which both increases their strength, and makes the motions of the joints less jolting or jarring than it would be in the case of perfectly straight bones applied to each other. Others again are long and curved, as in the ribs; and bones of this form generally support the walls of cavities admitting of a varied capacity,—as the chest, which expands and contracts in the operation of breathing. Some bones are broad and flat, and when these have much fatigue to undergo, they are in general strengthened by a ridge placed longitudinally upon the external face of the flat bone. The blade-bones, which are embedded among the soft parts of the shoulders, and not articulated or jointed with the spine or back-bone, are of this description. The haunch bones which support the posterior part of the cavity of the body, forming a basin for this purpose, and also having the thigh bones, or first bones of the posterior extremities articulated to them, are irregular in their forms. Bones are also often elongated into a sort of branches at particular places; and those branches in general serve for giving a more extensive insertion to the muscles, and they also answer as levers in moving the bones from which they project. Those projecting branches, when they form a connecting part of the bone, are called processes, or *apophyses*, either of which words means that they proceed or project outward from the bone; but when they are less firmly united, and have the appearance of one bone applied to another, they are called *epiphyses*, which means that they have the appearance of being applied or planted on the bone. For the sake of ready distinction, technical names have been given to these processes, according to the particular forms. When round and smooth, as they are in the extremities of bones which have a circular motion—as, for example, in the shoulder and hip joints of the human body—they are called heads; and they are received into sockets of greater or less depth; the head, when the bone is vertical, being always placed under the socket, in which position it is much less liable to be dislocated than if the position were reversed. When the motion of the joint is in one direction only, with comparatively little lateral play, the extremity is called a condyle; and it is a portion of a greater or smaller circle fitting into a concavity which is sometimes single and sometimes double, thus forming a hinge. The working extremities of bones at their articulations are often, however, far more complicated than this, and by means of variously shaped bones, and the sliding and rolling motions thence produced, a degree of play, still consistent with perfect firmness, is given to the limb of the animal, which it is altogether impossible to imitate in common mechanics. The human hand and wrist, and indeed the whole bones of the arm, and the mode of their combination, furnish one of the most remarkable instances of this, as we shall afterwards have occasion to notice at greater length.

Of the permanent processes to the extremities of which other bones are not always united by articulation, the following are the principal names and distinctions: — *Mastoid*, or those which have some fancied resemblance to a nipple; *Coracoid*, or those which are something shaped like the bill of a crow; *Styloid*, or those which resemble the style or bodkin used by the ancients in writing; *Spinous*, or those which stand out like a thorn; *Pterygoid*, or those which are supposed to be something like a wing; and *Zygomatic*, or those which have some resemblance to a yoke. When the irregularities on the bone merely roughen the surface with roundish projections, they are called tuberosities. These names are, of course, merely conventional; but as they are used by every writer who treats of the forms of the bones, and the motions of which they admit, with any thing like precision, it becomes necessary to know them if we are to study the structure or the living action of animals with any thing like the proper advantages. Bones are never, or at least seldom, in the mammalia of the same consistency throughout their whole section when divided. The long cylindrical bones have generally a hollow in the middle part which contains marrow or fatty matter in the full-grown animal, but has more of the colour of blood in the young subject. Toward their extremities they become cellular, the cells being still filled with fatty matter, and at these parts the central cavity is gradually obliterated. There are also usually openings into the bone for the admission of vessels; and there are also frequently grooves along their surfaces. The thin bones consist of two plates, which are called tables, with a spongy diploë between them.

In the working structures of the body, bone never touches bone, and therefore we must attend to the basis of bones, as it were, in seeking to know something about its nature. In the middle part of the bone this basis is composed chiefly of gelatine or animal glue, which boils soft, and may be extracted from the bone by boiling for a sufficient length of time;

but the working ends are covered with cartilage of a bluish-white colour, and very elastic; this differs in its chemical nature from the basis of the rest of the bone, for it contains a good deal of albumen; and it is worthy of remark, that there should be this difference between the mere cement which retains the earthy matter, whereby strength is given to the bone, and that which enables the extremity of one bone to work smoothly on another. There is an oil provided by nature for all those working extremities, but they are themselves also very smooth, and composed of matter which is very elastic, so that they are but little liable to jolt, which, in the more violent motions of animals, would shatter the bones to pieces. No doubt the way in which the different bones come into action contributes a great deal to this purpose, for it never strains directly upon the end of a bone, nor yet on the side of it, so that one bone supports another. By this means, a blow given with the extremity of the limb is capable of breaking a substance stronger than any part of the limb itself.

The cartilaginous basis of the bone is an elastic or flexible substance, as well as that which covers the moving parts; and it does not appear that any truly animal formation, while it is in the living state, can acquire such hardness as to be stiff and inflexible. It is reasonable to suppose that this should be the case, because living matter is in a state of continual change, by the old being taken up and new deposited in its place, and it does not appear how this could be done in an inflexible solid. Hence the bones are rendered stiff by the accumulation of a quantity of earthy matter in the cells or interstices of the cartilaginous bases. Those earthy matters are all salts of lime, the same as they exist in minerals, or any where else, without any reference to their being products of animal life; and therefore, though they are unquestionably deposited in the bones by the action of the animal, they cannot in themselves be regarded as animal matter—that is, matter which it would be vain to seek for any where save in the structure of an animal. They consist chiefly of phosphate of lime, carbonate of lime, and sulphate of lime, of which the first predominates in all bones except the enamel of the teeth. It is less dense than the other salts of lime, and not so brittle.

How these salts of lime come to be deposited, we can no more tell than we can tell why any animal is of one specific form and not of another. We are certain, however, that it does not exist in the very early stages of life, because there is no earthy matter in the bones then; and, though we know not the process, we can observe the progress of its formation. The process is called ossification, which means changing to bone; and it appears to be an operation of the bone itself, for it always takes place in the middle, and proceeds gradually from a series of points, until the whole bone is ossified. It appears, also, that this complete ossification limits the growth of the bone, and that before it is absolutely completed the stature of the animal ceases to increase. It appears, also, to be the part of the animal system which, in the gradual decay of nature, and without any local injury or casualty of disease, is the first to give way. We seldom see wild animals in a state of decrepitude; because, depending wholly on their animal resources, they are more liable to contingencies than human beings; but we readily perceive, in the decay of the human subject, a remarkable exhaustion of the bones before the structures which are more immediately concerned in the functions of life begin to give way. Their limbs become feeble and tottering, their vertebral columns bent; and they seem gradually to sink towards that grave which is the place of final repose for every animal body. In these cases it is evident that some contraction takes place in the bones; they are dried of their juices, and there is reason to believe that either their salts of lime are taken up by the absorbents, or the materials necessary for their formation are retained in the larger vessels, and precipitated on their coats, forming what are usually termed ossified vessels.

Besides the cartilaginous base and the salts of lime, which give stiffness, every bone is covered externally by a firm membrane, the periosteum, which means that which is round the bones. This membrane does not extend to the working surfaces of the bones, or those which are covered with cartilage; it reaches nearly as far as the parts which are actually bone. It is exceedingly sensitive; and it becomes indurated in its substance as the animal waxes older. In the young animal, its connexion with the bone is but loose, but as the animal advances in age it adheres more and more firmly. It appears to be essential to the healthy state of bone, for if the periosteum is destroyed from any part, the surface of the bone scales off or exfoliates; and if the periosteum becomes diseased, it speedily eats into the substance of the bone, and destroys its texture. Such are the leading particulars of the supporting structure of the mammalia, in so far as the substance, growth, and decay of that structure are concerned; and we shall now advert to the arrangement of the bones in the human skeleton, to which we can afterwards refer as a standard, in order to show how the divarications from this standard, which we find in the other animals, are essential to their more confined and localised species of action. In the human skelcton—skeleton is the name of the entire bony structure of an animal, and is peculiar to vertebrated animals,—in the human skeleton, as in all the others, the vertebral column, or spine, is the foundation upon which the whole skeleton is organised; and, indeed, as vertebrated animals are the only ones in which the system of sensation, the characteristic animal system, is fully developed, it may be said that the whole structure of the animal is founded upon this column and its contents. One extremity of this column supports the head, and the other extremity is supported by the feet, through the medium of the bones of the pelvis or lower cavity. The bones themselves are so many, that it is necessary to classify them so as to remember the groups, and then each group becomes a sort of index to the individual bones of which it is composed.

The first and most obvious division is into the head, the trunk, and the extremities; and this division applies to the whole class of mammalia. The bones of the head admit of subdivision into those of the cranium and those of the face; the former enclosing and defending the brain, which is understood to be the most important organ of a sentient animal; and the bones of the face supporting the mouth and those organs of sense which are directed to the front. The cranium consists of eight bones, and the face of fifteen, besides the thirty-two teeth, which do not come properly within the class of ordinary bones.

If we include these in the number, and also the peculiar bone of the tongue, and the small bones in the apparatus of the ear, the total number is sixty-three.

The trunk also admits of subdivision into the vertebral column in the middle of the back, the sternum opposite to it on the breast, the ribs in the sides, and the ossa innominata, or unnamed bones, which form the basin of the pelvis. The vertebral column consists of twenty-six pieces jointed together, and admitting of a vast number of flexures, but not of any great motion in a single joint, excepting in one or two, which we shall mention afterwards. Of these vertebræ, or jointed pieces, seven belong to the neck, and are called *cervical vertebræ;* and this number seven is common to all mammalia, whether the neck be long or short. In some of the cetaceous mammalia those vertebræ are so exceedingly short, that the neck appears to consist of thin plates of bone, which have scarcely any motion; while in some other animals, as in the giraffes for instance, it is exceedingly long, but this is owing to the greater lengths of the vertebræ, and not to any increase in their number. The next part of the column consists of twelve joints, of the back or dorsal vertebræ as they are called, which have less motion upon each other than any of the rest. Then there come five joints of the loins, or *lumbar vertebræ*, after which there are two terminating bones, the *sacrum* and the *coccyx*. The breast-bone generally consists of three pieces; but these are often so united as to appear only one bone. The ribs are twelve on each side, of which the seven which are nearest the head are called true ribs, and the five towards the loins false ribs; the former are joined both to the processes of the spine and to the sternum, though these are not articulated so as to have one surface moving upon another in either case; but the union is formed by flexible cartilage, and the ribs, both true and false, are capable of a limited degree of motion. Properly speaking, the pelvis consists of only two bones, one on each side; but each is divided into three parts—the hip-bone, the haunch-bone, and the share-bone. Thus the number of bones of the trunk varies, according to the view which we take of those bones of the pelvis and the breast-bone. If we count each of these only as single, then there are fifty-three bones in the trunk; but if we consider them as divided, then there are fifty-nine.

All the bones that we have now enumerated, and indeed all the bones in the body, are perfectly symmetrical, whether they exist in pairs, with an entire bone on each side, or whether they are single bones equally divisible in the mesial plane.

The anterior extremities, which are the arms in man and the fore legs in the other mammalia, consist of thirty-two bones each, and the posterior extremities consist of thirty, which gives sixty-four in the pair of the former, and sixty in that of the latter. It is convenient for the sake of brevity to call the anterior extremity the arm, and the posterior the leg; and if this is understood to refer to the mere position of the extremity, and not to the function which it is best fitted for performing, it can occasion no mistake, though applied to all mammalia whatever. There is even an advantage in this general nomenclature, because it lessens the number of mere names, and by necessary consequence increases that of descriptions; and it also enables us more readily and clearly to see the differences of structure in those parts of animals, and to understand and appreciate those differences of of action, which result from, or are dependent upon, the differences of structure.

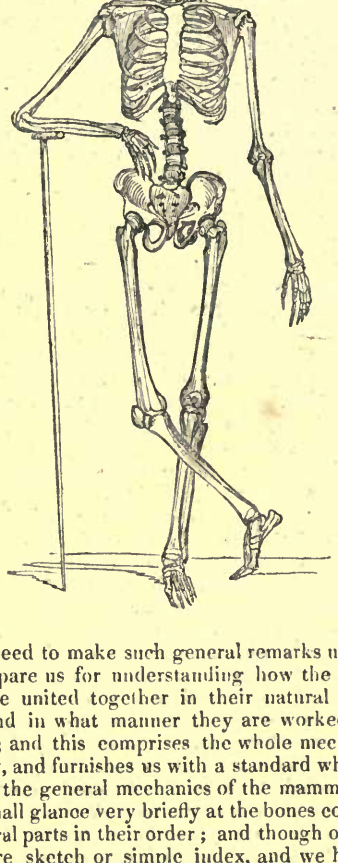
The bones of the arm consist of two uniting bones, the one of which is the blade-bone, embedded in the flesh of the back, and joined to the other parts of the skeleton, the ribs chiefly, only by muscles; and the other is the clavicle or collar bone, which extends from the top of the shoulder to the upper part of the sternum, the latter union being made by means of flexible cartilage; and thus this bone admits of considerable motion in that part of the blade-bone which contains the cavity for receiving the upper part or head of the humerus, or bone of the arm above the elbow. There is only one bone in this part of the arm, and it is the same in the corresponding part of the leg; and this runs through the whole of the mammalia. The fore arm, from the elbow to the wrist, consists of two bones; the wrist, (*carpus*), of eight bones; the palm of the hand (*metacarpus*) consists of five bones; the fingers, of three bones each; and the thumb of two bones. The bones of the fingers are called phalanges, because they are ranged something like a line of warriors in a battle phalanx, when viewed across the hand; and when we take them in succession they appear rank after rank.

As the head of the femur or thigh-bone is articulated immediately on the bones of the pelvis, it does not require that support which the arm gets from the blade-bone on the shoulder, and the collar-bone on the upper part of the breast; but the consequence is, that without flexure of the whole body, the point to which the leg is articulated has not so much motion of its own as that to which the arm is attached. This, however, is a great advantage in the use of the leg, and gives it a stability which it could not have possessed if the point to which it is attached had been moveable as the shoulder is; and on the other hand, the arm would not have been applicable to very many of those purposes which it can perform well, if the point of its insertion had not been movable, without the whole body being moved along with it. There is not such complete difference between the mobility of the point of attachment of the arm, and the firmness of that of the leg, in any animal, that there is in man; and this is the reason, or at least one of the chief reasons, why man walks so much better in an erect position than any other animal, and also why man can use his hands in so many different positions, while the body remains perfectly steady, though resting on only the part of one foot.

This is a part of the subject to which the greatest attention should be paid by every one who wishes to understand the action of animals, and why one animal and not another is found inhabiting a particular place, and performing particular operations; for it is according as the arm or the leg, or both, deviate from this type at their primary articulation, that we find them diversified throughout the greater part of their length. If the arm become principally a leg—that is, if it is used for scarcely any other purpose than that of walking—the blade-bone is comparatively loose upon the shoulder, and the collar-bone is wanting or imperfect; on the other hand, if the leg partakes of the character of an arm, and is furnished with a hand, or more correctly speaking a prehensile foot, it is invariably loosened in the joints, has a wriggling lateral motion, and is comparatively unfit for the proper function of a leg. We shall be better able to explain this matter, however, when we come to compare the other orders of mammalia with man as this typical animal. The number and arrangement of

the bones in the human leg are as follows:—one in the thigh as already mentioned; one on the knee, the knee pan, which is embedded in the tendons, and serves to keep the joint steady, and also to protect those tendons from injury when the knee is very much bent, and to prevent it from bending in the contrary direction, and yet leave it more flexible than it would be if its motion were stopped by bone, and fatigue it less than if it were held back merely by soft matter. After these, the leg itself contains two bones; the tarsus, or ankle and heel taken together, consists of seven bones; the metatarsus, of the same number as the metacarpus; and the toes, also of the same number as the fingers and the thumb, the great toe having only two phalanges as the thumb has, and each of the smaller toes three. Thus the whole skeleton may be said to contain two hundred and forty bones, besides those which, as we have remarked, may be regarded as made up of, or divided into parts.

We shall now introduce a figure of the skeleton,



and proceed to make such general remarks upon it as may prepare us for understanding how the different bones are united together in their natural arrangement, and in what manner they are worked by the muscles; and this comprises the whole mechanics of the body, and furnishes us with a standard whereby to estimate the general mechanics of the mammalia.

We shall glance very briefly at the bones composing the several parts in their order; and though our figure is a mere sketch or simple index, and we have not confused it by references, yet any one may, by means of it, and his own body, easily make out the positions and general forms of the principal bones, which is at all events a beginning.

Bones of the Head.—The frontal bone, which is a very characteristic one in the human subject, forms the forepart of the skull, and the upper arches of the orbits of the eyes. It has various elevations on its external surface, is perforated in its substance by the frontal sinuses, and has some spinous processes on the inner surface, which serve to keep the brain steady in its cavity. The ridges and inequalities on this, and on all the bones, are far more conspicuous in the male subject than in the female.

The parietal bones, or walls of the skull, compose the upper part behind the frontal and the sides; and they have not any very remarkable projections from their surfaces, neither are they perforated for the admission of any important organ; but there is a hole in each, near the corner at which it joins the frontal bone and the temporals.

The temporal bones form the lower parts of the sides of the head, and may be said to contain chiefly the organs of hearing. They also have various processes on their surface, and are pierced with holes for the passage of arteries and veins.

The occipital bone forms the back of the head, and it is the bone by means of which the head is articulated on the spinal column, and also that through which the spinal continuation of the brain finds its passage into the tube or cavity which all the vertebræ contain for its reception. The joint here is a hinge joint, having the plane of its action parallel to the mesial plane. It is double, there being two condyles, or knobs on the lower part of the bone of the skull, and two cavities in the upper side of the vertebræ, on which they work. This gives protection to the spinal marrow, and also allows the head a very considerable range for motion backwards and forwards; but this is not the joint upon which the lateral and twisting motions of the head are performed. This is the joint, however, that gives the principal motion to the head in the direction of the mesial plane, and the one upon which the head is balanced; and so well is it adapted to the keeping of the balance, that the condyles of the occipital bone are, on the average, immediately below the centre of gravity of the skull and its contents.

The sphenoid, or wedge-shaped bone, forms the base of the skull. It has many processes and irregularities on its internal surface, by means of which it keeps the brain upon a very firm base. It is perforated by the two openings by which the eyes are connected with the internal cavity of the skull.

The ethmoid bone is situated at the back of the nose, and unites the proper bones of the nose to the frontal bone. The bony plate of the nose stands out from it; and its cavities, from which it gets its name, which means that it is like a sieve, are the chief receptacles of the organs of smell. The frontal bones of the nose are the nasal bones, which form the firm part at its union with the frontal bone; and they are pierced so as to admit the matter of tears generally into the cavity of the nose, though these last are, more strictly speaking, bones external of the nose, or rather between it and the inner parts of the orbits of the eyes. They are the ungual bones.

The cheek bones are situated below the eyes and support the cheeks. They have various processes and cavities, and their form gives considerable character to the head.

The upper jaw bones contain the sockets of the upper teeth, and also form a considerable portion of the palate, and serve to continue the organs of smell

o the mouth, where there is so curious a sympathy etween them and the organs of smelling. The bones f the palate, properly so called, are situated in the ind part of the palate, and between the cavity of the nouth and the nasal openings.

The vomer, or ploughshare bone, stands out from he ethmoid, and forms the principal part of the sep- um, or partition which separates the nostrils from ach other; and this is prolonged in the cartilaginous art of the septum, as the sides of the cavity are by heir cartilages.

None of the bones that have hitherto been men- ioned have any proper articulations upon each other. They support the brain, and the principal organs of he senses, as well as afford the plane of resistance gainst which the lower jaw acts in preparing the ood for the stomach, and they also give assistance o the muscles which move the jaws and the eyes, nd give all the varied expressions to the face; but one of these can be said to be subject to any of he mechanical actions of the animal. The other rincipal bone of the head is different. That is,

The lower jaw, which has both a vertical or open- ng and shutting motion, and a lateral rolling or grind- ng one; and all mammalia which have this last notion of the lower jaw, are capable, in part at least, f subsisting upon vegetable food, whereas there is o such motion in animals which kill and eat other nimals.

The teeth, when complete, are thirty-two, eight n each side of each jaw. Eight of these are incisors, our canines, and the remainder grinders, equally dis- ributed in both jaws. The incisors have only one utting edge, and a single fang or root; but the rinders have double flattened crowns, and each of hem has two roots. They are not, however, so lecidedly grinding teeth as those of the animals which eed solely upon vegetable matter. In these, the namel, or harder part, is dispersed in ridges or layers, lternating with the bone; but in the human grinders he enamel covers the whole crown of the tooth.

We shall mention some of the leading forms both f the partial and the more complete motion of one one upon another, when we come to treat of those arts of the skeleton in which such articulations ccur; but as the bones of the head form one of the est instances of the union in which there is no motion, t may be proper to notice them here.

The general technical name given to this kind of nion between bones is *synarthrosis*, which implies hat they are equally related in the junction, or that either of them moves upon the other. The union, r line of union, is called a suture or seam; and it is listinguished as serrated, or toothed when the bones re indented into each other. This is by far the irmest kind of suture, and we accordingly find it at he union of the most important bones—the frontal, arietal, and occipital bones of the skull, and the heek bones. This kind of suture is very difficult ither to be separated or displaced. The second kind f suture is that in which the edges of the bones are nerely brought together, without any toothing or nterlocking. This is a feeble kind of union, as com- ared with the former, and therefore it occurs between uch bones as those of the nose and the two parts of he upper jaw, upon the union of which there is little train. The third kind is called squamous or scaly, ecause the edge of the one bone is thin and over- aps that of the other. The temporal bones form this sort of suture with the occipital, which they overlap at the junction. From its form, this suture is more yielding to a strain than the others are.

All the three forms, however, yield more than if they were a solid bone, and when a fracture of the bone does happen, it is not propagated beyond the suture. All these contrivances render the skull much stronger with the same quantity of materials, than it could have been rendered by any other means; and as in man the upright position supports it nearly upon the centre of gravity, it is borne in the easiest possible manner upon a column, which is so finely adapted for supporting it.

Bones of the Trunk.—As the skull is the chief bone of the head, and contains the brain, so the spine is the most important bone in the trunk, and contains the continuation of the same mass. The spine, in the balancing of the body in all the varied attitudes which are necessary in the human subject, requires to be firm, and at the same time flexible to a considerable extent; and as injuries to the contents of this spine are of the most fatal nature, it is necessary that, in all its motions, it should be protected against dislocation. This is accomplished by the numerous processes with which the vertebræ are beset, and by the mode of their union, and the nature of the substance that unites them. The processes of the spine are so arranged, that it is not very easy to dislocate a spine without breaking some part of it. The muscles which give it its motions have comparatively little or no power upon the joints, and the matter with which these are connected is very tough and elastic. All the different parts of it have different kinds of motion. In the neck, the lateral motion across the mesial plane is nearly as great as that in the plane; but in the dorsal vertebræ, where the ribs are attached, and where their order would be deranged, and the contents of the chest disturbed by a great extent of lateral flexure, the cross motion is more limited. There is a contrary flexure in the spine, which is at once graceful and contributes to the strength of the organ. The upper extremity inclines forward, so as to reach the central part of the bone of the skull, and this at the same time affords room for those muscles and their tendons, which communicate the principal motions to the head. The spinous processes in the upper part are short; and it is not till we come to the setting on of the neck, as it is usually called, that we can feel a prominent process through the skin. They are more produced in the dorsal vertebræ, and they are far more produced in running mammalia, which require a firmer lateral support to their blade-bones than is necessary in man.

The projecting parts of the vertebræ of the spine, and their perforations may be briefly stated as follows:—The first vertebra of the neck, which immediately supports the condyles of the occipital bone has two transverse processes, two articulating ones, and two inferior oblique ones. This vertebra is styled the *atlas*. The second vertebra is called toothed (*dentata*). It has two transverse and four oblique processes; and the articulation is a cleft tooth-like process, which acts in the cavity of the atlas, and admits of the lateral and twisting motions of the head. The remaining five of the neck resemble the second one in other respects; but they have not the toothed process. All these have the central opening for the spinal marrow, and two lateral holes in each.

The vertebræ of the back and loins have the same

number of transverse and oblique processes as the last five of the neck; but those of the back have long pointed spinous processes, and those of the lower have processes of the same kind, but shorter and blunted. The spinous processes give the spine a firm embedment in the muscles; the lateral ones have the ribs soldered to their inner surfaces, with the head of the rib resting on the thick or articulated part of the vertebræ; and the oblique processes are the principal means by which dislocation is prevented. In proportion as the column has more weight to carry, and is less supported by the muscles and ribs, its diameter, and also the articulating surfaces of the vertebræ are enlarged. All these have the cavity for the spinal marrow; but they have no lateral holes.

The sacrum, which is again deeply imbedded in muscles, has three spinous processes, but no oblique ones; within it the spinal marrow terminates in a triangular cavity. It affords support to the spine; and it is also the centre of the bones of the pelvis. The coccyx is a simple bone attached to the termination of the sacrum, having no spine or internal cavity; and its chief purpose is to afford support to the terminal part of the intestinal canal.

The bones of the pelvis we have already mentioned. They are connected with the sacrum at those portions which are called the haunch bones (*ilii*); on the sides are the hip bones; and the share bones advance in front completing the cavity. The haunch bones have two tuberous spines, and the share bones or bones of the pubis, form an arch; and in the hip bones on each side there is situated the cavity (*acetabulum*), which receives the condyle or head of the femur or thigh-bone, which is the principal articulation of the leg. These bones altogether support the lower parts of the viscera, and also the base of the spinal column; but from the intervention of two unions of separate bones on each side, between the insertion of the femur and the spinal column, any shock or concussion which is communicated to the hip-bone by rapid motion of the legs, is not propagated so as to jolt the contents of the spine, or to disturb the viscera contained in the pelvis. The form of the bones of the pelvis throws the articulations of the femoral bone proportionally farther apart from each other in man than they are in the other mammalia. In the male subject this distance may be considered as the one which conduces most to give the trunk a stable base. Physiological causes render it necessary that this measure should be rather exceeded in the female; and this is compensated by a slight inclination to each other of the thigh-bones at their distal, or knee ends, which gives a peculiarity to the walk of females different from that of males.

The remaining bones of the trunk are the sternum and ribs. The sternum, or breast-bone, is flattened; and though they are intimately connected, it consists of three bones, by which means its flexibility is much increased, and the danger of fracture diminished. At the under end it terminates, or is sheathed by the *ensiform*, or sword-shaped cartilage, which answers in flexibility to the false ribs which form the lateral walls of the lower part of the chest; and their sternal extremities are united by the cartilage. The sternum contains cavities to which the ribs are articulated; but, as we have already mentioned, their opposite extremities are merely soldered to the lateral processes of the vertebræ, so that though the sternum and ribs are much more flexible than any other of the assemblages of bone, and therefore a strain or thrust is much less readily propagated through them to their union with the spine; yet provision is made against the possibility of jarring the spine even in this way. We cannot, indeed, whatever part of the skeleton we advert to, avoid noticing the universal and admirable provision which is made for preserving this organ from the effects of any of those violent actions to which the other and less essentially vital parts are necessarily often subjected in the exercise of the body. There is no bone articulated directly upon any part of the spine, but the unions are formed by flexible matter, consisting partly of cartilage and partly of elastic ligament; and thus the brain and its continuation are everywhere supported upon springs, springs of a far more delicate nature than those which we construct in our mechanics. When the pressure is great upon the spring, that spring is doubled; and on the other hand, when the motion of the bone approaching the spine is extensive and varied, as it is in the blade-bone, there is an embedment of muscles and of cellular membrane between the moving bone and even the ribs.

The seven true ribs on each side, extend from the dorsal vertebræ to the sternum, having heads and tuberous processes at their dorsal extremity, being united to the sternum in front, and each being furnished with a groove, along which an artery is conducted. The five false ribs are connected to the transverse processes of the lumbar vertebræ; but at their anterior extremities they are united by cartilage one with another; and the first one with the last of the true ribs. As this cavity of the body contains the most active portion of the respiratory and circulating systems, it is necessary that it should have the power of contracting and enlarging with very little effort; so that the pressure upon all the delicate organs and vessels which it contains may be uniform; and yet that the requisite quantity of air in breathing should be alternately received into the lungs and discharged from them. Nothing can be more yielding to internal pressure; nothing better adapted for resuming its shape when that pressure is removed; and nothing equally light in its structure can be stronger or more secure against external injuries than the chest.

Bones of the arms.—In considering these, the first thing to be attended to is the point of insertion; because that, in a great measure, determines the principal action of the articulated members. The blade-bone and the clavicle are the two supporting bones in the human subject. The blade-bone, as already mentioned, is embedded in the muscles of the shoulder, and it is itself the point of insertion, or rather the surface of attachment. It is formed with three ribs, a dorsal spine, and three processes, against one of which the clavicle or collar-bone abuts; and the others support the muscles and prevent dislocation of the shoulder joint. The glenoid cavity into which the condyle, or head of the humerus, is articulated, is placed below one of those processes; and the lever of the bone, against which the collar-bone acts, is placed a little further from the body than this cavity. By this structure, the severest strain in pulling, pushing, or otherwise moving the extended arm, is thrown upon the blade-bone, though the peculiar curve of the collar-bone, and that of the process to which it is attached, enables it to give a firm support and yet one which admits of considerable motion.

This is a part of the structure in which mammalia differ from each other, and also from birds; and, therefore, it must be well attended to. The two extremes of articulation for the shoulder, or rather of affording a support for its articulation, may be considered the nearest approximation to absolute rest on the one hand, and that which admits of free motion in the mesial plane, without any cross bone applied as a strut or tie, to restrict the motion of the glenoid cavity; that is, of the humeral end of the blade-bone on the other. The first is what we find in birds. In them the motion of flying, which is the essential motion of the anterior extremities of the class, not only does not require a free motion of the glenoid cavity; but it requires that this cavity should be as nearly as possible fixed in its position upon the body of the bird; because the powerful stroke which a wing requires to take in order to send a bird rapidly through the air, is inconsistent with any considerable degree of shake in the first joint of the wing. If motion proceeding or produced from any fulcrum, is to be vigorous and effective in proportion to the whole muscular force exerted, this fulcrum must be firm; and yet it is inconsistent with the contents of the chest, even in a bird, that the wing-joint should be articulated directly upon the walls of that. A tripod is therefore (see the article Bird), provided for the articulation of the wing, and this tripod is firm, and bears equally upon its three branches in proportion as the action of the wing is to be vigorous. The three branches of the tripod; first, the blade-bone, placed on the upper part of the shoulder as in the mammalia, but more simple in its form, and less abundantly supplied with muscles; the coracoid bones, which connect the heads of the scapulars with the anterior angles of the sternum, and which, though separate bones and differently arranged, bear some analogy to the coracoid processes in mammalia; and the fucal bone which is applied to the heads of the blade-bones and coracoids, and keeps them asunder. This is the bone which answers to the clavicles in mammalia; and, as is the case among them, it is the bone which varies the most in form and strength according to the different kinds and degrees of action of the wing. The opposite extreme may be regarded as that in which the shoulder-blade has a free and extended motion, untrammelled by any connecting bone; this is the characteristic form in galloping animals, as in horses for instance. The blade-bone, though embedded in the flesh in these cases, may be said to be a part of the acting limb; and thus, in animals which are unfettered with clavicles in this part, the whole muscles of the shoulder come into play in the same action; and the spinous processes of the dorsal vertebræ form the points of support for the first series of muscles that come into play in the rapid motion of the limb. The human subject is intermediate between them; and the glenoid cavity can be moved round in a circle, though the chief motion is in the blade-bone, in consequence of its being free at its distal extremity from the joint, whereas the clavicle is tied to the sternum. The humerus, shoulder-bone, or more correctly the arm-bone, is connected with the blade-bone only at its upper extremity, It forms the strongest part of the arm, and has two tubercles, and also condyles on the exmity, most distant from the body. The two bones of the fore-arm are the ulna and radius. The ulna forms the elbow joint with the humerus, and the radius acts against a tubercle, and gives a twisting or rotatory motion to the hand. Both these bones have cavities at their extremities for receiving the processes of those bones with which they are articulated; but they have also projecting processes which increase the lever power of the joints, and ridges in their length which give firm insertion to the muscles. The chief muscles that move the fingers as a whole, have their insertion on these bones.

It is scarcely possible to give a popular account of the bones of the wrist so as to make the mode of their action intelligible to ordinary readers. Generally speaking, they have sliding motions; and those motions are secondary, or only modifications in the direction of such motions as are communicated to the hand. With the exception of that one of the number which answers to the thumb, the metacarpal bones, that is, the bones of the palm, have comparatively little proper motion. Their chief purpose seems to be to support the tendons which move the fingers and thumb, and to afford a more extensive grasp. The latter use of them is illustrated by the fact that those mammalia whose hands are more exclusively grasping instruments, and not instruments of all work like the human hand, have this part of the structure more extended, and they grasp more firmly in proportion to their size than the human hand can grasp. The principal motions of the phalanges of the fingers and thumb are opening and shutting; but the fingers have some rolling motion on those joints by which they are articulated to the palm; so that a small circle may be described with the point of the finger, while its articulation with the palm, that is, the point to which it is articulated, remains perfectly at rest. This motion is more free in the fore finger than in any of the other three; and it is comparatively very free in the thumb, which is articulated upon a sort of universal joint, only it does not in a stiff hand extend far backwards. We shall, however, have occasion to speak of some of the articulations afterwards. The bones of the lower extremities have been in part already mentioned. The thigh bone is connected at its lower extremity with the upper end of the tibia, or principal bone of the leg; and the knee-pan lies over and strengthens the articulation in the manner which has been already described. The knee-joint between the thigh bone and the tibia is a hinge, formed by two processes of the upper bone acting in two cavities; and the head of the tibia is enlarged, in order to adapt it the better to the enlarged processes of the thigh bone. The external part of the head of this bone is the most enlarged; and to the enlargement of this the head of the fibula, or small bone of the leg, is applied; and this gives a slight twisting motion to the knee. The distal extremity of the tibia embraces the astragalus, or great articulating bone of the foot, on its upper surface, and also on its inner side, where an extended process forms the inner projecting bone of the ankle. The lower extremity of the fibula is applied on the other side, and forms the external projecting ankle bone. The enlarged process of the astragalus which forms the heel, and gives the limb a firm basis while the body is in a horizontal position, or bent in any direction, and still resting firmly on the foot, is peculiar to the human subject. The tarsal bones of the foot have sliding motions, something analogous to those of the wrist bones; and by means of them the foot can adapt itself to many forms of surface, and

maintain the balance of the body in a great number of attitudes. The metatarsal bones consist of five elongated phalanges, like the metacarpal ones; and the phalanges of the toes are equal in number to those in the fingers, only they are individually much shorter, and their motions are far more limited; and though the great toe has no grasping motion against the others, as the thumb has against the fingers, yet it may be educated to far more activity, and may acquire far more strength in its muscles than it has in those who use their feet for no other purposes than those of ordinary walking, and have them confined and not unfrequently cramped in shoes from their infancy. It has sometimes been said, and the analogy at least is in favour of the truth of the saying, that those who have been accustomed to go without shoes in their earlier days are more vigorous in the feet and retain the use of them longer than those who wear shoes from the beginning. Over the joints of the toes, and sometimes over those of the fingers, and especially the last joint of the thumb, there are sometimes little bones, formed not of diseased matter but in a quite healthy state. These last are called sesamoid bones, or milletseed bones; and it is understood that they act something in the same manner as the knee-pan, in strengthening the joints and increasing the facility of their motion.

Such are the bones of the human subject, in their arrangement, their application to each other, and their principal uses. We have noticed the principal modes in which bones are united by sutures, when it is not intended in the economy of the system that the one of them shall have a motion upon the other. We have also mentioned some of the forms of those parts of the moving bones which are applied to each other, but it may not be amiss to recapitulate the principal modes of those unions as they are usually stated in the books. Of unions of bones which have motion to a greater or less extent, there are two general classes: those which are only partially moveable, or partake something of the nature of sutures, and also of the nature of joints; and those which, whether moveable in one direction or in several, or moveable to a greater or less extent, have their motions free as far as they go. The first species of union is called *amphiathrosis*, which means that they partake of one or of both of the modes of separation or of junction; and the second is called *diathrosis*, which means that the bones are completely divided from each other, unless in so far as they are bound together by ligaments. Cases of this last kind form the proper joints of all mammalia; and, therefore, they are of the greatest consequence in studying the action of animals, though the others are scarcely less important when we consider the adaptation of the animal structure to its own preservation, which is far from being the least interesting, or the least instructive point of view in which it can be regarded.

The first modification of amphiathrosis is that in which the bones are simply united by cartilaginous matter. This mode of union is called *synchondrosis*, because both bones stand in the same relation to the uniting cartilaginous matter. Bones united in this manner do not, strictly speaking, admit of motion; but they yield to pressure much more than bones which are united by sutures. The different bones which compose the pelvis are instances of this kind of union.

There is a modification of the union by the mixture of elastic ligament with the cartilaginous matter which admits of considerably more motion, and also is much stronger, than the mere cartilage. The vertebræ of the spine, already alluded to, are examples of this kind of union; and we may remark, that whenever flexure is given to a joint by muscular contraction, the joint straightens again by the reaction of the ligament whenever the muscular effort ceases. Ligaments more complete in their structure, and more extended than these, are employed in many parts of the structure of animals, as antagonists to muscles; and as the elasticity of the ligaments is a mere property of matter, and not an effort of the living principle, any repose, adhesion, or other result, which is brought about by means of an elastic ligament, is rest to the animal, and not fatigue. A third form of partial movement is that which gets the name of *syndermisis*, which means that the bones are equally tied together by ligaments surrounding them, but that their surfaces are left free to slide upon each other. This is the case with bones which merely modify those motions which are conveyed across them by tendons reaching from one bone to another; and the most remarkable instances that the human body furnishes of these are the numerous little bones in the wrist and the instep, which modify but do not originate, by means of muscles attached to them, the motions of the hands and feet. When one bone is united to another by intervening muscles, and thus imbedded in the flesh, the technical name given to it is *syssarcosis*, which just means that the bone has its lodgment in the flesh; and of course it can move upon the other bones without the intervention of any thing else than those connecting muscles. The blade-bones are the most remarkable instances of this.

In *diathrosis*, there are three original and simple forms of articulation, with regard to the plane or planes in which the motions take place, and there is a fourth one which is compound. The first is the hinge-joint, which admits of motion in one plane only, that is, bending and extension of the limb or member, but not twisting or cross motion: the articulation of the occipital bone upon the atlas, the second and third joints of the fingers, and the joints of the elbow and knee, are chiefly of this kind, though the application of the second bone turns these, in part at least, into compound motions. The second form is rotatory motion, or motion in the same plane all round and at right angles to the axis of the bones forming the joint: the articulation of the atlas upon the second or toothed vertebra of the the neck is the most remarkable instance of this motion in the human body. A third form arises from the combination of these two, which may be produced by the peculiar form of the condyles and the cavities in which they act, or it may arise from a compound joint, where two bones act upon one, and the one of them tends to twist the other round, at the same time that the joint is bent: the articulation of the lower jaw in man and other mammalia, which have a grinding motion of the jaw, is an example of compound motion, produced by the form of the condyle which allows one muscle to draw it laterally, while another is drawing it upwards or downwards; and all those joints in which a twist round and a flexure can be produced at the same time by means of two bones, as in the elbow, and to a less extent in the knee, are examples of the second form.

The last form, and that which admits of the most general motion, is the ball and socket joint, in which

the circular head of a bone is introduced into a cavity of a similar form. The most perfect ones of this kind are the articulations of the thigh bone with the hip bone, and that of the arm bone with the blade-bone, and there are less perfect instances in the thumbs. Very often, however, a motion of this kind is obtained by the intervention of a number of bones, which all contribute to the motion to some extent or other, though it is not very easy to assign each its proper share: the curious motions of the wrist, which may be said to be in all imaginable directions to which the members can be bent, are perhaps the most remarkable instance of this, not only in the human subject, but among the whole mammalia.

In those joints which have the most general motion, arising from the peculiar motion of two bones, there are two precautions against the chance of dislocation. The hip joint, which, though it is a ball and socket, still has its most powerful motion in the mesial plane, has the ball united to the middle of the socket by a round ligament, which partly forms a pad between the acting surfaces, and partly allows a more free motion, but prevents the bone from slipping out of its socket. Other joints, such as the joint of the knee, which have their principal motion hinge-ways by means of two condyles and two cavities, have a division between the condyles in which there are ligaments placed crossing each other, and allowing, at the same time, free motion to the joint. Such joints are generally also inclosed in ligamentous matter, which forms a border round the brim of the cavity, and extends over the condyle and part of the bone. These ligaments are, like the others, elastic, and when the joint is strongly bent in one direction, there is a tendency in the ligament to bring it back again, if the muscular action is suspended.

The position of repose, or perfectly easy rest, in animals which stretch themselves down to rest, assumes that of a uniform balance of the ligaments, at least in the limbs of the animal. The muscles are the portions of the animal structure which are soonest tired by exertion, and the position of rest at perfect ease is that in which all the muscles are equally in a state of repose; and any one may know whether a limb is in a state of complete repose or not by trying whether external force will bend it with equally little exertion in all the directions in which it naturally bends. Painters and others, who endeavour to represent the positions of animals and their parts, whether in a state of action or in a state of repose, often commit sad blunders from ignorance of the mechanical action of the animals. They often lay a figure down in repose, or even asleep, with all its limbs in a state of great muscular excitement; and they as often represent a limb as in the act of performing some mighty deed, when the said limb is in a state of perfect inaction. The most ludicrous blunder of this kind is that in which violent action is endeavoured to be represented; for, in these cases, an assassin may be represented as in the very act of felling his victim to the ground with a bludgeon, or of stabbing him to the heart with a dagger, and yet the muscles which extend the arm and those which draw it back may be both so equally excited in the representation that the arm could not possibly move a hairbreadth. We must, however, close our observations on the bones and their adaptation for motion, for to exhaust the subject, even on the human body alone, would be a vain expectation. What is already known would fill many volumes, and the unknown would, in all probability, fill a far greater number.

The Muscles. As the muscles, or immediate organs of motion, vary in their forms according to the state of action or repose that they are in, and as from their being wholly composed of soft animal matter they are subject to perish, or at all events to lose their original shape far sooner than the bones, we shall not go into even a list of them, but content ourselves with a few remarks on their nature and mode of action, and on those appendages which connect them with the parts which they move, or keep them in that shape in which they can perform their offices most effectively, and with the least exertion on the part of the animal.

Wherever a muscle appears, or to which ever of the functions of the animal it ministers, its general structure and general mode of action are the same, though from the number of different motions of which they are the organs, their shapes, sizes, and relative degrees of strength vary much.

Various divisions of the muscles into classes have been proposed, according to their supposed connexion with what is called the will of the animal, and also according to the fancied system in the animal of which they are supposed to form a part. Such distinctions are, however of little or no value. The question of will is one which should be introduced as seldom as possible, for this very plain reason, that nobody can tell what it means; and, instead of the muscles of the arm being voluntary or obedient to the will, and the muscles of the heart involuntary, or not obedient to it, the whole difference is, that the external one, exposed as it is, and temporary as it is in its use, is not so easily or so constantly excited to action as the internal muscle, which is defended from the air, preserved uniformly at a high temperature, and has the stimulus of the blood always applied to it in the course of the circulation. The real ground of distinction is, therefore, one concerning the causes which stimulate muscles; and as the actions which the different mammalia, to leave all other animals out of the question, have to perform in nature are perfectly innumerable, and as we know nothing about the stimulus or cause of action in the muscle farther than as we see of the animal which possesses it, and the circumstances which *appear* to us to stimulate the animal to action, we cannot draw the line of distinction between what is voluntary and what is not. So much, indeed, is this the fact, that even in our own case, where we may naturally be supposed to have the best information, we cannot confidently say that we are possessed of any thing called will, which comes in as a sort of third party between us and the circumstances under which we act in any given manner. At all events, will can never be of any practical use, unless it advances as far at least as *can*, and therefore it is not a fit subject for popular writing, and perhaps not for instructive writing of any kind.

The best way, therefore, is to disregard all those metaphysical or systematic distinctions, and deal with the muscles just as we do with the bones—that is, describe them according to their forms and situations in the body, and the functions which we see them perform, without ever troubling ourselves why a muscle produces motion and a bone does not, or why one muscle appears to perform one kind of motion and another not. In all the varied motions and actions of the animal body, the muscle, considered as sub-

stantive matter, can perform no action and originate no motion, unless we trace it downward as connected with the race from its original creation as a living creature, how often so ever it may have passed through the embryo state during the interval. All our inquiries respecting the action of muscles must, therefore, be confined to what they do, and the manner in which they do it, because, as to *why* they do it, we can get no information.

Muscles consist almost entirely of fleshy fibres, generally arranged parallel and formed into bundles, which bundles, as well as the more minute fibres of which they are composed, are all encased with cellular tissue. This tissue admits a ready passage to the numerous blood-vessels, nerves, and lymphatic vessels, with which muscles, in the mammalia at least, are always copiously provided. The bundles of fibres of which a muscle is composed, are variously disposed in the muscle. When they run longitudinally through the whole of it parallel to each other, it is called a straight muscle; but it is sometimes run obliquely across the general substance of the organ, sometimes they diverge from partitions dividing the muscle internally, and sometimes they are disposed in a circular manner. The last mentioned structure occurs in the iris of the eye, which, in diurnal mammalia, contracts to a point by the action of light; but the eyes of climbing animals, which are nocturnal, generally speaking contract to a vertical line, while those which range the surface of the ground often have the iris contracting in a horizontal line.

In all muscles which give motion to the limbs and other articulated parts of animals, it is the distal bone, or bone most remote from the body of the animal, or from the spinal column in the mammalia, that the muscle moves; and when there is a regular articulation, the distal bone is moved upon the proximal, or one nearest the body, or centre of articulation in the body. In order to make a distinction of these two in the mere naming of the parts to which the muscle is attached, it is usual to say that the proximal attachment is the origin of the muscle, and the distal attachment the insertion of it; and when such a muscle acts, the tendency of it is always to draw the point of its insertion towards the point of its origin. If, however, the distal part of the member with which the muscle is connected rests on a fulcrum whose resistance is greater than the weight of the animal, the animal must move upon the member, and not the member upon the animal. Thus, in the case of an animal rising from a recumbent or a bent position, or in the case of the straightening of a bent limb by muscular exertion, it is to the body of the animal that the motion is communicated, and the extremity of the straight line remains upon the ground, unless there is as much force in the muscular exertion as to project the animal fairly into the air by a leap. In all leaping, galloping, and jumping, and indeed in all kinds of progressive motion, the body of the animal is thus propelled by the action of the muscles against a resistance sufficient to overcome the weight or inertia of the animal's body. Thus, the reference to the origin and insertion of muscles applies only to their positions in the body of the animal, and not to the absolute kind of motion which may result from their exercise.

Sometimes the muscles are inserted directly upon the bones to which they give motion, and in this case a layer of tendinous or cartilaginous matter is the means of their union. In the living animal this matter adheres firmly; but when the parts are exposed for a sufficient length of time to the action of boiling water, or even to maceration in cold water, the tendinous matter is partly converted into jelly and separates from the bone. In other cases, and indeed in the majority of cases, in those parts which have extensive motions, the muscle terminates in a tendon or cord; and this tendon, which is popularly called sinew, consists of substances more or less approaching the nature of ligament. These tendons are fibrous though their fibres are not nearly so distinct as those of the muscles; and they are placed in various directions with reference to the fibres of the muscles themselves. Those tendons are not susceptible of motion like the muscles, neither are they so elastic as ligaments; but there are considerable differences in their consistency in different animals, and in different parts of the body of the same animals. When the tendons of a muscle lie in the same direction as the fibres of a muscle itself, they may be at either extremity of the muscle, or at both extremities of it, according to circumstances. The tendons sometimes also pass through the body of the muscles, either in the direction of the muscular fibres or across it; and sometimes there are several tendons connected with the same muscle. All these varieties are adaptations to the different kinds of motion which the muscle is intended to produce; and not unfrequently the tendon is continued for a considerable way, and over intermediate bones. The muscles of the fingers and toes afford instances of this, for their tendons are very long, the muscles being situated upon the bones of the fore arm in the case of the fingers, and upon the bones of the leg in the case of the toes. When the tendons of muscles are extended in this way, they generally pass over bones which modify their motion, and not unfrequently over joints which have proper muscles for their own movements. In these cases the tendons are tied into their places by ligaments which surround them, and keep them to their arrangement; and very often it is where there are such ligaments, that modifying bones, with sliding surfaces, diversify the effect ultimately produced upon the part which the long tendon connects with the muscle.

In all those muscles which immediately affect the bending of joints, there must be in the greater number of cases an action of muscle against muscle; and these opposed muscles are called the antagonists of each other; as, for instance, a muscle which bends a joint, and a muscle which stretches it in the opposite direction, are antagonists, and the first is called a flexor muscle, and the second an extensor. When the bending or contractory action of the part is more vigorous, or, which amounts to the same thing, more important in the action of the animal, the flexor muscle is always the stronger; but when the extension of the part is the chief action, the flexor muscle is the weaker. The muscles in the human body are very numerous, very varied in themselves, and in the kinds of motion which they produce; but in the case of the individual fibre, the bundle, or the congeries of bundles, of which the several portions are separated from each other by tendinous septa, the action of the muscle is always the same—namely, the pulling together of its opposite extremities, by the shortening and swelling out of the fibrous part, and the extension of it in length by the subsidence of the contraction, and the relaxing of the muscle and its tendons.

Whatever may be the specific process, and the immediate means by which muscular contraction is produced or excited, it evidently has some connexion with electric action, and indeed with merely rapid motion of anything which is fatal to life. Persons who are killed by lightning have all the muscles relaxed, and the body rendered as loose and feeble as though the whole soft parts were deprived of their cohesive power. It is nearly the same with those who are killed in battle by gun-shot wounds, for they also are relaxed, and have no expression of any strong passion on their countenances after death; whereas the countenances of those who are killed by wounds with cutting instruments, set rigidly in death with that expression of rage, agony, or whatever strong passion under the influence of which they cease to live. Those results of the rapid concussion of the lightning, and the rapid stroke of the bullet, have been too frequently noticed for leaving any doubt of their truth; and as the lightning and the leaden bullet have nothing in common but the rapidity of their motion; for the one produces its effects by a mere shock, and the other by a mechanical wound, it is difficult to avoid concluding that it is from this sudden assailment of the system, that two causes, apparently so different, produce the same effect upon the muscles.

This, by the way, is one strong ground for concluding that they have a general connexion in this rapidity of motion; and that the animal life which they destroy belongs to the same general class, although, as it acts through the medium of a very different apparatus, its displays are correspondingly different. What is called the wind of a spent cannon ball, which often stuns for a time, and not unfrequently destroys life altogether, must be regarded as acting in nearly a similar manner upon the sensibility of the whole living structure of the body; and in the case of man, we have results very similar, produced by sudden and violent mental excitements. Every one must have heard of how effectually a sudden panic turns the bravest men into perfect cowards, or how sudden fear, even when the ground of it is purely imaginary, will unnerve the arm, strike the tongue dumb, and hold the individual rivetted to the spot, and powerless against even the feeblest enemy, and very often when there is no real enemy in the case at all. We cannot suppose that, in the case of human beings, these are primary affections of the mind; because it should seem that the mind can be affected by external nature only through the instrumentality of the senses: and therefore we might be prepared to expect that similar cases of the influence of intimidation might be found among the other animals. Something of this sort occurs in what is usually termed fascination. The accounts which have been given upon this subject must be all received with some degree of caution, because, generally speaking, they bear the stamp of extreme credulity upon them. But still they are so many, and a number of them are given with such apparent claims to probability in many parts, that it would be perhaps carrying scepticism to an excess to deny the whole, though it would be equally wrong to give the whole implicit credit. All the facts, however, seem to point to the general conclusion, that there is a remarkable agreement in many particulars, among all the various modifications of action, the effects of which present themselves in the material world.

But though the muscular action of animals may be the same in kind with every other denomination of action, the effect of which is to produce motion, this does not lead us one jot nearer to the origin of the animal action than we were before. We know that the first rudiment which we have of every animal capable of awakening into life, and growing by proper nourishment into the general resemblance of a species, is the result of an act on the part of animals of the same species; and we know farther, that if we endeavour to extend the performance of this act beyond the species, there is a limit at which it fails, not only in its effect, but in the tendency towards its performance; and therefore how much soever we may have reason to conclude that the action of animals is in principle the same with all other kinds of action in matter, we are utterly unable to say why the result should be an animal of one species and not of another, or indeed why it should be an animal at all.

Other organs of Animals.—The other organs of animals, besides the external ones which we have mentioned, and the general structure upon which the external action and adaptation in nature of animals, and especially the mammalia, depend, may be referred to certain classes, each class being more immediately fitted for the performance of some one particular part of the animal's economy, though they all harmonise with, and support each other in such a manner as to show that how complicated soever the organisation may be, the animal is still one, and that not one of the functions performed by those different systems of organs which belong to it could be carried on without the others; though there is still that play of the system and adaptation to contingencies here, which we find to run through the whole.

Those systems of organs need not detain us long, for some of them have been alluded to in previous articles of the present work, and others can be more conveniently taken along with the notices of those divisions of the mammalia of which they form characteristic features. The organs of nourishment have received sufficient illustration in the general article Assimilation, and the variations can be better appreciated in contrasting the animals wherein they appear. A mouth for receiving the food, a gullet for transmitting it, a stomach more or less complicated according to the species for its digestion, an intestinal canal, certain separate glands for preparing liquids which promote action in that canal, absorbents to take up the food from the canal, and leave the impurities, and an apparatus for further elaborating the new matter so taken up, and conveying it, along probably with part of the exhausted matter brought back by the lymphatics, into the mass of the blood, are common to the whole of the mammalia. In like manner, there is a common mode of respiration, or of applying the blood which has been mixed with the new matter and the matter of the lymphatics, to the action of atmospheric air, in order that it may deliver out a certain portion of carbon to the oxygen of the atmosphere, which is common to all the mammalia, and is in every case performed by receiving atmospheric air into cellular lungs, along the walls and passages of which blood vessels are ramified with an extreme degree of minuteness. The quantity of respiration, and the rapidity of circulation, vary a good deal in different species, and in the same species, and even the same individual under different circumstances; but still the general mode is the same throughout the whole class; and both in their increase and their decrease, to what cause soever the one or the other may be owing,

they keep pace with each other. The respiration of the mammalia is always accompanied by voice of some kind or other, but though in many of them the organs of voice bear a much closer resemblance to man than those of other classes of animals, and especially than those of birds, yet none of the mammalia have ever been taught to articulate, or to imitate sounds, although many birds are capable of being taught to utter words, and to execute pieces of music with very great perfection. This unquestionably does not happen from any inferiority of resources, or what is usually called animal sagacity; for in these respects the mammalia stand far higher than any other animals. As they do in other respects, so in this, they differ greatly from each other; but in the whole of them there is an expression in the eye, a readiness in the ear, and an aptitude to take notice of circumstances around them far superior to what is to be found in any of the other classes. They also readily know persons and places, and they understand sounds, and feel pleasure at some, while they are irritated by others. It should seem, therefore, that their inability to imitate sounds, and especially articulate sounds, is a matter of organisation merely, and has nothing to do with the system of sensation. Indeed we have something nearly corresponding to this, for the most eloquent speakers are rarely the most acute or profound thinkers; and it is at least not proverbial that those who have the sweetest voices have the best understandings.

The allocated organs of particular senses are the same in number and in situation, making allowance for differences in the general form of the body, in all the mammalia. The ears are always two in number, farthest backward on the upper or lateral part of the cranium; but they differ greatly in their development and their external form, according to the extent to which the animal has occasion for the sense of hearing, and the times and places when that sense is exercised. The eyes follow next in advance; but their position varies according to the direction in which the animal has most occasion to exercise the sense of sight; and many circumstances also tend to vary their size, mode of action, and intensity of perception. The organs of smell have also their general situation similar in the whole; and so have the organs of tasting; though both of these vary much in the degree of their acuteness. What is usually termed the sense of touch, or of feeling, is a very doubtful matter, and one of which it is by no means easy to give a general explanation which will meet all the points, or even be very satisfactory upon any one of them. This sense ought, strictly speaking, to include not only those sensations which we fancy that we derive from touching substances with our hands, such as roughness and smoothness, hardness and softness, heat and cold, and the like; but it ought to include all sensations which we can consider as being pleasurable or painful, or in any way perceptible, except those sensations which we refer to distinct organs, and lose if those organs are destroyed or seriously deranged. Among these last ought to be numbered those influences of the atmosphere, which affect us deeply in proportion to our sensibility, but which we cannot refer to a sense of touch, as connected with peculiar and localised organs, any more than we can refer them to the other senses. The feeling of high health and buoyant spirits, and also all the opposite feelings down to absolute internal pain, of which we are often unable to describe the seat, should also be included under this head, or else the sense of touch ought to be subdivided into as many branches as there are different sensations which impress us, not through those local organs to which particular senses are attributed.

When we consider carefully the circumstances now mentioned, and bear in mind how many different circumstances affect our bodily comfort, without having any thing of a mental nature in them that we can discover; and further, when we bear in mind how very often we are thus affected pleasurably or painfully, when we can trace the affection to no source, observed as physical, or suggested as intellectual, we can hardly help admitting that we ought to give this sense, one modification of which we call touch, as extensive a locality as the whole sentient structures of our body, and perhaps even those which we do not usually at least consider as being possessed of any capability of sensation. The senses which have local organs, the destruction of which puts an end to the sense, do not participate with each other, unless perhaps in that curious connexion which subsists between smelling and tasting; but this general sensation belongs to the organs of the allocated senses as well as to the other parts of the body; and often, as they are more finely organised than structures of more rude employment, they are the very first to be affected. The converse holds equally good; for this general sense may be excited, and that to a degree highly pleasurable or highly painful by the exercise of those allocated senses upon particular objects. There are sights and sounds, and odours, and even savours, which can make the whole frame thrill with delight; and there are others in each of the four classes which can make it shudder with horror. All this may happen too without any suggestion of relation which can give us the slightest ground for believing that the matter is a mental one; and thus we are constrained to look upon it as a mere affection of the sentient body by external circumstances.

Such being the case, it follows by a most natural analogy, that this general sense of the living structure must be common to all the mammalia, only varying in acuteness with the species, and indeed with the individual; it must do the latter of these as well as the former; for if we find this general sensibility, as we may term it, so variable among the human race, as the observation of every day proves it to be, we cannot expect to find perfect uniformity among the individuals of any species of mammalia whatever.

When, therefore, we speak about the sense of touch in these animals, we must be careful not to fall into error, and suppose that it necessarily belongs to some particular kind of surface, such as a naked skin covered with small papillæ; for the sensation can be conveyed as readily by a hair, a bristle, a porcupine's spike, or even the horn of an ox, as by the most delicate finger belonging to the human race. We know that the whiskers of nocturnal animals, and probably the whiskers of all animals which have such appendages, communicate a sense of the presence, and even the approach of objects, with wonderful quickness. The hair of horses, and indeed that of all animals, respecting which the experiment is properly made, give proofs that they are possessed of equal sensibility to external objects. The sensibility of leaping animals to friction, calculated to produce voltaic action in their fur, is well known, from the familiar experiment of rubbing a cat's back against the grain; and in order to show the perfect identity

of the two kinds of excitement, we invariably find that sparks are most readily obtained from the cat's back in those states of the atmosphere best adapted for the working of a common electric machine. The sensibility of many of the mammalia to atmospheric changes, even when those changes are too slight for telling upon our feelings or upon our instruments, are also well known; and in this way the almost eyeless mole, lodged under the surface of the ground, is probably a more certain "weather-wiser" than the most zealous human student of the science of meteorology. Upon this branch of the system, as well as upon the others, we may therefore say that the system of sensation is the same in kind among all the mammalia, and only varies in degree in the different parts, so as to adapt each species to its proper haunt and habit in the most perfect manner.

Even in the external coverings of their bodies there is a characteristic resemblance among all the mammalia, in which they differ from all other animals, and which, if it is known in the case of one can never be mistaken in that of another. The skin of the mammalia is very thin in some species, and very thick in others; but still in the whole it consists of the same number of parts similar in their composition and their arrangement. Whatever appendages grow from this skin for protection to the animal, or for any other purpose, are always substantially the same. They may be of exceedingly delicate texture as we find in many of the fur animals, and in the fleeces of some of the finer-woolled sheep, or they may be coarse and shaggy, of which we have examples in the produced hair of the American bison and the mane of the lion. They may also have that appearance which we find in the substance called whalebone, or more correctly baleen, which forms the apparatus used by toothless whales for capturing their food; it may be tubular, with an opening in the centre, as we find it in the ornithorhynchus and some other animals; it may be in hard spines, which have their insertion into cavities, as in the porcupine, the echidna, the spiny rats, and some others; it may be an agglutination of fibres without any core, as we find in the horn of the rhinoceros, or it may be a casement of horny matter upon a core of bone, as we find in the ox, and all those other animals which have true horns; and, according to the species, it may differ in its consistency, and also in the proportions of its ingredients, but it is still substantially the same substance; and whether it appears in the form of fur, of wool, of hair, of bristle, of horn, of hoof, or claw, or of nail, it is still substantially the same, and when examining it we could at once pronounce it to be a product of the skin of the mammalia in one or other of the species, and not any thing else.

Thus, notwithstanding all the diversity which there is in the size, the structure, and the habits of this class of animals, there is in every part of them a general character which prevents us from confounding them with any other animals; and this character pervades their whole organisation, and is traceable in all their habits.

In the mode of their reproduction—the means which have been given them for the continuation of their several species, there is the same uniformity. Every species consists of two sexes, and each individual is of one sex only. Instances are indeed mentioned of the appearance of a double sex; but these instances, which are rare, are always monstrous formations, and whatever may be their appearance they never have a double function, and very often they have no function at all. Some physiological facts connected with this part of the subject are very curious, but at the same time perfectly inexplicable upon any principles with which we are acquainted. One of the most familiar, and at the same time perhaps one of the most singular, is the case of "free martens." Hitherto we believe the occurrence of them has been found in no animal save the common domestic ox, and no reason can be assigned for its occurrence in that animal. One young one is understood as being the regular or normal number produced at a birth in this species of animal, but there are sometimes two. If these two are both males or both females, they follow the ordinary law, and are perfect animals; but if the one of them is a male and the other a female, the female is imperfect or a free marten; and differs not only in its general expression but in its flesh from the perfect animal, whether male or female, being accounted far superior to either of them as food, even though they are mutilated very soon after their birth.

There is another remarkable distinction in the mode of reproduction in the mammalia, and that is the difference between placental animals and marsupial ones. The latter have not yet been completely investigated; and for much of what is known respecting them we may refer the reader to the article KANGAROO. But, independently of the difference of structure requisite for the double gestation of marsupial animals, there is a characteristic distinction of a more general kind between them and the placental mammalia, that bring forth their young in full maturity. Their appearance as to form wants the elegance and lithenes of the others. They are shapeless animals so so speak, and the very covering of their bodies is different, though it is not very easy to speak particularly of what the difference consists. The most remarkable distinction between them and the others, however, is in the expression. The eyes of all marsupial animals look blank and vacant, and though physiognomy is not perfectly understood, and consequently our opinions concerning it cannot always be trusted, yet the whole air of the head, as well as the general shape of the body, give us at once the impression that marsupial animals are stupid and resourceless. Even the feet, which one would suppose to be less affected by physiological differences than any other parts, are different from those of the common or characteristic mammalia, and in many of the species they bear some resemblance to the feet of birds or those of reptiles. The anatomical structure has not been examined with the requisite degree of attention; but it should seem that there is an inferiority in the tarsal and carpal parts of the extremities, and that the foot, for whatever kind of work it may be adapted, is always inferior to that of the placental mammalia.

But notwithstanding the differences of appearance, expression, and intelligence, which follow this difference in the production of these animals, their predominating character is still that of the mammalia, and therefore in what light soever we view the numerous species which constitute the class, we must always come to the conclusion that it is clear and well defined in its general characters.

SEC. II.—PHYSIOLOGY OF MAMMALIA.—Physiology literally means "the voice of nature," but in general it is restricted to nature as organised, and thus it becomes "the voice of life," and is divided into two

parts answering to the two great divisions of organic nature, vegetables and animals. With the former we have, in the mean time, no concern. Our view of the latter must also be principally directed towards one class of animals; but as that class, the mammalia, are those in which the system of sensation, which is the grand character of animals, and that which at once distinguishes them from vegetables, is most fully developed, their physiology in a great measure includes that of those other classes whose sensation is inferior.

In the proper, that is the most useful sense of the term, animal physiology is the science of life, or of the investigation of all the phenomena of living beings, and the causes of those phenomena, as far as such causes are capable of being known. The phenomena are of course as open to our observation in the animal world as they are in the vegetable or the inorganic; and as they approximate more nearly to our own personal phenomena than the others do, and are also in themselves more striking, they occupy more of our attention, and there is perhaps no individual of the human race, however uncultivated and however careless, who is not at some times an animal physiologist. Nor is it at all to be wondered at that such should be the case, for when we come to think seriously of it, there is something truly wonderful in an animal; and if it were possible to imagine a human being possessed of the average degree of intelligence, that had lived to the years of careful observation and calm reflection, without ever having seen an animal, and then to have one brought before him for the first time, it is not easy to find words expressive of the surprise and the delight which such a novelty would produce. All the spectacles and shows, after which the restless minds of the idle and unthinking pant and toil with so much solicitude, would sink into perfect insignificance before this especial wonder; and the individual in the circumstance which we here suppose would fancy he possessed in the animal a treasure of knowledge which could not be exhausted.

We have practical evidence of this in the case and conduct of the young, of simple country people, and of all whose minds have not been debased by that love and pursuit of sensual gratification and frivolity which are the curse of the majority of mankind in all ages, and in none more than in those societies and states of society which lay claim to superior degrees of civilisation and refinement, but in which, in reality, by far the greater majority spend their lives in "sowing the wind and reaping the whirlwind." When we observe those unsophisticated persons examining a new animal, that is, an animal new to them, they present to us a lesson of genuine wisdom, if we, in the pride of our fancied superiority, would but deign to learn it. It is not the unwonted shape or peculiar structure of the animal which rivets their attention, it is "what the animal does"—the display of the principle of life in it—the phenomenon of that mysterious power, veiled in its essence from mortal ken, which, generally speaking, makes the mass of matter before their eyes an animal and not any thing else; and, in its peculiar modification, makes it the particular species of animal before them, and not another. Ask any person of the description alluded to, upon returning from a menagerie, or even from a common show of wild beasts at a fair, what he has seen, and the answer will never be concerning modification of shape or diversity of colour; it will invariably run upon the action of the animals, and it will be expressed with admiration and delight in proportion as that action is novel and energetic. The common exhibitors, who address themselves to the least learned class of the population, are well aware of this, and never fail in turning it to the proper advantage. They plaster pictorial representations upon the display canvas in forms which the wildest imagination never fancied, and in attitudes which set every principle of equilibrium at defiance. But though these attract the first gaze of the rustic, they do not constitute the spell which beguiles him of his hard-earned pence, and betrays him within the deceptive booth: there are two short words—"all alive"—which are the real attraction, and the irresistible desire is to know what shapes so marvellous *can do*.

This is an every day and a homely illustration; but the instruction which it is capable of affording, and which it affords largely, is not the less valuable upon this account. It will be remarked too, that in those cases, mammalia always attract more attention than animals of any other class. Birds may be ever so elegant in their shapes, and ever so gay in their colours; and the folds of serpents may be represented as though they could break bars of iron, and their mouths (some of which are abundantly wide naturally) as much distended as though they could swallow elephants; but if the rubric presents any novelty in the mammalia, although not larger than a rabbit, and equally simple in its expression, the eye of the rustic ultimately settles upon that, and it even in its simplicity tempts him more than all the beauties and all the monsters of the other classes of animals, heightened as the latter are by every exaggeration to which a paint brush, unfettered by taste of any description, can have recourse.

Evidence obtained from sources such as those now mentioned, whatever may be its intrinsic value, is always genuine, being free from the contamination of theory and system of every sort. Therefore, whether the distance it carries us be shorter or longer, we can always depend upon it so far as it goes. The specimen of mammalia, we have said (and any one who chooses to make the observation may verify the saying), is the real attraction. Why is it so? This is a simple question, but the answer to it is very important: it is so because, from what the rustic has already observed in the course of his personal experience, he expects to find a greater display of the phenomena of life, or of the living principle in that specimen of mammalia than in all the animals of the other classes. This familiar illustration, and we have endeavoured to draw it from a source as little connected with artificial learning as possible, is certainly the most sincere, and far from the least convincing proof of the superior interest and value of physiology (we mean animal physiology) that could be adduced.

When we come to this department of study we find that we are upon new ground, and that there is something in addition to all that we meet with in mere matter and its laws, which those laws will not explain. The unorganised body, under what form soever it may exist, is wholly under the government of the laws of matter, which laws we can reduce to mathematical proportions in their different instances, and state them by weight or measure; and whenever one substance of this kind acts upon another, or two act jointly, so as to produce a new substance by their union, the whole materials of that new substance are ready prepared before the act of union, and after that

act is completed, the resulting substance is in itself as passive as any of the parts of which it is composed. If we expose it to the air and the weather, to which all mammalia are more or less exposed, otherwise they cannot perform their functions—if we expose it to these, their effects upon it is in all cases a decomposing or otherwise destructive one. There is no principle of reproduction, no faculty of growth, and no means of preservation in the inorganic or dead substance. It is perfectly passive to those physical laws which it is the province of natural philosophy and chemistry to discover; and were we acquainted with the whole of those laws, we should be intimately acquainted with the nature of every organic substance, and could foretell the exact change which under any given circumstances it would undergo, with the same certainty as we can predict that fire will burn dry wood, lead melt at a certain degree of heat, and water crystallise into ice at a certain degree of cold.

In these inorganic or dead matters there is, therefore, strictly speaking, no physiology; the individuals or the kinds have no story to tell, for the whole of their story is told in the physical laws of matter, and, for the sake of illustration, it may be said that those laws are inexorable despots to whom all the species of inorganic matter yield the most implicit obedience.

When however, we come to animals, and especially to the mammalia, which are, as we have said, the most typical animals, we find the case very different. The physical laws of matter, taken generally, will not only not explain their phenomena, but these phenomena are displayed in spite of the physical laws of matter, and, in opposition to them, by the triumph of a greater power over them as it were. This is true of the very materials of the animal body. The animal, or the principle of animal life—that unseen power which we cannot describe except through the medium of its phenomena—cannot change the physical nature of any one substance, considered as a simple substance, which enters into its composition. Carbon, for instance, is exactly the same substance in the body of a living animal as it is in a diamond, in the charcoal of burnt wood, or in any mineral carbonate, or compound of a carbonate. The oxygen and the hydrogen which exist in the structures of an animal are also exactly the same as they exist in water, or in any oxide or any hydrate whatever. The same may be said of the nitrogen, and of all the other elements which enter into the composition of the animal body. And, as the action of the animal has no power of changing the nature of any one elementary substance, so it has not the power either of producing or of finally destroying any one elementary matter; so that, when an animal of the largest size, the most active character, and the longest life, ceases to exist, it leaves the quantity of matter, and the proportions of those kinds of matter which we call elementary, in precisely the same state that they were at the dawn of its first rudimental existence.

But though this is unquestionably true, and though it is a truth necessary to a proper understanding of the first and simplest principles in animal physiology—the principle upon which all our knowledge of a subject so difficult and so apt to tempt us astray must be grounded—yet we must be careful as to what we understand by elementary matter of whatever kind. For our purpose it is not necessary to inquire how many kinds of elementary matter there are, or whether any one of those substances which the art of the chemist has not hitherto been able to resolve into parts, differing in their qualities from each other, is or is not a simple element, and absolutely indecomposable. The practice belongs to the chemist, and is in itself a physical matter and not a physiological one; and being a physical matter, information concerning it must be sought in those physical laws of matter which, as we have said, are opposed and overcome by the law of life in the individual animal as long as its life continues. The principle is all that the physiologist is concerned with; but it is especially necessary that his knowledge of this should be clear and distinct, because the common loose expressions about animal matter and vegetable matter, and matter which is neither vegetable nor animal; and also the distinctive names given to imaginary kinds of animal matter, such as the matter of bones, the matter of membranes, the matter of blood, the matter of nerves, and an endless variety of others, are sure to mislead us if we do not clearly understand that they are simply conventional expressions.

When we speak of substantive matter as existent, and obedient to the laws of matter and nothing more, then there can be no such thing as *animal* matter, because there must be something in addition both to those laws and to the matter before there can be the smallest part of the very smallest animal. When, too, we speak of the different kinds of animal matter, of those above alluded to, or others according to the structure to which we refer, we do not mean different kinds of substantive existence as merely matter, and under the physical laws of matter and nothing more. The real meaning of such expressions is, that each of the compounds to which we allude is the result of some degree or mode of animal action, wherein the laws of mere matter have been subdued and suspended for a time.

In the general expression, "animal matter," our real meaning, when we have any meaning at all (for we are very apt to use such words without meaning), is that this matter displays the result of the action of animal life; and when we speak of a particular kind of animal matter, as, for instance, of the matter of bones, all that we mean is, that a particular kind or modification of the action of animal life is displayed in the matter of which we speak.

Even the words, "action of animal life," though we cannot well refrain from using them upon some occasions, inasmuch as the life of one animal displays many species of action, are not altogether free from objection. Our conceptions of life in animals, though different in their subject, are similar in their nature to our conceptions of mind in man: we know nothing of the essence either of the one or the other, but merely their successive states; and that which we call the life of an animal, whatever it may be to our thoughts, is nothing to our observation but the succession of actions which that animal performs. Some of those actions are, however, so very different in their nature from any action which we can attribute to mind, as a thinking principle, that we naturally make a very broad and clear distinction between the two. Mind is capable of knowing matter, and turning its experimental knowledge to account, whether sensation be immediately concerned in this application of experience or not; but mind is not capable of acting upon matter so as to counteract or suspend any of those laws which belong to matter. It is emphatically said in

the sacred volume, that "no man, by taking thought, can add a cubit to his stature," and there is a great deal of philosophical truth in the saying. The mind of a human being has not the least controul over the character or appearance of any one part of the human body, unless in so far as experience may have taught it to use physical means for such a purpose; and if this is the case with regard to the matter and material structure of the body with which it is so intimately though mysteriously connected, much more must it be the case with all matter external of the body.

The principle involved in this is not an unimportant one. We know nothing substantive but matter, and can form no notion of any kind of substance exeept material substance, and therefore our conceptions of the nature of mind, and also of the nature of that which we call animal life, must be made up of negatives: we can tell what they are not, but we cannot tell what they are; and as the negative in respect of both is much the same with relation to substantive matter, it is very desirable that we should have some means of discriminating between the two, and understanding precisely the difference between them; for if we do not, we are in constant danger of confounding them together; and as a good many of the actions of those mammalia which have the most sensation and the most numerous resources have a great deal of similarity to actions performed by human beings, we are in great danger of considering the difference between mind and animal life as being a difference in degree only, and not an essential difference in nature.

When, however, we view the relations in which the two stand to matter, and the laws of matter, we readily perceive the difference. Mind, as we have said, has the faculty of knowing matter; but it cannot, without the instrumentality of some material means, the employment of some material agent of which it has acquired a knowledge by experience, produce the least effect upon matter, or suspend or counteract, to the smallest extent, even the most simple physical law. It has the knowledge of matter, and it is the nature of knowledge that it does not perish with that which is known. New objects, indeed, are so repeatedly drawing our attention in this world, and we have such a scramble to supply the real and artificial wants of the body, and all those other demands which the customs of society impose upon us, that we do not heed many things that were once known to us. But, even in these cases, there is no absolute loss or oblivion of the knowledge, for the most trifling circumstance will, if we were once acquainted with it, return, as we say, to our recollection, and that frequently by means which we cannot understand. All material things can pass into new forms, by entering into new combinations, and when the new form is assumed, the old one is gone for ever, and can no more be recalled than the noon of yesterday can be brought back to illuminate the midnight of to-morrow. But knowledge, of whatsoever it may be the knowledge, cannot thus be obliterated or cease to exist by passing into any new combination. It is true that we can and do, in many instances, obtain new knowledge by combining together, or rather comparing together, different portions of knowledge previously acquired. But this bears no analogy whatever to what takes place in combining matter, for the new knowledge is not composed of the previous knowledge which leads to it, and the previous knowledge is not lost, or clouded, or confounded by the additional knowledge to which it has pointed out the way. Every portion of it stands as entire and unmixed as if nothing but itself were known; nor are there any means by which we can contrive to bury in oblivion that which we once knew; and every one must have felt that the more we labour to forget any thing, we just remember it the better.

The characteristic of mind, that in which alone it does or can display itself, is thus of an immortal nature, and cannot be lost or have its properties obliterated in a compound, as can happen to every kind of matter with which we are acquainted. A portion of knowledge cannot, in fact, be a compound; for whatever be the subject known, the knowledge of it is one and simple. The ancients, for instance, knew atmospheric air as a simple substance, and water as another, and from this supposed simplicity they called both elements of mere compound substances. We know atmospheric air as a compound of oxygen and nitrogen, and water as a compound of oxygen and hydrogen; and we also know that, as they exist in nature, both of these, generally speaking, contain other matters. But our knowledge of air or of water is not, in itself and considered as an act or state of the mind, any more compound than the knowledge which the ancients possessed of the same substances, when they believed them both to be simple and elementary.

Knowledge is, therefore, in its very nature simple—incapable of combination in the sense in which we apply that term to matter, and not material; and it follows, by necessary consequence, that knowledge is immortal—that is, it cannot be destroyed by the operation of any cause which affects matter, or by all such causes acting together—that it can yield to nothing save the power of One who could command matter to be where matter did not previously exist, and command matter to depart and leave nothing in its stead.

Now, if the only manifestation which we have of mind, namely—that of knowing, or being possessed of knowledge, is of an indestructible and, therefore, immortal nature, it must follow that this must be an essential attribute of mind itself; because whatever is known only from the demonstrations that we have of it in its effects as an active principle, must necessarily be regarded as possessing any one property, whatever it may be, which is common to and inseparable from all those effects. But all the evidences which we have or can have of the existence of the human mind are of an immortal nature, being knowledge, and nothing but knowledge; and, consequently, from this alone, and without any other argument or proof, natural or revealed, it is impossible for us to come to any other conclusion than that the human mind is of an immortal nature, not resolvable into parts, or decomposable by the operation of any or of all the secondary causes or energies of created existences that can be named, subject only to the direct fiat of its Maker; and as we can by possibility know nothing of the work of creation, or production without materials, so we can know nothing of the counter-work of annihilation in the ceasing to be of that which once existed.

This a point, the clear understanding of which is of the utmost importance, if we wish to possess rational views on the subject of animal physiology.

No matter how high, according to an estimate, the animal may be in the scale, the action of the animal still belongs to matter, and may mingle with and be blended and lost in the general mass of material action, just as the substantive matter which composes the body of the animal may, in whole after death, or gradually and successively during life, be blended with and lose in the general mass of substantive matter. It is evident from the facts, and it ought to be distinctly understood, that animal life, or animal power, or whatever we may call that which evolves an animal from its embryo, brings it to perfection, and ultimately renders it up to mingle with the dust, merely acts upon matter, but has no knowledge of matter in that sense in which we speak of knowledge as the only demonstrative attribute of mind.

We have a proof of this in the daily economy of our own bodies: when we are young and increasing in size, there is of course an addition to our frame of all those different kinds of matter that enter into the composition of the parts which are increased. But we have in ourselves no knowledge that this is going on; and even at the period of our lives when our increase in bodily volume is most rapid, we have no knowledge that we are growing. So, also, throughout the whole period of life, when matter unfit for living action is removed, and new matter introduced to supply its place, we have not the least knowledge of what occurs; and though it is probable that in the course of a very few years the whole matter of the body is removed and replaced by new matter, we are not in the least aware of the occurrence even of the one or of the other. Now, if in our animal system we have no knowledge of the matter which ministers to our growth, or that which repairs the waste of our system, it would be contrary to all the principles of reason and judgment to suppose that, considered as animals, we could have any knowledge of matter or its actions or changes, external of our own bodies.

Thus what we actually feel in ourselves is quite sufficient to guide our judgment in drawing the distinction between mental and animal action, and enabling us to give full scope to our animal physiology, without allowing it in the least to interfere with the physiology of mind. We can no more give a specific description of the animal power, than we can do of the mental power, for we know nothing about powers of any kind, farther than what we see in the effects which they produce; but we know that the animal power invariably acts upon matter without having any knowledge of matter; while the mental power knows matter without having any capacity of acting upon matter, and this is a sufficient distinction.

But although the animal, or the power or energy which exists in the animal, is inscrutable to our senses, and we cannot describe it as we describe material existence, yet we cannot help believing of it that it is mortal, capable of existing only for a limited time in one organisation which it elaborates for itself; and when it is as it were exhausted and worn out in the individual by the continual struggle which it maintains with the physical properties of matter during its life, it must pass again through the embryo state, and appear a new creature, though identical with and species of the parent. This limit, which ties it down to the species, we can no more understand than we can understand why there are specific differences in inanimate and inorganic matter; but we can observe the fact in both cases, and it is as determinate in the one as in the other.

Although, therefore, our consideration of animal physiology is entirely separated from the physiology of mind, and shown to be totally different from it in its nature, even in the human subject, in which the two exist in combination; yet we require to advert to very different causes in the physiology of animals from any which we meet with in the philosophy of inorganic matter. In the last, the causes which we have to consider are all *physical;* but in the other they are what may be called *final;* that is, causes which are to be inferred from the purpose which their operation accomplishes. The animal is a sort of warfare against the common laws of nature in mere matter: it grows in opposition to those laws, and it lives and performs its functions in opposition to them; so that in the study of it we have to advert to assimilating and conserving faculties, which have nothing to do with the physical operations of matter, whether mechanical or chemical. The temporary or mortal power of the animal is proved by the fact, that it can maintain this warfare against the common laws of matter only for a time; and though this time is very different in different species of animals, we cannot predicate immortality of it in any one particular case. It is not found except where there is both a combination of matter and an organisation of matter; that is, a distribution of matter in a particular form, which it would not assume were it not for the principle of animal life; and therefore, though during the exercise of this principle, the merely mechanical and chemical powers of matter are subdued, the principle of animal life is so intimately connected with matter, that it is impossible to separate the one from the other.

We must allow that there is not only a general principle of animalisation, but that there are as many distinctions or diversities of this principle dependent on itself, as there are species of animals in the world; because we find that the line of distinction between species and species cannot be broken. But while we admit this, we must also admit that the laws of matter exercise their power upon the material substance of animals in the exact proportion that the animal power allows them so to operate. There is no capacity in the one to originate the other; and as an animal cannot create matter, or change the nature or form of elementary matter, so neither can matter of itself originate any animal how simple soever. In every case there is an embryo, an alimentary animal being wanted, and it is not a little remarkable, or confirmatory of the principle for which we are arguing, that the care of this embryo, and the connexion which it has with an antecedent animal life, are always in proportion to the development of animal energy, or the deviation of the animal considered as a piece of matter from the common mass of inanimate matter of which the globe is composed. In all cases there is a certain dependence upon the parent. This dependence is more brief and slight in some cases, and more durable and intimate in others; but in no instance with which we are acquainted is there a new animal life produced without some assistance from a parent animal.

When we look at the different classes into which systematic naturalists divide the animal kingdom, we find very remarkable proofs of this. In those which have the least development and exercise of the sensa-

tory or true animal system, we find the egg produced in a very short time, and abandoned by the parent the instant it is deposited. It is true, this egg in the most minute species to which own observation can reach, is always brought forward to a certain stage within the body of the parent, and it is equally true that the parent is in all cases endowed with an instinct, by means of which it places the egg in that situation which is most favourable for its present preservation, its further development, and the obtaining of food by the young animal after it awakens into life. The provision made, and the ingenuity displayed, in many cases of this kind, are indeed truly wonderful; and the reader will find many remarkable instances of them narrated in the general articles Entomology and Insect, and in various particular articles of that department of the animal kingdom in this work.

Upon this part of the subject it is necessary to exercise a very sound discretion in order to avoid falling into a very serious error; and indeed throughout the whole range of physiology, and it is far from a narrow one, there is more danger of error than in any other department of human study. It may seem strange, but it is nevertheless true, that doctrinal errors in religion are not so injurious, even in a religious point of view, as many of our physiological errors. The physiological error spoils the instrument which we bring to the study of religious truth; and if the instrument is spoiled, no excellence of the materials can make the workmanship good; whereas, if the instrument is sound and perfect, we have means of shifting from the bad material to the good, and so perfecting our work.

The great error into which we are apt to be betrayed upon this subject, and those who betray us into it are often actuated by the purest and most benevolent intentions, is that of ascribing forethought and provisional knowledge to the creatures in thus disposing of their eggs in situations the most favourable for their preservation and development; and by this means a kind of reasoning respecting cause and effect is imputed to the very humblest orders of animated beings. The tendency to do this is so very general, that we can scarcely open a book in which the habits and manners of animals are treated of, without meeting with numerous, fervent, and eloquent expatiatings on their sagacity; by which "sagacity" it is invariably meant that the animal so acting *knows what it is about* —pursues a certain course, from a previous conviction that this course is to lead to a particular result.

Now there are only two ways of enabling any being whatever to do this. The first is a perfect knowledge of the future in itself, and without the necessity of any analogy, or the means which can serve as a key to it. If we grant this power with regard to any portion of time, however short, we by necessary consequence grant it for every possible extension of future time, or in other words for all eternity; because if the morrow of this day is known of itself, and without any guidance of analogy, or other experimental clue to what it may bring forth, the to-morrow of next day, and so on without end, must be equally known. But this intuitive knowledge of the future, without any experience of the past, or other means or medium of information, is one of the most characteristic attributes of Godhead; and a being who knows to-morrow, or even next moment in its own unhappened occurrences, must be capable of knowing every jot of the destiny of a world, or system of worlds, before the same is called into existence. If, therefore, we attribute this kind of knowledge of the future to any animal, whether the perceptive powers of that animal are more or less active and extended—or as we say developed—we, by necessary consequence, make a god of the animal, and thereby destroy our proper understanding and feeling of the God of nature. If we do this, we at once lay the axe to the root of all that is wise and good in our own characters, and with so impure an alloy debasing our understandings, our morality and our religion are nothing more than hypocritical fictions, for the sake of imposing upon the world for the furtherance of our selfish purposes, which, with minds so degraded and debased, can be nothing but gross, sensual, and animal. Thus an error of this kind, though committed with the very best intentions, and expressed in the most proper and even pious language, is virtually a quenching of the immortal spirit within us; and we forfeit the hope of eternal happiness by becoming unworthy of it.

We must, therefore, abandon this notion of the provisional knowledge of those animals, in the depositing of the germs of their young; and when we have done so, the question of "what other kind of knowledge can they have of the future" arises, and demands an answer.

"Coming events cast their shadows before,"

says the wizard to Lochiel, in Campbell's delightful poem. But these are the words of a wizard, a pretender to a portion of that knowledge in himself, which we have shown can be possessed by God only; and though it may be possible that, imbued with the superstitions of his native land, and touched with a live coal from the altar of Apollo, which sublimes and illuminates the fancy high and radiant above the sober, level, and calm light of philosophic thinking, the Child of inspiration may have believed or half believed what he wrote; we must bring him down to that common level, and quench and dim him to that sober light, before we can admit him as evidence. If the coming event does cast a shadow before it, that shadow must tell upon the past; for shadow, as well as light, is not substantive in itself, and therefore it is not revealed to our perception unless it tells upon something, and something substantial if it is to be very apparent. The common shadow in sunlight or moonlight tells on the ground or on the wall, but it does not tell upon the clear atmosphere. In like manner unless the shadow of the future tells upon the experience of the past, it is impossible to trace any knowledge of it; and therefore any being that is not God can have no knowledge of the future, except what it derives by analogy of reasoning from the past, upon the simple and self-evident principle that, like causes operating under like circumstances must produce the same effect at one time as at another.

This is the principle upon which man proceeds in the course of knowledge and the progress of action; but the body of man is merely animal matter, and has no concern whatever in this. Sensation, however keen it may be, and however pleasurable, or however painful, is but for the moment; and it acquires durability as a subject of remembrance only through the operation of the mind, which has the power, though we can but ill explain that power, of recalling our experience of the past, and setting it before us as our means of judgment, and our guide with regard to

the future. The invertebrated animal which deposits the egg in circumstances which appear to us to be chosen with the greatest judgment and knowledge of the future, has no experience of the past to guide her in her operations. All animals of that class may be considered as animals, that is they produce but once, and when the labour of production is over they speedily perish. They also pass through various stages of being before they become sexed animals, and some of them have their duration in that state so brief, that they do not require to feed even once before they have accomplished their purpose, and are gathered to the dust. Under such circumstances it is altogether impossible that they can have any experimental knowledge respecting what will become of their progeny, or whether one substance or situation is more fit for its reception than another. Therefore, though they do place their eggs in the best situations, no sagacity can be attributed to them on this account; and we might as well allege that the salifying principle and the base, which, when chemically combined, form a salt, have a previous knowledge of the nature of the salt which they form, as that an insect which deposits her single brood of eggs and dies has a knowledge of the future fate of those eggs.

The same principle applies to all animals, not excepting man, in so far as man possesses a material body and is animal. This body has sensation and instincts, as the bodies of other animals have, and as the whole of the senses are perhaps more fully developed in the human body than in that of any other animal, though there are various animals which excel man in the acuteness of single senses, yet we can in no instance take upon us to say that the body is possessed of any knowledge, or that it can recal the past as a guide to the future.

The difficulty of separating the portion of our actions which is bodily or animal from that which is mental renders this a very nice point in the physiology of our own nature, and it is exceedingly difficult for us to perform an analysis of so searching a nature, as to enable us to carry the animal part to the study of other animals wholly divested of the mental part. But if this is not done we spoil the whole by jumbling together elements which in themselves have no natural connexion. We have already stated the main ground of distinction; but, because it is a very important one, and not generally stated in books which treat of this subject, we shall repeat it, earnestly pressing it on the attention of the reader:—the animal principle, whether more or less developed, acts upon matter by suspending for a time the common laws of matter, and assuming to itself, contrary to those laws, the substances which are necessary for the original growth and the subsequent repair of the organisation in which it displays itself. But while it does this it has no knowledge of the matter which it appropriates, or of the laws of matter which it overcomes in this appropriation. It merely performs certain functions, which, according to our knowledge of the subject, are the evidences of its peculiar nature, and it is capable of performing these only for a time. This time is longer or shorter, according to the species; but we are acquainted with no animal which can hold out against the common laws of nature for an unlimited period of time. It appears to be a general arrangement of the whole creation, that the more general in every case shall include and controul the more particular; and though we cannot in all cases, or correctly in any case, state the precise circumstances which limit the life of an animal to that period which we know to be its ordinary duration, yet as death, by natural decay and without the contingency of disease, is the common lot of all animated beings, if disease does not peviously stop their career, we must conclude that this death is the result of causes too general and too powerful for being overcome by the energies of animal life. Hence, though the animal is enabled to overcome and controul the general laws of matter, and apply a certain quantity of matter to its organisation, yet this is a finite power and measurable by time; nor is it unworthy of remark, that, in the same species of animal, an unnatural forcing or stimulating of the power of animal life always abridges its duration; while, on the other hand, a uniform degree of exercise lengthens the life of the animal.

This shortening and lengthening of life by the means we have stated is a perfectly general truth, to which there is no exception; but it is one the statement of which requires a good deal of knowledge and caution before we can pronounce with certainty concerning it. We must know the whole of the functions and actions of life, in order that we may be able to ascertain that they are all affected equally, otherwise the means which we apply in order to procure longevity may actually have the contrary effect.

In contradistinction to what has been stated as the leading characteristic of animal life, that of acting upon matter but not knowing it, the leading characteristic of mind as it exists in man, and we know not of its existence in any other being, is that it knows matter but cannot directly act upon matter. We ought perhaps to exempt from this a certain mysterious reciprocity of action which takes place between the mind and the body, in which they appear mutually to influence each other, both in a pleasurable and in a painful manner. But upon this part of the subject we are unable to speak with much precision; because, though when we come to action in which matter external of the body is affected, or even part of the body itself moved, we can always refer a portion of such action to the body, yet in the commencement of such action as this, namely, in that in which it is induced or begun, it is impossible for us to separate the bodily part from the mental. Thus, for instance, in the act of reading a book, the eye sees a succession of variously formed spots of black on a surface of white paper, and the mind acquires a certain portion of knowledge, different in kind and in value according to the nature of the book, though the markings on the paper, except in the order of their arrangement, may be exactly the same, when the information which the mind receives is of little or no value whatever, or even when it is valueless or pernicious, as when it is of the utmost importance. That there are many mental operations intervening between the bodily perception of the printed letters and the mental understanding of the sense which those letters convey, we have no reason to doubt; but the succession of these operations is so quick that it is impossible for us to take note of them, or to feel any part of the train, except the bodily beginning and the mental ending.

This by the way leads us to another very remarkable distinction between the mental principle and the principle of animal life, and that is the total indepen-

dence of time and space which are evinced by the mental principle; whereas, though the animal principle may be rapid in some cases and slow in others, it always requires some time to produce even the simplest effect; and though the organisation in which it displays itself occupies a very small space in some instances, and a comparatively large space in others, yet it always requires some space. Mind, on the other hand, requires neither time nor space. The swiftest animal—the bird which can fly or the whale which can swim at the rate of more than one hundred miles in the hour, would require at least ten days to circumnavigate the globe, whereas thought, the only exercise of mind which we know, and the most direct evidence which we have of its existence, can go to the remotest star—to every star in the universe, in less time than the twinkling of an eye—in fact, in no time at all. So also, in regard of space, the most minute animal must have a passage opened for it; but mind requires no physical opening—no separation of matter to make room for its march, for thought can pierce through the solid globe, in a nameless fraction of the time which it requires to raise the foot in taking one step across a room.

A clear understanding of the difference between mental action and animal action (for though we speak of the principle of the being in both cases, it is the action alone which comes properly under our cognisance as matter of philosophy) is of the utmost importance at the very commencement of our study of animal physiology. The reason is obvious—almost self-evident indeed. It is impossible for us to avoid making ourselves the standard in all investigations of this kind; and as both reason and revelation teach us that we ourselves are possessed of a mind, or intellectual principle, while all the objects of our senses, and subjects of our physiological considerations, with the exception of our fellow men, are destitute of this intellectual principle, it becomes necessary that we should be able, in as far as such an analysis is possible, to separate it from the standard before we proceed with our comparisons. To do this completely may not be possible in all cases, or even in any one case, but we ought always to bear its existence in mind and make allowance for it. This circumstance alone ought to teach us to be humble, and to beware of dogmatism upon those very recondite points of philosophy, if we have any desire of arriving at the truth.

There is another elementary consideration, which it is necessary that we should well and thoroughly understand, in order to prepare us for entering upon the subject of animal physiology with proper understanding, and to profitable use. This is the distinction between created and finite though intelligent spirit, as it exists in man, and infinite, uncreated, and omniscient spirit, as it can exist in God only. It is not necessary to a right understanding of animal physiology that we should enter into the minutiæ of this last doctrine, or that we should show how perfectly consistent the whole tenor of scripture history, and the doctrine of the fall and redemption of the human race, are with the physiology of the entire system of nature, when that physiology is studied in the proper manner. We may mention, however, that those geological and other fancied contradictions of Holy Writ, which have sometimes been brought forward, will, upon examining carefully the characters and even the statements of their authors, invariably be found to have had an origin previous to that study of nature of which they profess to be consequences, and that they are thus in reality errors and perversions of the study of nature, arising from scepticism produced by earlier causes. The object of the Bible is not to teach man anything of which man can acquire the knowledge without its assistance. God has endowed man with perception, understanding, and judgment, perfectly adequate to the acquiring of every species of natural knowledge which is either pleasurable to the mind or profitable in the arts; and therefore, if God had given man a direct revelation of these things, in addition to this natural capacity of finding them out, man would have been a perfect anomaly in creation, because he would have been the only creature furnished with two distinct and opposite means of arriving at the same results, whereas every thing else in nature is perfect, and, with its single adaptation, the very best fitted for its particular purpose.

We shall suppose, for the sake of the argument, as it is both a strong and a useful one, that the Volume of Inspiration had taught man, in the plainest language, and with the utmost minuteness of detail, every discovery which science has made, and every application of such discoveries to the arts; and having made this supposition, we would bid the reader just ask himself what sort of creature would man have been under these circumstances? Is it not plain that he would have been incapable of appreciating the discoveries, or availing himself of the applications. It is not the mere ultimate discovery, the simple fact that a truth has been arrived at, which draws forth and elevates the human character, and gives that elasticity and importance to the mind which send it bounding onward in the career of philosophical knowledge and useful execution with constantly accelerating speed. It is the labour of arriving at the discovery; and the moment of success, though it be a moment of exultation, is really a pause in the mind's career. When we examine closely the history of human nature, whether in the individual or in the aggregate, we find that the adaptation of knowledge to man, and of man to knowledge, is as beautiful and as perfect as any one of those other countless adaptations which we witness around us. The senses of the body are the primary inlets of all our knowledge of nature; and in proportion as these are exercised in observing, and the relations of the observed facts are traced, we find increased enjoyment and augmented pleasure going hand in hand with what is known; and thus the lot of every man—remorse for crime apart—is nearly as happy as that of any other; that is, the measure of happiness is about equally full to all, though its capacity is very different in different individuals. Imagine it otherwise—or that the whole of natural knowledge, even as it now stands, had been declared to all mankind by direct revelation, and it must at once be perceived that the world would have been a scene of insupportable misery, because the vast quantity of knowledge without object, of desire without gratification, which would have been possessed by a vast majority of mankind, would have been torment not to be borne. But, according to the wise ordinance to man in nature, the craving and the supply come together, and upon the whole bear a very exact ratio of equality. Not that they are mathematically equal, for it is the desire which is the vital or improving principle; and therefore the perfect working of the human system, that is the rational system of man, demands that desire should keep a little a-head, for a reason similar to that upon

which every power or agent throughout nature is always made a little stronger than the average of its work requires.

When we look carefully at the matter, we see therefore that a direct revelation of the knowledge of nature would have been incompatible with the whole of the rest of creation, and destructive of all improvement and happiness in man himself. It would in fact have levelled him with the beasts; and, to use a homely expression, a rational and immortal spirit would have been thrown away upon him. Man, as a created being, is necessarily a finite one, and therefore the knowledge of which he is capable, whether by the immediate exercise of his own powers, or by a supposed direct revealment from Heaven, must necessarily have had a limit under every circumstance which we can possibly imagine. No matter where this limit is taken, for be it wide be it narrow—and admit that within it man possesses by direct revelation from God all that can be known—and to what would such a supposition reduce this knowledge? clearly to nothing else but a set of instincts; for what are the instincts of animals, the habits of plants, the modes of inorganic matter, but so many direct revelations, so many givings forth of that decree of the Creator, which sets its bound to every unreasoning thing which he has created, and says, "Hitherto shalt thou come, but no farther."

Now if natural knowledge, as one science or as many sciences, is thus perfectly incompatible with man as a rational being, it is perfectly evident that the Bible could not, consistently with its being the book of inspiration, communicate this kind of knowledge as its express and original purpose. It is true that it became necessary to extend the line of Bible history backward to the dawn of creation; but the earlier events, those antecedent to what are more essential to the grand purpose of the book, are barely touched on; and as no language could explain in exact terms the manner of the Almighty's acting in creation, the language is of course figurative. The Bible too was delivered to people at different times, and possessing very different degrees of knowledge; and the object of it being clearly that all the revealed portion should be intelligible to the majority of those to whom it was promulgated, it became necessary that, in taking illustrations from the works of nature, which illustrations are indispensable to man's understanding the truths which they illustrate, to take those illustrations in so general a manner as to avoid the temporary and local errors of speculators.

Those who read the book with attention will find that, making allowance for metaphorical language, and for the impossibility of rendering a work with absolute perfection in a translation, there is no ancient book which stands so perfectly free from violations even of the most recent philosophical truths than the oldest book of the Bible. So remarkable is this property, that there is not a single expression in the whole Bible, excepting such as are clearly and obviously metaphorical, which contradicts one single principle that experience has established in the philosophy of nature, how long so ever the expression may have been given to the world before the principle was discovered. This is a very remarkable property of the book, and one which distinguishes it from all books that ever were composed by human ability alone, whether their authors were more or less philosophical. Take any of the systems which were given to the world before what may be considered as the establishment of the philosophy of nature on the basis of experience, and leaving out of view the mythology with which they may be mixed, it will be found that, upon every point which had not been brought fairly to the test of experience, they are erroneous. It is highly probable too, notwithstanding all that has been done in modern times, that a future age will find the same imperfections in the speculative part of our philosophy. This cannot be avoided, upon the very principle that this philosophy is, by the constitution of man, left to human discovery; and perhaps there is no stronger natural proof of the inspiration of the sacred volume than its perfect avowal of this subject, and never producing error where it would have been inconsistent with its nature to reveal the truth.

These considerations are not generally, at all events they are not habitually introduced into disquisitions on physiology, and yet the subject is very imperfect without them, and unless they are made, the ignorant are very apt to suppose that there is some doubtful ground lying between philosophy and revelation, upon which the investigator of nature is afraid to enter, and the introduction of this suspicion is in itself a serious evil. It were indeed to be desired that the system of nature should be viewed in its connexion, not merely with natural theology, but with the particular revelation of the divine will to man; because if any part is left out, the very fact of leaving it out creates a suspicion that it does not harmonise with the rest.

Perhaps the most perplexing part of the subject, when viewed thus extensively, is the doctrine of the fall of man, and his redemption through Jesus Christ. But when we view this in the sober light of philosophy, we find that it is perfectly consistent with the rest of the system of nature, and we cannot easily imagine how the result could have been otherwise. We have already endeavoured to show that an immediate revelation to man of all that it behoved him to know and to do, would have been inconsistent with his character as a rational being, and have brought him within the class of other animals, over which in all their actions, the laws of nature have complete and absolute power, and which, as all that they do is not only in accordance with the law, but in consequence of it, cannot by possibility violate the law in any one respect. But a creature so tied down would have reason given to it in vain, because that would be furnishing a guide where no guidance were needed, and would therefore be the introduction of something useless into nature, which is contrary to all that we observe of nature, and to all that we know and believe of nature's Author. In order therefore that man might exercise his powers and fill his place in creation, it became necessary to leave his reason to its own exercise; and as the reason of man at any given stage of his being is not only finite in itself, but limited in respect of many parts of that knowledge which is necessary for enabling man to conduct himself in a manner the most conducive to his own advantage, it is morally and philosophically impossible that man could keep, or can keep in the right path by the guidance of his own judgment; because his knowledge never can, in the nature of things, apply equally to all the circumstances or ways in which the future may be affected by the present action. We may say therefore that

the fall, or moral departure of man from the strict tenor of the divine law, was a necessary consequence of the very constitution of man's nature, and that in order to have remained uniformly in perfect accordance with the divine law, he must have been possessed of divine powers, and ceased to be man, which would have been rendering him a totally different creature.

We do not speak of a particular statute, nor a specific act of disobedience on the part of man. There are so many ways in which man can deviate from the law of God, and that law descends so completely to the most minute and momentary portion both of acting and of thinking, that it is impossible to get any name or expression at all descriptive of the whole; and, therefore, upon this, as upon all points in the bible in which it is not possible to express what is meant in direct terms, similitudes must be used, and the meaning of those similitudes gathered from general system. The grand point, however, is, that from the place which man had to occupy in creation, and his perfect adaptation to the occupying of that place, it was quite impossible for him to keep the divine law, or in very many cases to know whether he was keeping it or not.

It is to be distinctly understood that when we speak of man's keeping the divine law, we make not the least allusion to any merit which man would have had in so keeping it, far less of any service that he would have thereby rendered to God. Irrational nature throughout all its departments, inorganic, vegetable, and animal, yields to the divine law the most perfect obedience; but it does not thence follow that there is merit in this obedience, because the hold of the law upon it is too strong for being broken; and it is because the natural law cannot, consistently with the exercise of reason and judgment, have this hold upon a rational being, that man is placed in a situation in which departure from the law is, according to the soundest judgment that we can form, the inevitable consequence.

But, though man is not thus placed under the absolute dominion of the natural law, as compelling him always to think and to act in that manner which shall contribute perfectly to his well being (for this is the meaning of obedience to the divine law); yet he cannot escape from under the power of that law; and if he is not under it for good, in the sense in which we have used the term, he must be under it for evil,—the good in the one case or the evil in the other being wholly to himself, and in no wise affecting either the law or the law giver. It is easy from this to see, that having once deviated from the law in the one form conducive to his perfect good, man was by necessity under the same law in another form not conducive to his greatest good; and that, to return from this state to the former, is even more hopeless than the preservation of the former, hopeless as we have shown that to be; for it has the error already committed, in addition to the liability to commit error anew.

Such, then, is the natural state of man viewed upon principles strictly physiological, and as consistent with the whole system of nature as any one other part of that system is with the rest:—man has departed from the law of his God, he has no power of returning, or of keeping the law for one moment of his life; and, therefore, there is no salvation for him but through one who can partake in the limited understanding of man, and yet be invested with the powers of Godhead, so that he may bring man back to the law and keep him under it, until the days of man's life as a compound being in this world are numbered. This is the grand mystery of the Christian redemption; upon which it is impossible to enter physiologically; because one element of it is the eternal Son of God, equal with the Father, and therefore infinitely above the reach of all human philosophy. In this world, therefore, the system is of necessity a system of faith; but, independently of the direct evidence of the facts, the perfect consistency of its physiology with the nature of man, places it upon a foundation which nothing but headlong ignorance can dare to assail.

Such as have not been in the habit of connecting this subject with the general system and physiology of the works of God, must not suppose that the few observations we have made are out of place. The subject of religion, viewed in itself, and as between man and his Maker, without reference to human forms, is the most important consideration which the human mind can entertain; and though it is of too sacred a nature for being introduced upon trivial occasions, and too holy for being prostituted as the cloke of hypocrisy, yet it ought never to be omitted when the occasion harmonises with the introduction of it. Having said this, we shall now proceed to notice very briefly one or two of the leading points more immediately connected with animal physiology.

In the former part of this article we have made allusion to the principle and the action of animal life; and leaving these words without explanation, it might, perhaps, be supposed that we alluded to some distinct existence apart from the material substance composing the body of an animal, which that animal possesses. Now nothing is farther from the truth than this. We know nothing of a general animal, which is not any one of the species with which we are acquainted, and yet which includes them all. This was the doctrine of the schoolmen, who in their systems put the wrong end foremost; by supposing that language, according to all their rules and substitutes, was first invented as a complete system, and then adapted to the objects of observation and the subjects of thought. So far from this being the case, these general words are only abridged names for all the particulars to which they apply; and, in the case of any one of them, it is more or less general, according to the extent of knowledge possessed by the party using it. A person who had never seen or heard of any but one species of animal—a horse for example,—would have his general word animal limited to that particular species; and so also if he had never seen or heard of any but one brown horse, his general word would have no further meaning than that single individual. It will be in the recollection of many that when sheep and goats were first introduced to the notice of some of the natives of the South Sea Islands, these natives were very positive in declaring them to be birds: and, simple as this fact is, it serves to show how completely the extent of our knowledge limits the real meaning of our words, however we may pretend to use them.

In this, the proper view of the matter, our word animal extends just as far as our knowledge of what we have resolved to call animation; and when we speak of animal life, we do not use the word life as expressive of some substantive existence which belongs to an animal; we use it as a general name for all the

functions which the animal performs; and then we form our systems, or indices to particular groups and species, upon the modifications of those functions or the results of them. The materials of all this are, however, originally obtained from observations made upon individual animals.

In the case of a single animal, we naturally say that every thing in the appearance, habit, structure, or any thing else of an animal which we can find in no other department of nature, is the result of a function of animal life; but this is nothing but a short expression for its belonging to and being characteristic of an animal, and not of any thing else.

If we attend duly to such precautions in the use of words as we have now stated, we may with safety introduce a nomenclature, and subdivide and arrange the functions of an animal in the same way as we do the different parts of any other branch of knowledge; and though the words which we make use of for such a purpose, are nouns or names, as well as those by which we express substantive existences, we need not on that account confound the realities.

Animal life, then, is the general name for every function which an animal performs; and, of course, it varies along with those functions. The principal functions to which it is most essential to advert in a physiological point of view, are organisation, muscular contraction, nervous agency, and sensation; and upon each of these we shall offer one or two brief remarks.

Organisation is the name for the general process by which new matter is applied to the body of an animal, whether for the general increase of its bulk by growth, or for the repair of any part that may be wasted. This organisation is, however, far from a simple result; on the contrary, it is exceedingly complicated; and as we know the function only from the result, the function must be as complicated. The operations which it performs are in brief as follows: first, the original growth of the body; but this is exceedingly complicated, and is probably very much modified by the other general functions to which we have alluded, and also by the progress of its own development. In the progress of animal growth there is not, in any stage in which we can observe its operation, a mere accumulation of matter upon the rudimental part or germ previously existing. The very matter itself is always a product, and undergoes an operation by which its former aggregation, state, and composition, appear to be completely changed, and a sub-division of all the parts made, probably down to the ultimate atom, before the new compound is formed. This is what we may consider as the initial step of animal organisation, or perhaps we ought to say animalisation, because we must suppose it to take place previous to the formation of any specific organ. We do not, however, find the new matter in the animal structure in that state of its growth which altogether precedes organisation; and therefore the mode of working in this, the most elementary process, must remain one of those mysteries of nature into which we cannot penetrate; and we know not whether the new matter remains in this first animal state during a measurable portion of time, or during an indivisible moment only.

The second stage of the process, though still veiled in great obscurity, leaves traces of its operation in the animal; and therefore, though the working be just as mysterious as formerly, we can see the effects. In the case of the mammalia, we have reason to believe that, up to the complete organisation of the young one in the maternal uterus of the placental animal, the arterial blood of the mother is the matter which goes to the increase of the fœtus; but even here there is a mysterious application of two surfaces, both apparently imperforate, where the maternal and fœtal parts of the placenta are applied to each other, and while we lose the extremities of the maternal vessels as we approach this singular application of surfaces, which appears to perform the functions of union and separation at one and the same time, we are led to conclude that there is a perfect elemental change in this blood before it passes from the one to the other; and we have a further confirmation of this in the fact that the globules of fœtal blood are not of the same size as those of the blood of full-grown animals of exactly the same species.

In the case of marsupial mammalia, we cannot speak with the same precision as in that of the typical or placental mammalia. In them the uterine gestation is no doubt placental, as well as in the others; though as a placenta, like every other organ, is developed only as it is wanted, it is much more obscure in them. But still when the fœtus is transferred to the marsupium, and freely exposed to the action o the atmosphere, it is still in a very formless and rudimental state, and its future growth, exposed to the action of the air, must be different from that of a fœtus not so exposed.

In both cases, however, the first development of which we are sensible, is a development of organs; and it is well worthy of remark, that those organs appear to be developed very much in the ratio in which they are wanted in the economy of the animal. The theory of development formerly alluded to has been had recourse to in this matter, but with very little effect. It does not appear that there is any good ground for supposing that a single organ of the mammalia changes from its original type, with which it starts even before we can observe it; there is not much greater reason to believe that any one organ originates another, or even that any of the four classes, into which we have said the animal functions can be divided, can in any one of its modifications originate another, although there is not the least doubt that, in their healthiness, and also in their disease, they act and react on each other; so that though no one of those systematic divisions (for they are not natural ones) can be supposed to originate or give life to another, we have every reason to conclude that the morbidity of any one of them can destroy the soundness of each and all of the rest. We have a proof of this in the application of putrid animal matter, and more especially if it be matter of the body of an animal of the same species, to parts which are sound and healthy. The touch of the sound does not heal the diseased, but the touch of the diseased contaminates the sound, and, whether the corrupt matter is general or local, the portion over which corruption triumphs is lost for ever. The pit of the small pox, or the honey-combed scar left by vaccination, when it takes proper effect, is never obliterated in after-life; though much more serious injuries, resulting from mechanical means, are often so changed that hardly a trace of them remains.

These facts tell us little, however, except the extent of our own ignorance upon this subject; and the most careful observations, and the most cautious conjectures, which have been made on the subject, leave it in its original obscurity. The very first movement of

the rudimental animal is really the movement of an organised being, however simple its organisation may be; and we might perhaps infer this from the fact of there being no new animal originated, without an act of union on the part of animals already existent. While the rudimental animal is still an extenseless thing, or in that state in which it has been called the *punctum saliens*, or starting point, it consists of a containing membrane and contained fluid, which reciprocally act and react upon each other as the first motions of life which it is possible for us to observe: but even in this state of the mammalia we have no trace of those inferior organisations, through which it is customary with some theorists to suppose that an animal must pass, before it is developed up to the dignity of the mammalia; for this *punctum saliens*, at the time of its first and feeblest rudimental flutter, is not only an animal but a vertebrated animal; and not only vertebrated, but clearly and specifically mammalia, and not another class. We cannot speak with so much precision as to how the case stands with the marsupial animals, because they have not been subjected to the same careful examination; but there is not the slightest doubt but that all the true mammalia are as characteristic in the first movement of their rudiment, and even in their rudiment before it begins to move at all, as they are in the full development of their strength and vigour. On this, as on all other branches of animal physiology, more attention has been paid to man than to any other order of mammalia; but in so far as they have been examined, the law regarding them appears to be uniform. They are vertebrated animals; and the spinal column is the first distinctly traceable part of their early organisation. It is impossible to say that this is merely the medullary substance of the spine; for the probability is, that it contains the rudimental bone, though both the bone and its contents are yet nearly in a fluid state. It is remarkable, however, and calculated to prevent us from doing wrong, if it does not carry us far in the right way, that the spine is developed before the head; for at its first rudimental appearance, the head, which afterwards increases so much in proportion to the spine, is not perceptibly thicker; and altogether the development of the spinal column precedes that of the brain, properly so called, though by the time of regular parturition the development of the head has got greatly the advantage.

The only inference which we can with safety draw from this is, that the different organs are developed and come to maturity in that order of succession in which the animal requires them, which is saying little more than that, both in the young and the mature state, the adaptation of the animal to the circumstances in which it is placed, is always the best that we can suppose.

There is evidently an intimate connexion between the early developments of certain parts as compared with others, and the influence which those parts have upon the general organisation of the body; and perhaps there are none which are in this respect more characteristic or more important than those which determine the specific part that the individual is in future to bear in that most important of all the merely animal functions, the preservation of its race, notwithstanding the successive deaths of generations.

The development (for we may safely use this word in merely speaking of the actual fact of the growth and expansion of an organ which we can trace, and do not copulate it with any other organ or separate substantive power by which as a substantive existence, we suppose the organ to be developed)—the development of those parts of the body in which the different functions of life display themselves, varies greatly in the different order and genera of the mammalia. Generally speaking, that part of the organisation which carries on what are sometimes termed the vital functions, or those of nutrition, circulation, and respiration, is the first to be perfected; and we have at least an apparent reason for this in their necessity to the development of the rest. The organs of locomotion, and of those other motions which are usually called voluntary, or which the animal appears to have controul over in suspending or continuing at its pleasure (at least within certain limits), vary perhaps more in the degree of their development at the time of birth than any of the others. This might be expected to vary in proportion to the nature of the food of the animal, and the degree of ease with which this food can be reached and taken possession of. Thus a grazing animal which nips the tender leaves of the grassy sward that supports it, can find its food at a very early age, because the finding of such food requires comparatively little labour or strength, or what we call sagacity. An animal, on the other hand, whose food requires greater exertion and effortt, and has to be lain in wait for, or hunted down, or taken by force in any way, and against resistance, requires a greater degree of development before it is able to depend on its own resources. We accordingly find that such animals are fed as well as suckled by their parents, and that in the young state they are gentle and playful, and do not acquire their predatory dispositions until the weapons, and the muscular structure necessary for the working of those weapons, have acquired the proper tone.

There are differences in different species, for which the physiological causes cannot perhaps be assigned in a manner altogether satisfactory. But still it is a general law, the deviations from which appear to be perfectly explainable in so far as we know the facts, that the length of time requisite for bringing the animal to perfect maturity, bears a pretty constant proportion to the resources which the full grown animal is to possess, and the necessity which it has for those resources. The human race furnish perhaps the most remarkable instance of this. Human beings are longer in arriving at the full development and exercise of their bodily powers than any other animals, even though the lives of those animals are of longer duration than the life of man; and when in addition to the bodily powers we take the mental sagacity, we find that this goes on increasing, even after the decay of the others is far advanced, which, by the way, is a strong proof that those powers have quite a different origin and depend on a different agency from the mere powers of the body. In this last respect we cannot find an exactly parallel case in the rest of creation, because there is no mind there; and in our virtual analysis of human nature, it is difficult for us in all cases to separate the mental portion from the bodily; but in as far as this can be done, we have the analogy continued in man, who, as being the animal of most varied resources, viewing him merely as an animal, is also the one of most tardy development. The same holds good in even the two sexes of the human race. As society is constructed and conducted in all

countries, and we must conclude from the universality of the fact, that there must be something natural in it, the male is, taken upon the average, though there are many individual exceptions, possessed of much more resource than tho female, and we find that the female comes first to maturity.

But it were idle to follow the details of a subject, the grand connecting portion of which is beyond our reach; and, therefore, though we cannot but admire the process of growth in animals, and the adaptation of the various parts of that process to the necessities and habits of different animals, yet the commencement, the rationale, and the principle of this process lie beyond the reach of our inquiries; and, whether we address ourselves to the living animal, or dissect and analyse the different parts and structures of the dead one, we equally fail in our attempts to arrive at any thing which we can distinctly consider as life, or the principle of life; we know life as it displays itself in the living animal, but beyond this we are wholly in the dark concerning it.

Nor are we better with regard to the particular process by which individual portions of this work of animalisation is carried on, whether in the growth of the animal body or in its repair. This is the second branch of the general doctrine of organisation; and the common name of secretion which it has received is of itself enough to show that we know very little about it. There is no doubt that the organic changes constantly going on in the animal body are exceedingly numerous; and that though we give the name of secretions to a certain number of the permanent products of those changes, yet there are others of so evanescent a nature as that they leave no trace in the structure of the animal, but vanish with the action of which they appear to form part. So far all the named secretions, or rather perhaps the preparations for them, appear to be mechanical, and whether the matter of the secretion is taken directly from the general mass of the blood, or consists of other matters, the process is to some extent mechanical. As the secreting apparatus is approached, there is a subdivision of the conducting vessels into parts still more and more minute; and it has been found that if a more dense and a more subtle fluid be injected into those vessels by mechanical force, the subtle one will extend further, and into more minute ramifications, than the other; but in no instance has the seat of secretion itself, that in which a distinctly new substance is produced, been reached by any effort of human ingenuity. This matter of secretion in the body of an animal, whatever the product of the secretory process may be, brings us always to a difficulty of the same kind as the original production of animal matter, and we have no more means of solving the difficulty in the one case than in the other. We can follow both to the extreme limit of the eye and the microscope, but at this limit they take farewell of us, and veil themselves in obscurity without vanishing from existence. We know that the ramification of the conducting vessels into diameters still smaller and smaller at every branch, must mechanically subdivide the blood or other fluid contained in them into parts still more and more minute, as the ramifications are further and further carried on; and we are also led to suppose that in proportion as this division becomes more minute, the action between the internal surfaces of the containing vessels and the fluids which they contain must be greatly increased, upon the principle that the contents of vessels are as the square roots of their surfaces, or the surfaces or the squares of the contents. We have also some reason to believe that all living action, whether animal or vegetable, is ultimately reducible to the action of surfaces upon each other; for this is really the law which is followed in all the analogous kinds of action, and we find it in every rudimental case in which we can observe action either in animals or in vegetables. All this, however, is but little; and when we have reached this length, we leave the rationale of secretion as we are forced to do that of life and growth—very nearly where we found it. We must, therefore, however desirable it might be to obtain more intimate knowledge of the subject, leave it and proceed to the others.

Muscular contraction is the one which naturally follows next in order; and it it is probable that in the growth of animals, it, to some extent or other, is the first modification of what we call the general organising, or rudimental production of an animal. So far as is known, this function is peculiar to animal matter, most ordinarily resident in the muscles, but still transmissible from one part of the body to another, even though there is no muscular connexion between them. This function, or rather the power which is understood to give origin to this function, has been called *irritability*, and a variety of other names; but it is like all the other powers for specific purposes which have been attributed to animal bodies, or to different parts of them—we know nothing of it as a power, we merely observe certain effects; and we use this name power, or any of the particular names, for the purpose of enabling us to speak about their unknown causes, by which again is meant those states of the animal body, which take place before we can begin our observation of it, and which of we of course can with certainty know nothing. It was long confounded with what is called nervous action; though subsequent experience has shown that though combined in producing certain joint effects, they are yet distinct and separate, both in their nature, and in the parts or structures of this animal body in which they peculiarly reside.

It is of little consequence what name we give to this power, so that we understand the effects of the power itself; but it is of the utmost consequence that we should understand these, and how they differ from each other in different animals, and under different kinds of excitement; because this is a part of the subject essential to the proper explaining of very much of the action of animals. Haller was the first who gave even a tolerable account of the phenomena of this power; and as he used irritability as the discriminating name for it, it is not worth while to alter the name, if we rightly understand the sense in which it is used. It is not irritability in the common sense of the term, in which it means anything indiscriminately which gives pain or annoyance, which must be understood of this irritability of the muscles; it is the fact of a healthy muscle shortening in length, and at the same time swelling out in thickness, when certain stimuli are applied to it.

What those stimuli are, and whether they are the same, in all natural cases, in the same muscles of the same animal, we have no means of ascertaining; and there is as much difference among physiologists respecting the ultimate structure of muscles. They are all composed of fibres as already stated; but how those fibres contract is a point upon which there exists

no precise information, and therefore the theoretical explanations which have been from time to time attempted, have generally borrowed their foundation from the particular department of science which happened to be most fashionable at the time of their invention. Among the oldest of those theories, or rather hypotheses, for none of them amounts to a theory, is that of Borelli, who describes the muscles as consisting of rhomboidal vesicles, which are empty and stretched in length when the muscle is relaxed, but filled with a nervous fluid, which enlarges their diameter and increases their length when the muscle contracts. The principal objection to this hypothesis lies in the facts, that we are acquainted with no nervous fluid which circulates, and could be injected into muscular vesicles by any mechanical power; that there is no structure in which such a power could reside, unless we supposed the contractility of the muscle to be transferred to it, which would be no explanation, and that muscles retain this power after all nervous connexion with them is broken off. That action, and very powerful action, mechanical in its effects, is produced by the contraction of muscles we cannot deny, for we have instances of it before us every day, and that the exercise of this action is intimately connected with the general energy of all the functions of the animal is also true; but neither the one nor the other of these, nor any other hypothesis, mechanical or chemical, throws any light whatever upon the real cause in which muscular motion originates.

In the mammalia, the muscles are more copiously supplied with blood-vessels than any other parts which are to be considered simply as working structures, and not engaged in secretion, or in specific action upon the blood itself; and a degree of heat is always excited by violent muscular action; but it does not appear that either of these is connected with muscular irritability. For in other animals, which have the circulation far slower, as for instance in reptiles, the irritability of the muscles is much greater, and they can be excited not only after the circulation has been stopped, but after the limb containing them has been separated from the body.

Observation and experience would thus lead us to suppose that muscular irritability is an antagonist to the stimulus of the blood, to that of the nervous agency, whatever that may be; and generally speaking to all other agents, external or internal of the system, which can have an influence upon muscle; and that therefore the contractility, in which way soever it originates, is a power perfectly *sui generis*, and explainable in or by nothing but muscles themselves. When the muscles serve for the purposes of propelling the contents of vessels, we may generally suppose that the contents are the stimuli of these vessels; and we have pretty convincing evidence of this in the fact that the introduction of artificial stimulants, even in small quantities will increase the excitement, while sedatives have a contrary effect. The stimulus of arterial blood appears to be a powerful one, and one which is essential to the excitement of muscular action, especially in the mammalia. Dr. Fordyce notices a fact, which shows that the power of muscular contraction can greatly exceed that of the stimulus by which it is excited. Upon introducing a needle into the ventricle of a very recent heart, and touching the inner surface very gently, the ventricle contracted with so much force, as to force the needle deep into its surface. This is farther illustrated by the well known fact, that animals, especially when in a state of excitement, run forcibly upon any weapon which pricks them ever so slightly, and in this way horses, and also men, run upon weapons in battle to their certain destruction.

Every possible component part of muscular substance, and every agent which appears to affect the action of muscles, have been investigated with the utmost care; but though it has been repeatedly shown that many, if not all of these, are necessary to the production of muscular action, it has not been proved that any one of them, or even the whole of them taken jointly, are the real sources of that action. It is unnecessary, therefore, to follow them further into the details, although to profound physiologists those details are of the utmost value.

A power directly the opposite of that of contracting has sometimes been attributed to muscles; but it does not appear that there is any reality in the supposition, and indeed it is opposed by the whole analogies of the case. We never find a contracting muscle which tends to draw a part of an animal to any distance in one direction, which is not accompanied by a counteracting power which can bring it back again, or move it in the opposite direction. In the limbs of the mammalia, and in all parts of their bodies which are concerned in their external motions, there are antagonist muscles set against each other as it were; but if the object is merely to bring back a part to a certain position, it is not necessary that the antagonist which effects this when the muscular action is over should be a muscle. An elastic ligament attendant, or even the cellular tissue, may effect this purpose, and there is little doubt that the cellular membrane which sheaths the fibres and fasciculi of the muscles tends to restore them to their form in repose, when the contracting action of the muscular fibres, properly so called, is at an end. Many membranes in the living animal possess a power of contracting in every dimension, at least in extent of surface, under the operation of proper stimuli. This is called corrugation or crumpling up, and it enters to a considerable extent into the structure of those animals which which have soft parts. In the mammalia, however, which have the skeleton more perfect, and the muscular system more distributed than any of the other animals, muscular irritability is to be regarded as the grand source of motion, and the only one to which it is necessary to have much recourse in treating of such actions of those animals as are necessary for understanding their habits and adaptations in a popular way.

The action of the nerves is the next department of the physiology of the warm-blooded animal; and as those nerves in the central part of their system are protected with much more care than any of the other parts, and are much more developed in the mammalia than in animals possessing less sagacity and resource, it is natural to conclude that they form a very important portion of the structure, and one which must not be overlooked. This is, however, a branch of the subject which is exceedingly difficult in itself, and to the consideration of which we are in great danger of bringing some prejudices, or at all events some mistakes, along with us to the contemplation of it. In all the more complicated phenomena of the living animal, particularly those of sensation, and of action as consequent upon sensation, we are in con-

tinual danger of carrying the matter further than animal physiology in the proper view of it will warrant. This is unavoidable, from the circumstance of our naturally taking ourselves as the standard of judgment in these cases; and from there being a mental process in addition to the merely animal one, in every case in which a *known* impression is made upon our senses. There may be slight momentary affections of the body as matter, which pass away without mental cognizance, just as there are mental impressions once known which may never again return in those suggestions to which we give the name of rememberings; but in every case, where the impression on the sense is sufficiently powerful and continued, for the mind taking note and forming a judgment concerning it, there is an element between the initial impression on the sense and the final thought, whether that thought does or does not ripen into action, which can belong to no other animal. This mental part of the succession is inferred rather than originally felt even by ourselves, and therefore the separation of it is in all cases exceedingly difficult.

There is another source of difficulty;—we can say very little of the mode of action in nerves, because there is nothing to which we can compare their structure. It does not appear that there is any circulation in it; and it does not appear to be a substance calculated for transmitting any powerful kind of action of a mechanical or chemical nature. The most careful examiners are not agreed as to the structure of nervous matter, and even though that were made out, it would not explain nervous action. That it is a means for the very rapid production of animal action, we have no reason to doubt; and the analogy would lead us to suppose that that which it resembles the most, though we cannot say that they are identical or even alike, is that display of action to which we give the name of galvanic electricity. We know that this electricity is one of the most powerful solvents that can be applied in the arts; and as the arts cannot, of course, introduce a principle, or even a mode of action, further than as it depends on the use of apparatus, we may naturally suppose that this mode of action enters very largely into the operations of nature; and more especially in the more delicate functions of life in the mammalia as the most highly developed of animals. It is known that the division of nerves, connected with organs of secretion, impairs the functions of those organs, though the way in which this takes place is not so clear a matter. There is one other analogy which would lead us to conclude that there is such a connexion between the excitement of nervous action and that of galvanic electricity as has been stated; for those fishes, such as the torpedo and the gymnotus which have electric organs, which resemble galvanic batteries, and are capable of giving severe shocks, have always those organs very copiously supplied with nerves. We must be on our guard, however, against laying too much stress upon this analogy, or supposing that our galvanic batteries can point out to us how such batteries are worked by nature; because too much credulity on this subject, or too much of some other means of bringing it forward, is has occasionally introduced much electrical quackery into the art of pretended medicine.

That the excitability of the nerves, even in man, is not necessarily connected with or dependent upon sensation, in the common meaning of the term, to say nothing of mind, is proved by many direct experiments; and indeed the actual existence of life does not appear to be absolutely essential to the one any more than to the other; for it may be called into action not only after the part has lost what is properly termed sensibility, but after it is divided from the body. A certain condition of the organs in which it is excited, as well as a certain composition in those organs, appears to be necessary to the production of this excitement; and in the mammalia and other warm-blooded animals there must be a connexion of nervous substance, freedom to act, and a continued supply of blood; but from some experiments detailed by Dr. Philip and Mr. Brodie, in the Philosophical Transactions for 1822, it appears that absolute continuity in the nervous substance is not essential; for when the ends of a divided nerve are brought very near to each other, the communication by means of that nerve is not wholly destroyed. The whole doctrine of the nerves and their modes of action is, however, very imperfectly known; and what is known is not well adapted for popular explanation.

Sensation, the last function of the animal system to which we deem it necessary to advert, is so closely connected with nervous excitement, and the obscurities of the one are so much involved in those of the other, that we cannot speak confidently beyond what we feel in ourselves, and there are doubts and difficulties even there. The word too has been used in different senses, and in some of them with great latitude of expression, though in other instances it has been narrowed beyond its proper meaning.

Generally speaking sensation, or rather sensibility, for sensibility is the function and sensation the exercise of the function, is applied to the quality of receiving impressions from objects or causes external of the organ immediately impressed. Those impressions are very different in their results, even in the same animal, or part of an animal. They may be pleasurable, they may be painful, or they may be decidedly neither the one nor the other, but merely what we may term informatory, and their effect may be to produce, terminate, or suspend the actions of the body both external and internal.

Sensation, in this view of it, extends almost to every part of the animal system; for if the part is considered as not immediately capable of receiving an impression itself, it always can transmit the impression to some other part which can. In a perfectly healthy state of the body, and in undisturbed repose, as when it is in dreamless sleep, it is all insensible to slight impressions; and if the sleep is very profound, it may be seriously injured without sensation till the injury is done. In disturbed sleep, which is broken by dreams, there is always some remnant of sensation, arising from a disturbing cause; and thus dreaming is not, in its primary state, an affection of the mind even in man; for, from the very nature of the mind, it cannot sleep, and in those animals with which we are familiar in their sleeping hours, there are evidences of dreaming as well as there are in man, though we are as ignorant of the nature of their dreams, or of how these differ from our own, as we are of the difference between sensation accompanied by mental action and sensation not so accompanied. Various diseased conditions of different parts of the body will also bring very acute sensation into parts which do not possess it when in their natural state of health, as for instance tendons, ligaments, bones, and even fatty substances may experience most acute pain from

diseased action. Irritation or pressure will produce these results: and this would lead us to conclude that all sensation is ultimately resolvable into some suspension or change of the general motions or actions which are continually going on in the very complicated structure of the animal; and that the sensation, whether its immediate cause is external or internal, is extensive in proportion to the extent of this resistance. We have a very clear proof of this in those cases in which both men and animals are panic-struck by appearances or impressions of any kind upon the senses, which are not only not dangerous in themselves, but which under another previous state of the system would be regarded with perfect indifference, and probably with pleasure.

The most interesting, but at the same time the most difficult, portion of this branch of physiology is that which treats of sensations that lead to action in the animal. In the mammalia, and in other animals not endowed with mind, the reciprocating principle, which as it were transfers the sensation to action, is called an instinct, and this instinctive mode of action prevails also in man, and the form of it is put on after long habit, in many cases of which the first instances are the undoubted results of mental inquiry and determination, upon judgment formed according to the evidence. From the difficulty already mentioned as arising from our inability so to analyse our sensations, or rather the impressions we receive, into the animal part and the mental part, and this additional difficulty produced by the merging of processes once mental, in habits merely animal or little else, render this an almost inexplicable part of animal physiology. Many hypotheses have been formed for the purpose of explaining it; and as in these hypotheses structures have been endowed with gratuitous or imaginary functions to make them agree with the phenomena, there is some plausibility in every hypothesis of this kind, but it is impossible to say that there is philosophic truth in any of them. One of the most commonly received of these hypotheses has been that of two sets of nerves, one of them originating in the brain and its spinal continuation, and ramifying thence to all the surfaces and terminal parts of the body, where their extremities, furnished with certain structural apparatus, such as papillæ for touching and tasting, and more complicated structures for hearing and seeing, stand as sentinels there, and send word of whatever is going on to the great central mass of nervous matter, which, according to the hypothesis, is the sensorium or seat of instinct in the irrational animal, and of instinct and mind jointly in man. It is to be understood that this is perfectly gratuitous, or that at all events the alleged functions have been invented or shapen so as to suit the phenomena which are said to arise from their exercise; but there is a business-like mechanical detail about it, and therefore it has never been without numerous and devoted adherents.

But before any novice takes it up dogmatically, he would do well to consider that we are, and are likely for ever to remain, in perfect ignorance of the principle which moves the smallest fibre of the most delicate muscle in its contraction; and as this sensorium is a structure of many "stories," resting upon the supposed knowledge of this power of action in the muscular fibres as its very first foundation, it cannot surely have much more philosophical stability than that upon which it is presumed to rest.

It may not be amiss to notice the second or reversed part of this supposed communication, between the nerves which are ramified through the organs more immediately concerned in action and the sensorium. The course is the opposite of the former, according to the hypothesis, but not necessarily by the same means, as the perception and the action may not be performed by the same parts. It may, for instance, be the sight of a hare by a greyhound or other dog, and the following of that hare in the chace; or it may be any other sensation, and any other action; but there is always understood to be an informing of the sensorium, which is not supposed to have in itself any direct knowledge of the external world, or even of the internal structure or action of the body of the animal; but which nevertheless always decides whether action shall or shall not follow the deliberation on the evidence, and in what manner and to what extent the action shall be carried on.

All this is done too by means of organisation in the sensorium; and the different parts of this organisation affect the result differently, according to their different degrees of development and consequent power. Thus a village cur, with short bandy legs and a wriggling body, sees a hare as well as the greyhound did. His organ of acquisitiveness is instantly roused, and off he waddles, losing on the hare at every step, because his organs of locomotion will not obey the full bent of the acquisitive organ. Thus, in him at least, we have the effort of the sensorium foiled by the stubborn resistance of the external organs. Innumerable cases of a similar nature might be mentioned, in which it is impossible to impute the success or failure of the action, or even the commencement of it, to any thing but the general structure and present circumstances of the animal, and this casts much doubt upon the whole hypothesis.

But the whole case as it applies to the mammalia, and by necessary consequence to all the lower classes of animals, must necessarily be explained upon animal principles alone, without the slightest reference to any thing mental; and this notion of a sensorium, consisting of a certain portion of the animal's organisation, which receives the impressions of the senses either from the local organs of particular named senses, or from the general sensibility of the animal; and then, after duly understanding the impression so brought, puts the organs of action in motion, according as the result of its judgment may be, is really endowing the animal with an intellectual principle or mind, whatever name may be given to it.

The author of this article does not believe that the source of action in animals, even of that kind which is consequent to sense or perception, can be shown to have its seat in the brain any more than in other parts of the structure. That the brain is the central mass of the nervous system, and that it supplies nerves to the organs of the allocated senses, which are, for convenience of use, situated in the head of all the mammalia, is perfectly true; and it is equally true, though the particulars are much more obscure, that a healthy state of the nerves is necessary in order to make those organs perform their functions properly. This, however, proves nothing as to any exclusive possession of the faculty of sensation, and of the stimulus to action in the nerves; for a healthy state of the blood vessels, and even of the lymphatics, is just as essential to the proper functions of the organs of the senses as a healthy state of the nerves. We have an instance of

this in the fact that when the vessels immediately surrounding the eye are relaxed and distended with lymph, in consequence of long and severe exercise of the organ, the sight becomes dim, the eye will not adjust itself, and small objects are seen double. One of the most immediate remedies for this is the application of a sponge soaked in a solution of salt; and this acts by drying up and giving tone to the parts, so that the delicate muscles, which adapt the form of the eye so nicely to its purpose, are again enabled to act. We know that salt applied to a muscle will make it contract, whether the nerves of that muscle are or are not removed; and therefore this application of salt, as a tonic to the region of the eye, obviously gives an artificial power of contraction to those muscles which had been exhausted and relaxed by excessive use.

From this, and from a countless number of other instances which could be enumerated, it appears that the impressions made by objects of sensation, are really addressed to the muscles, and not to the brain through the nerves, however necessary a healthy state of the nervous system may be to the proper performance of the functions of the muscles, in sensation as well as in action. Indeed it is difficult to understand how there can be any pause or medium between sensation and action in an animal which proceeds upon instinct, and not upon the judgment of experience, which in all cases requires deliberation. In man, where there is an intellectual principle, to make the comparison and draw the conclusion, we must admit that sensal perception, intellectual judgment and decision, and bodily action, are the three parts of the compound process, when that process is complete. But it is probable that, even in man, the operation of the middle part may sometimes be left out, and man may play the animal; and we have stated already that there are other cases in which from habit the mental part of the process is unheeded.

But when we return to the animal, and consider its case in comparison with the complete case in man, which is always our natural standard in these matters, we do not see how there can be any middle part of the process in the animal, unless we attribute this part to something mental; and as the want of the grand characteristic of mind in all mammalia, even the most sagacious—the total absence of any tendency to communicate experimental knowledge among themselves, or to hand it down from generation to generation, each generation adding its part to the general mass, forbids us from coming to the conclusion that any of them can possibly be possessed of mind, we are driven between the horns of a dilemma, and cannot avoid concluding either that the animals are possessed of mental and therefore immortal principles, or that the entire nature of man is material, and lost for ever as regards the individual, in the dissolution of death and the decomposition of the body, in the very same manner as in the other animals. But either of these conclusions is so contrary to the evidence afforded by nature generally, and by the physiological examination of man, that, leaving revelation out of the question, we cannot entertain either, without outraging every principle of sound philosophy.

We have direct proofs in some animals, that the power of originating action is not altogether seated in or directed by that portion of the nervous mass which occupies the skull. Many reptiles can move about after the head is separated, or the spinal marrow divided, though their motions are not so regular as when entire; but this is the case in every mutilation of an animal, and therefore, when an injury is done, we are always warranted to suppose, that if it affects any of the general systems of the body, no matter which, it affects the compound structure of the body, in its functions as a whole, to the very same extent. Many readers must have heard of the archery of the emperor Commodus in the circus. He had his arrows made with a cutting edge, and these he discharged at ostriches driven across the arena, so as to cut off their heads when about mid-way, and they ran headless to the end of their journey. The same has been observed in many other birds, and also in the lower classes of vertebrated animals. In the mammalia the separation of the head, or the division of the spinal marrow, is attended with much more immediate effects, for the animal is instantly thrown into a state of complete stupor; but still there are some instances in the smaller animals of this stupor wearing off after a little, and the animal making efforts to reach the wound in the neck with the hind feet, so as to alleviate the pain, which animals that have much action of the feet always attempt to do, by bringing the foot to the wounded part if they can reach it.

From all the evidence which we can collect, indeed, it appears that there is no pause, no intervention of a middle process between the sensation and the action to which the sensation leads. But it does not follow from this, that sensation in animals should in all cases be continued into action, because every animal requires some excitement, and even the same animal requires more excitement in some states than in others. Indeed, it is this necessary connexion between the degree of excitement and the result, as constituting only one state of the animal, which leads us to call the actions of animals instinctive, and which gives them a certainty and a regularity which those of reasoning man cannot by possibility possess. The animal is not a machine in our sense of the word, that is to say, the working of its system is not mechanical, or chemical, or even compounded of the two, but it is animal, or peculiar to this particular form of created being; but notwithstanding this, inanimate and inorganic matter is not more obedient, or more instantly obedient, to the laws of physics and chemistry than every animal is to the laws of animal life. Those laws vary with generic and specific differences, and circumstances vary them, though less extensively, in the individual; and we cannot account for the original differences of species; but our ignorance of the same differences is as great in the case of inanimate substances, and our ignorance ought certainly not to be made a ground of argument.

To enter into any details of the physiology of mind, farther than the general distinction between it and animal action, which has been already hinted at, would be inconsistent with the nature of this article; but if it is once established that the nervous system, as well as the systems of circulation, nourishment, motion, and all the others which have different organs in the animal structure, are constituent parts of that structure, and that the proper efficacy of each in the performance of its functions, requires the healthiness of the others, just as much as that of itself; then it cannot be pretended that any one system singly can be the seat of voluntary action, or of the cause and stimulus of voluntary action, when that action requires the co-operation of the whole. The more vigorous,

active, and, as we say, intelligent the animal is, the more completely are the parts of its system developed; and this holds in the case of the human body as well as in the bodies of all animals. It would therefore be inconsistent alike with general reasoning and with the facts, to suppose that there is any difference in kind between the nervous system of man, and that of the other mammalia; though as the senses, taking them altogether, are more uniformly strong and more constant in their exercise in man than in the others, for this reason, and apparently for this reason alone, the brain in man is much more developed; and in proportion as we find the senses more feeble in some of their number, and more partial in their general exercise, we find the brain smaller. But when we attempt to make the brain the means of explaining any of the phenomena of mind we are still more in the dark, than when we endeavour to make it the means of explaining the phenomena of sensation and action in animals. In every case where the impression in sensation or the exertion in action is sufficiently strong, we find that it extends to the whole body of the animal, and that the agitation of the parts most remote from those which are immediately affected in sensation or exerted in action, is in some cases as great as that of those parts themselves.

The only rational conclusion to which we can come in animal physiology, notwithstanding the countless hypotheses which have been broached upon the subject, is that we can have no abstract notion of animal life, and therefore no means of actually separating it into distinct functions, the influence of one of which upon another can be at all understood. This term "animal life," is merely a name, by means of which we generalise all the phenomena of animals, just as "matter" is merely a name, by which we generalise all substantive existences which are in any way palpable to our senses. In both cases, the phenomena alone constitute the knowledge, and our general names are merely short modes of expression, answering to which there are no real existences. In the animal, however, we can carry our observation of phenomena much farther, and more in a train of succession, than we can do in the case of inanimate matter; and therefore the animal is by far the more instructive study of the two. It is more sensitive to external stimuli, arising from difference of situation, difference of season, difference of weather, and every thing else of general nature which can have difference at different times or in different places; and besides those obediences to external stimuli, there are internal stimuli in an animal, arising from those necessities which are inseparable from a material organisation, in continual action in some of its parts, and therefore requiring continual repair, the means of which are contained in itself, though the materials are derived from without, and taken in quantity proportionate to the waste of the animal, and the fitness of the alimentary substances for being applied to the purposes of growth or of repair.

There are many minor points in the physiology of the mammalia as the highest or most typical class in the animal kingdom; but as there are, generally speaking, adaptations to the situation and circumstances in which the animals are placed, they belong to the details of the several orders and minor divisions of the mammalia, rather than to the general functions of the class. We shall therefore proceed to the next branch of our general sketch of the order, namely, the modifications of their external action, and the organs employed in that action, so as to suit them to the places and the purposes for which they are appointed on the earth. Feeding is the grand stimulus to action, at least to general action, during the whole of every season of activity in all the mammalia; and as the food consists of a vast number of substances—of plants, from the lichen which feeds the rein deer in the polar latitudes, to the leaves and twigs of the most lofty trees in tropical countries, and of the flesh of every animal, from the small insect which is picked up by the viscid matter on the projectile tongue of an insectivorous animal of the humblest class, to that of the elephant itself—a knowledge of the food of the mammalia requires at least a general knowledge of the vegetable and animal productions of all parts of the world; and also of the situations in which they are to be found, and the most ready means of getting at them; and thus the study of the mammalia, when pursued in the proper manner, is a strong incitement, and very soon becomes a clear and readily consulted index, to natural history generally.

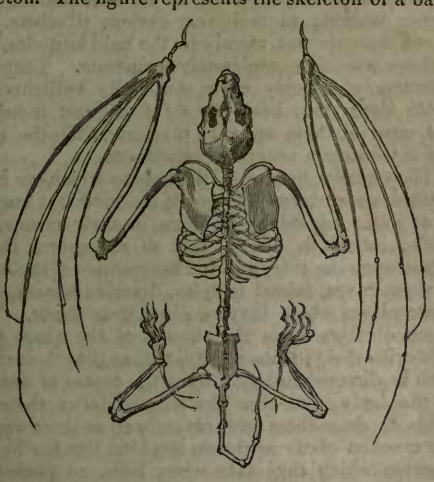
The feeding of animals, from the arousing of the animal by hunger, and its quitting the place of its repose to go in quest of its food, till the food is taken, prepared for the process of digestion by the mouth, and the animal again relapses into a state of repose, until fresh hunger shall excite it to a new exertion, is conveniently divided into three successive parts. *Locomotion*, or the conveying of the animal to the place where the food is to be found; *prehension* or the taking of the food, whether vegetable or animal, wholly within the power of the animal; and *mastication*, or the action of the mouth in preparing the food for the stomach. Our business in a general sketch is to notice the leading diversities of the organs by which these operations are performed, and the adaptation thence traceable both to the place of the animal in nature, and to its general structure. We shall very briefly glance at each of these in a separate section.

III. Organs of Locomotion.—The several kinds of locomotion exercised by the mammalia, though very many in their minor shades of distinction, may be reduced to the general heads of climbing, flying, running, leaping, and swimming; and as these are performed by means of the feet, there will of course be the same distribution of the feet into general heads; only, as each operation indicated by the general name is performed in various ways by different animals; and as, in addition to this, the feet, more especially the fore feet, have often other functions to perform; this circumstance will increase the number of modifications. Among these, the organ of flying is the one which performs its operation the worst; because the general structure of the body, and especially the articulation of the spine, the form of the sternum, and the absence of coracoid bones under the flying extremity, how much soever it may be developed, render it a very ungainly organ of flight as compared with the wing of a bird.

The organs of flight, and also those organs which are adapted for swimming and not for walking or any motion upon the land, are so anomalous to what may be considered as the true typical form of the mammalia, that they are worthy of a separate notice; though in their physiology they are as decidedly mammalia as any of the rest, and though in respect of their feeding they ought to come under different

classes, as a few of both live upon vegetables, though by far the greater number are animal feeders. Considering these circumstances, we shall notice their organs of motion separately from the rest, inasmuch, as all the other mammalia make the successive steps of their advances from solid supports, whether the length of the step be longer or shorter, and whether it be or be not prolonged by membranes which, like parachutes, take hold in the air, and prevent them from having so much downward motion as the natural gravitation of the mass of their bodies wouldgive them.

Organs of flying.—We shall, in our summary of the systematic arrangement of mammalia, mention the characters of the different groups which make up the numerous and widely distributed family of *cheiropterous*, or volant mammalia; and therefore, as our object in the mean time is to point out those deviations from the typical structure, as already described in that of the human body, we shall confine our observations to the bats, which are by far the most characteristic, and the ones which are most efficient in aërial motion, and least so in progressive motion along the ground. Indeed they are less effective upon the ground than any of the air birds, the swifts hardly excepted, which are rarely seen but on the wing, or clinging to the sides of high rocks and lofty towers in the same manner, though not by exactly the same kind of organisation, as the bats cling to the internal surface of caves, the undersides of the branches of shadowy trees, and other objects by which, as they are nocturnal animals, they may be protected from the direct light and heat of the sun, which no nocturnal animal can well endure. It will facilitate our explanation more if we introduce the skeleton of a bat, than if we were to give figures in detail of those parts which contribute to the peculiar action of these animals; because, as the form and articulations of the skeleton determine the general motions, it is not difficult for the imagination of any reader who is tolerably acquainted with the organisation of any one of the mammalia to understand any other as clothed with soft parts, answering to the peculiarities of the skeleton. The figure represents the skeleton of a bat.



The parts of the skeleton here, that is, the grand divisions of head, trunk, and members, are the same in number and general position with regard to each other as they are in man; but they differ greatly in their form, the development of their different parts and in the details of the extremities. On examining the anterior extremities, which we shall call the wings, though in every respect they differ from the wings of birds, it will be found that they differ greatly from those of mammalia, which have not the power of flight, whether the principal action of the fore extremities in these be progressive motion or any thing else. It will be seen that the scapula or blade-bone is very large, which affords it a firm embedment among the muscles on the back, and that the clavicle which forms the reacting bone, and keeps asunder the two sockets which receive the heads of the humeri or arm bones is also very strong for the general mass of the skeleton. The coracoid bone, as already noticed, is wanting, however, and the clavicles extend directly to the sternum and bear upon it, instead of forming a distinct arch or furcal bone, as in birds. The support of the shoulder joint is thus very strong for the size and strength of the animal; but it has not the same steadiness as the shoulder joint of a bird, which rests upon a tripod, and as the middle bone of that tripod, the coracoid, abuts firmly on the sternum, while the others are comparatively free, the one in its arch, consisting of the two lateral portions united, and the other in its embedment entirely among flesh; the sternum is the bone upon which a bird is really carried when supported by the action of its wings in the air. In the bat, on the other hand, the shoulder joint is supported by only two bones, and therefore the bearing up of the body in flight is thrown as much, if not more, upon the muscular attachment of the blade-bone to the ribs as upon the sternum. The bat is thus supported in its flight in the same manner as other mammalia are supported in their motions, in which the feet are the points from which the motion is taken, and the origin of it is from solid substances; and the remarkable part of this structure in the bat is such a modification as enables it to originate motion by striking its extremities against the air. To produce this modification, there must be powerful muscles to depress the wings in taking the stroke; and in order that those muscles may act with proper effect, they must have a place of origin proportionally firm to that of the joints of the bones to which they are attached. For this purpose the sternum is provided with an elevated keel along the mesial part, and to this keel the principal muscles which depress the wings are attached.

The bones of the fore-arm, and more especially those of the metacarpus and the phalanges of the fingers, or as we may call them, the four external toes, in each of the fore extremities, are very long and slender in proportion to their length, so that this part of the skeleton is slender and light to its extremity; and these terminal bones spread very wide at their extreme points. The thumb or inner toe on these extremities is comparatively short, and it is furnished with a strong and very crooked claw which assists the animal in suspending itself from the rugged surfaces to which it clings, and also in its slow and crawling motion upon the ground. From the nature of the shoulder joint in wanting the third means of support; from the length and slenderness of the bones, and the distance to which they are spread from each other at their extremities, and from the immediate organ of flight being membrane supported by bone and not feathers, this wing is much less efficient in proportion to its size than the feathered wing of a bird, and it is incapable of that

peculiar twisting motion in the elbow joint which makes the bird's wing act to the greatest possible advantage against the air. The bones in the extremity of this organ of flight are indeed the very reverse of those in the bird's wing, for while the terminal bones of that wing are soldered together, so that it strikes the air in one mass, those of the bat's are spread out, and the stroke upon the air is divided into as many parts as there are finger bones supporting it.

The production of the wing membrane too, which is often continued, with more or less interruption in the middle part, to the hind legs, and sometimes forward to the ears, and also backward so as to include the tail, does not allow the same freedom on the first or shoulder joint of the wing as birds possess; and from these circumstances the style of their flight bears more resemblance to the flutter of the larger insects than to the clean and effective strokes by means of which an air bird dashes along. Some details of the different parts of their structure will be found on referring to the article BAT in this work; but in order that we may better see the contrast between them and the other mammalia, as well as between flying mammalia and birds, there are one or two particulars to which it is necessary to advert. The flexible spine, the weight of the hind legs and the tail, and also some physiological considerations, render it necessary that the wings of the bats should in part support the posterior extremities by absolute connexion with the moving part of the wing, and not through the medium of its insertion; and there is this reciprocal advantage in the membranes which extend from the wing, that they steady it, and prevent such an action of the large blade-bones against the ribs as would otherwise take place in consequence of the weight of the body being less completely borne upon the sternum than it is in birds. Altogether, the wings of bats are to be considered as peculiar modifications of the anterior extremities of mammalia for a specific purpose, and not as bearing any structural analogy to those of birds.

In the posterior extremities, and these partake but little in the motion of the wings, though they yield to that motion, there is perhaps a still greater deviation from the usual form of the mammalia. These legs have, in the hip joint or articulations of the femur, a sort of half revolution outwards and inwards upon an axis, so that when the legs are bent, the toes and the legs are directed towards the belly, while the thigh is directed backwards. This arises in part from the backward situation of the cavities into which the heads of the femurs are inserted. This moving of the knee joint backward, while the foot and leg are brought obliquely forward, enables the first of these joints to tighten the posterior part of the membrane into a parachute, while the contrary flexure of the foot forms a cavity at each side, and so makes it take a better hold on the air. This species of resistance will be better understood by those unacquainted with the mechanical properties of the air, by noticing how much more speedily a little cap made of paper falls to the ground when the projecting side of it is turned downwards, than when the hollow is in that direction. This converting of the hinder part of the membrane into a parachute, which is supported by the resistance of the air under it, owing to its escape being prevented by the lateral bending downward, compensates in some sort for the imperfections of those parts of the membrane which are moved by the arms, and perform the active part of the flying. The membranous wings do not, like the feathered wings of birds, admit the air to pass through them when they are raised, and in consequence of this, excepting in so far as the rising wing is contracted in size by the flexure of the joints, as compared with the descending wing, which takes effect with the joints extended, there is not much in the structure of the bat's wing to make the one side of it offer less resistance to the air than the other does; and this is the reason of the great rapidity with which the wings are moved both ways, the parachute portion holding on until the moving part has gained its elevation, and is ready to descend again.

The whole structure of the bats, and more particularly of those which fly high and with considerable rapidity, is so formed as to give them a very great horizontal surface in proportion to their weight and length. The wings and continued membranes are not only very large, but the body is short and broad, which both increases the horizontal surface, and affords more room for the pectoral muscles. The posterior part of the body is made slender, and all the parts with which the anterior of the body can be loaded, consistently with the functions of mammalia, are situated there; for instance, the mammæ of the females are pectoral, and when they carry their young on their flights, these cling to the breast.

The wings of bats are not capable of bearing nearly the same exposure to the atmosphere and the sun as the wings of birds. The membranes possess a good deal of sensibility, and their motion would be rendered much more stiff and difficult if they were to become dry. Hence bats, at their regular hours of appearance, are never seen on the wing when the wind blows strongly; nor, notwithstanding their love of shade and humid air, especially in hot countries, are they ever seen during heavy rain; it is probable indeed that the violent rains which prevail in those tropical countries would beat them to the ground, just as a tropical hurricane would deprive them of all command of the air, and drive them before it like chaff. A high temperature appears, however, to be essential to the proper working of their very curious structure, for they hybernate not merely in the cold latitudes, but in those which are moderately temperate. They are creatures of gloomy caves and stilly twilights; at which times they beat the air with great industry, and most of them are very ravenous, even the ones which feed upon vegetable substances.

The peculiar flexure of the legs to which we have alluded, which turns the toes of the hind feet inward, is of great advantage to them in their manner of resting, which is usually that of suspending themselves upon the sides and the inequalities of the roofs of those caves, ruined temples, deserted houses, and other places where they take up their abode. The crooked claws upon the thumbs of the wings take hold with their points so situated, as that the axis of each is directed nearly toward the centre of gravity of the body, and thus the weight draws them, or tends to draw them inwards as well as downwards; the crooked claws again on the hind feet are by the position which they take when bent, so placed, as that they are drawn, or tend to be drawn, outward and downward; and as they have the line of their action also directed nearly from the centre of gravity of the body, the weight of the body tends to make each hind claw pull so as to tighten the fore claw on the

opposite side, and thus the two holds give firmness to each other. The hind feet have five crooked claws on each, and as they have in addition bent legs to press them to their points of adhesion by the weight of the body, they take a greater hold than the thumb claws, proportional to the greater weight which they have to sustain.

In consequence of this disposition of the claws when the animal is in a state of repose, very small irregularities of surface will enable a large bat to maintain its place with great firmness. Its position too is a position of perfect repose, and not one maintained by muscular exertion, for the whole is done by the elasticity of the tendons and ligaments. There is yet another peculiarity in this position, especially that of the hind legs, when the animal wishes to get into motion, the unbending of the hind legs throws the axis of the body upward, and opens the parachute, so that the air is under it, and the wings are ready for acting in flight, the moment that the hooks of the thumbs quit their hold. Getting to the wing from the ground is a much more serious matter, and we believe it may be said that, generally speaking, bats crawl up some surface which is perpendicular, or nearly so, when they take the wing. They are so seldom seen on the ground, however, that it is impossible to speak with perfect confidence about their movements under all the variety of circumstances to which they may be exposed, except by analogy from their structure.

On the ground, the action of the bat is peculiarly awkward, more so than that of any other mammalia. They cannot walk on all fours in the usual style, and as little can they, from the singular way in which the hind legs are articulated, and the weight of the fore part of the body, raise themselves into an erect position and walk upon these legs. The shoulder-joints are articulated for motion across the axis of the body, and therefore, independently of the awkward form of the terminal portion of these extremities, the humerus cannot be advanced so as to take any thing that can be called a step: they are therefore reduced to a very odd sort of motion; they advance one side of the body a little, which advances the bend of the wing or elbow joint on that side, and having done so, they lay hold in advance with the claw of the thumb. This being done, they, by the unbending of the hind leg, swing the body round upon this claw as a pivot, by which operation, the turn of the wing on the other side is brought in advance, and grappled by means of the thumb claw in the same way as the former. Repeating this operation with each side alternately, they contrive to wriggle along by a course something like that of a ship working board and board upon a wind, and thus the resulting course is in a straight line, though the actual motion is performed alternately right and left. A motion which is so laborious in the performance, and in which so little progress is made, can be of comparatively small use to the animals, as it can neither serve them in following their prey, or in escaping from an enemy. They therefore resort to it only in cases of necessity, and if they have to practise it for any length of time, they are completely exhausted.

Bats are the only mammalia which can actually fly—that is, which can renew their motion by gaining a fresh impetus from the stroke of their flying membranes against the air; for all other animals which have produced membranes which they can extend by stretching out their legs laterally, use those membranes only to prolong a spring which is originally taken from some solid fulcrum of resistance. A contrivance of this kind would be of little or no use to a ground animal, because the less resistance the air offers to such an animal, the more rapidly it can proceed, and also with the less effort of muscular strength, consequently, those parachute membranes as we may term them, are found only among climbing animals, and among that description of them which do not make their progress by grasping, but by running along the branches, and holding on with the claws. Some of them, however, have a great deal of freedom of motion; and the common squirrel, the membranes of which are very little produced, can make its way very rapidly through the upper branches of a clump of trees; and even when it is alarmed, it very rarely misses its footing or its hold, and falls to the ground. The proper place to mention such animals will be, however, that where we treat of climbing organs, and the auxiliary organisations, by means of which climbing animals contrive to pass from branch to branch, or from tree to tree, when the distance is too great for being reached by their limbs, or cleared at an ordinary leap.

Organs of Swimming.—As the bodies of almost all mammalia, when the lungs are inflated with air, are of nearly the same specific gravity as water, they may be said to be all capable of floating in that element; and as their so floating does not deprive them of their powers of locomotion, they in general can row themselves along by the action of their feet. This is a sort of swimming; but still with exceedingly few exceptions, if indeed there are any, mammalia of this description have the feet as well if not better adapted for some kind of motion upon land than for this description of swimming. When the water is to a considerable extent the pasture or the element of these mammalia, as in the case of the beaver and the otter, the hind feet have the toes webbed; and there are some instances, such as that of the ornithorynchus, where the webs of all the feet are very much produced; but animals having this structure, live habitually in the water, unless when they come up to breathe, or when one pool dries up, and they have to seek their way to another. The motions of none of these, whether performed on the surface of the water or under it, is the characteristic swimming which distinguishes the proper vertebrated animals of the waters, the fishes, from the other three classes. The seals and narwhals have much more of the swimming habit; but still they are capable of some motion on solid surfaces, for they can creep and they can climb, they therefore retain in part that character of the extremities which is perfect in land mammalia; and in order rightly to understand the typical organisation of mammalia for swimming, so as to be able properly to compare it with the organisation of the same general structure for the other kinds of motion, we must turn to the cetacea.

In the article Cetacea there will be found an enumeration, of the principal species, and some account of their structure and habits, so that all which remains to be done in this place is, to take the most typical one in illustration of the whole, and there is none so well adapted for this purpose as the common Greenland whale (*Balæna mysticetus*), which is unquestionably the best and the most constant swimmer of the race. There is sufficient reason why this should

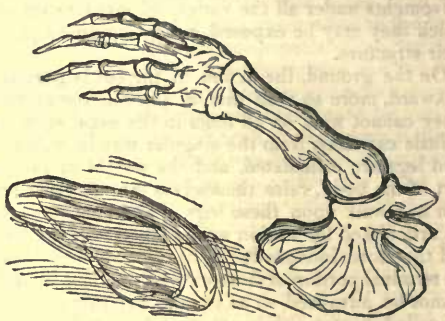
be the case, in the mode of feeding of this species of whale as compared with that of other whales, and in this respect there is a correspondence between the sea mammalia and those of the land. In both situations, those species which take their food in the smallest portions, or which have it of the least nutritive quality, which comes exactly to the same in effect, are most constantly feeding, and by necessary consequence most habitually in motion; though animals which subsist upon larger and more nourishing prey, and which require more violent efforts in the capture of it, can move with greater velocity for a short time. In respect of the proportion which the individual morsels of its food bear to its own size, the Greenland whale may be said to be peculiar among the mammalia. It is among the largest, if not the very largest of the class; and yet the animals on which it feeds are smaller than those which a common cat finds for itself in a state of nature. This food also floats at no very great depth, and consequently the whale is a surface feeder, and though its food is animal, and its digestive system in accordance with this, its ranging the ocean for its subsistence, in so far as the mere moving is concerned, bears no inconsiderable resemblance to that of a ruminant animal in browsing the herbage of the ground.

It is necessary to take this habit of the whale along with us, in order that we may rightly appreciate the particular form of its organs of swimming, and also that general shape of the body which gives those organs the greatest possible efficiency in the element in which the animal lives.

In as far as the head, the trunk, the tail, and the anterior extremities are concerned, the parts of the whale are numerically the same, and placed in the same order as in other mammalia; but the posterior extremities are altogether wanting, and though the internal structure of the mammalia requires that there should be a pelvis of some kind or other for supporting the abdominal viscera, yet this pelvis is very rudimental in the whale. [It is to be understood that when in this part of the article we use the word whale without any qualifying epithet, the Greenland whale is always meant.] The rudimental pelvis consists of three little bones, the middle one of which answers to the two bones of the pelvis in ordinary mammalia; and the others, which represent the haunch and hip bones, are only a single elongated and very slender bone upon each side. These bones serve merely to give a little stiffness to the flesh at the place where they are situated; and thus prevent the violent action of the grand swimming organ from jerking and disturbing the viscera, more especially the lungs, so much as it otherwise would do. They are not in any way articulated upon the spinal column, neither is there any appendage with a bone in it articulated upon any of them, either external or internal of the animal. By this means, while they prevent injury in the way which we have stated, they allow perfect freedom of motion to the spine. That spine is the grand basis of locomotion in the whale, and all the parts of the animal are adapted for giving it the very maximum of effect. As is the case in all the mammalia, its principal flexure is in the mesial plane, in bending upward or bending downward; but after the more essentially vital parts of the animal are past, the posterior part of it has both lateral and twisting motions. The vertebræ of the neck are exceedingly short for so large an animal, but they are always the same in number as in land mammalia, and they have remarkably little motion. With the exception of the anterior extremities, afterwards to be noticed, and the broad and bilobed expansion of the tail, there is no projecting member upon any part of the body of this animal, which can either accelerate or retard its motion through the water. In this respect it possesses an advantage over those whales which have a fin on the back, because this fin prevents the body from turning round with the same ease and rapidity.

The body of the whale is thus so formed as to be perfectly obedient to the operation of the few swimming organs which it possesses; and it is besides so formed as that these can act to the greatest advantage, while it offers the least resistance to the water which could be offered by an animal of equal volume. Its skin is perfectly smooth, and it is kept always soft and flexible by the great quantity of soft fat which lies under it.

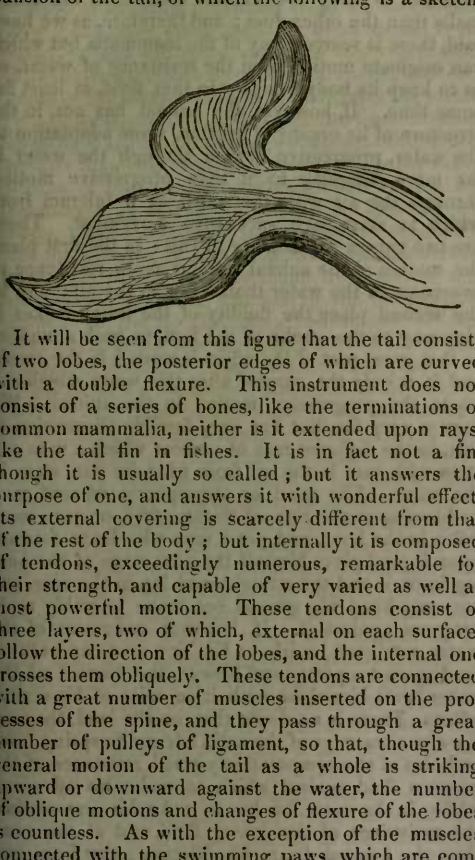
The anterior extremities, or "fins," or "swimming paws," as they are sometimes termed, are not organs of progressive motion, neither are they organs of ascent and descent, like the pectoral and abdominal fins of fishes. In moving, their chief use is to turn the body round on its axis, or to assist in enabling it to perform loops or doubles in the line of its movement. We introduce a cut of the skeleton of a



swimming paw of the whale. The bones of this member are the same in number and arrangement as those of the land mammalia—a blade bone, a shoulder bone, two bones in the fore arm, carpal and metacarpal bones, and four fingers. They are, however, much flattened in their planes, and their articulations have little motion upon each other, though their cartilaginous unions give them much pliability, and they have very powerful motion at the shoulder joint. These swimming paws, from the office they perform, can obviously act most effectively by being situated near the centre of gravity of the whole mass; but as the neck is very short, they are near the anterior portion of the spine; and thus, as the whole of the spine, from their position backwards, is efficient as an organ of motion, this organ would have no fulcrum at all competent to give origin to its powerful action, if there were no more in advance of the insertion of the paws than the short neck and a head of the ordinary size. To make up for this, the bones of the jaws are produced to a much greater extent in proportion than they are in any of the mammalia, with the exception of the cachalots or spermaceti whales. The organs of the senses are situated far backwards in this great production of the head; but as it does not appear that smell or even taste is exercised in the feeding, the eyes, which are the most efficient

rgans, are more advantageous in their backward and ateral situation. In consequence of the shortness of he neck, and the great production of the bones in dvance of the skull, the fore part of the whale is a arge mass which has little or no flexure in any direction; and thus it gives a firmer point of insertion o the movable portion of the spine than we meet vith in any land animal, not excepting even the houlder joint of the strongest winged hawk or the nost powerful eagle.

This flexible portion of the entire length is a cone, apering finely off, and gradually less heavy in its ones, and more free in its joints, as it approaches he extremity; and at that extremity there is the ex- ansion of the tail, of which the following is a sketch.



It will be seen from this figure that the tail consists f two lobes, the posterior edges of which are curved vith a double flexure. This instrument does not onsist of a series of bones, like the terminations of ommon mammalia, neither is it extended upon rays, ike the tail fin in fishes. It is in fact not a fin, hough it is usually so called; but it answers the urpose of one, and answers it with wonderful effect. ts external covering is scarcely different from that f the rest of the body; but internally it is composed f tendons, exceedingly numerous, remarkable for heir strength, and capable of very varied as well as nost powerful motion. These tendons consist of hree layers, two of which, external on each surface, ollow the direction of the lobes, and the internal one rosses them obliquely. These tendons are connected vith a great number of muscles inserted on the pro- esses of the spine, and they pass through a great umber of pulleys of ligament, so that, though the eneral motion of the tail as a whole is striking pward or downward against the water, the number f oblique motions and changes of flexure of the lobes s countless. As with the exception of the muscles onnected with the swimming paws, which are com- aratively few and weak, the whole motive energy is oncentrated upon this organ, it is equally ready and owerful; and perhaps, considering it as capable of iving a blow, it is the most efficient organ in the vhole animal kingdom. The texture of the portion f it which takes effect is also such that it can hardly e injured. It is so tough that it cannot be torn, nd so free from feeling that a stroke of it against a ard substance gives no pain to the animal. If it trikes a boat across the middle with the edge, the boat s cut asunder as clean and as speedily as if by one troke of a giant axe; whereas if it strikes with the lat of the lobes, the boat is driven to the depth of nany fathoms with the swiftness of an arrow. Those vho attack the whale in its strongholds among the olar ice are aware of the fatal effects of those blows, nd therefore they are studious to avoid them.

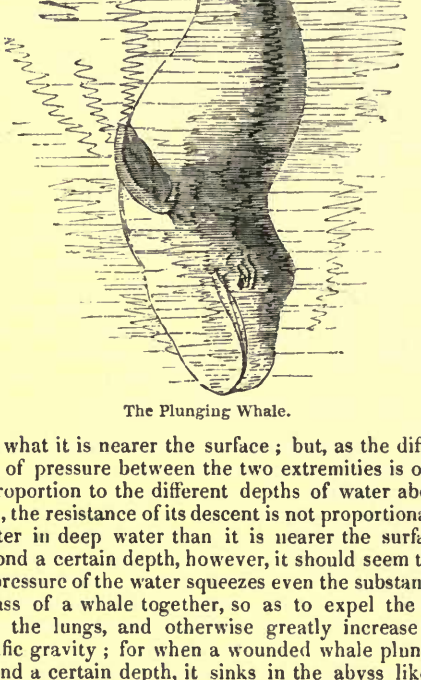
In swimming, we need not add that this instrument must be most efficient. It is placed at that part of the animal where a paddle or oar has the greatest effect; it has, as we have said, a steady point of insertion, and the vertebral column which supports it tapers at that rate which combines the maximum of strength and elasticity; and therefore, without the assistance of fin or scale, or the deriving any assistance from contrary flexures of the body, it dashes the animal onward at an exceedingly rapid rate.

The absolute rate of the whale's motion is of course not known, and cannot be known, as a mathematical quantity deduced from actual experiment, in which both time and distance are known; but some theoretical estimates which have been made, founded on the form of its body, and the force with which its swimming lobes strike the water, lead to the conclusion that the rate of its progress exceeds twenty-two miles in the hour; and this is not unlikely, because many birds which have to bear up their weight in the air are capable of moving at a far more rapid rate than this, and continuing their motion for many hundreds of miles. On this subject, however, it is impossible to speak with precision, but we may well suppose that in animals so finely constructed for progressive motion, and nearly of the same weight as the medium in which they move, the rate of motion may be even more rapid than this. Such powers give these animals full command of the most extensive oceans; and as, when the polar seas are frozen in the northern hemisphere, we do not find the whale migrating to the temperate seas of the same, as is the case with those birds which are frozen out of their polar quarters, it may be possible that these whales range from the one polar sea to the other. It is true that they are not found in the middle latitudes, apparently resident for a season, as the spermaceti whales are; but there is not a great deal of stress to be laid upon this, inasmuch as the spermaceti whales, being furnished with teeth and having wide throats, can find food in any sea where fish abound (and surface ones abound most in middle latitudes); whereas the Greenland whale, dependent on the small animals which it can catch in its whalebone net, can subsist only where such animals abound, and it should seem that those fitted for the food of the whale are most abundant in the high latitudes and during the summer season.

Besides their effect in turning round the body on its longitudinal axis, the swimming paws of the whale perform other functions. Their proper motion is a cross or clasping motion, so that one whale can embrace another by means of them; and the mother whale can carry her young in her arms, until it acquires sufficient size and strength for swimming by her side.

There is another use to which the animal is enabled to turn these swimming paws. When extended they form a line of considerable length at right angles to the axis of the body, something in the same manner as the trunnions form a line at right angles to the line of metal in a gun; and the whale can move the axis of its body in the vertical plane upon them, much in the same manner as the gun is moved upon its trunnions. By this means, the whale can descend to a depth and rise to the surface to breathe in much less time, and with much less range in horizontal distance, than if its motion were regulated by the tail only. The length of time that the whale can remain under the water before it rises to breathe is under-

stood to be about twenty minutes; but it often plunges to such depths as that more than this time would elapse before it could get up again, if it had to proceed upon so long a slope as the action of the tail alone would require. But, by the paws acting as a sort of axle to it, it can turn the axis of the body upwards or downwards with great rapidity; and it can both descend and ascend in nearly a perpendicular direction. It sometimes descends with so much rapidity as seriously to injure itself, by striking the bottom at a great depth; and Scoresby mentions an instance of a harpooned whale descending perpendicularly with so much rapidity that it fractured its skull against the bottom in a depth of 800 fathoms. At such a depth the pressure on the body of the animal is far greater



The Plunging Whale.

than what it is nearer the surface; but, as the difference of pressure between the two extremities is only in proportion to the different depths of water above them, the resistance of its descent is not proportionally greater in deep water than it is nearer the surface. Beyond a certain depth, however, it should seem that the pressure of the water squeezes even the substantial carcass of a whale together, so as to expel the air from the lungs, and otherwise greatly increase its specific gravity; for when a wounded whale plunges beyond a certain depth, it sinks in the abyss like a stone, and never again returns to the surface.

The cetaceous mammalia which frequent the fresh waters, or are found only littoral or near the shores, and which from this habit have no occasion to plunge to such depths as the pelagic ones which range the wide oceans, have not the same enlargement of the bones of the face, and it is obvious that, from the comparatively small depth of water in their haunts, they have not the same occasion for it.

The two kinds of organs of motion in the mammalia, of which we have given a slight notice, in the structure and action of what may be considered as the most perfect or typical form of each, may be considered as one general class, namely, motion in a animal taking its origin from a fluid as a fulcrum and this general class readily divides itself, accordin to the nature of the fluid which serves as the fulcru into two sub-classes or orders. The first of thes and that which we may presume to require th greatest effort from animals having the general stru ture of the mammalia, is motion originating in atm spheric air, which we have exemplified in the ba family, the only mammalia which in reality are capa ble of performing it. The second is that where wate the other abundant and generally distributed flui connected with the earth, affords the fulcrum. Thi from its greater specific gravity, more nearly ap proaches to being the natural element of the man malia than the other does; and therefore, as we hav said, there is scarcely any of the mammalia but whic can originate motion from the resistance of water, s as to keep its body buoyant in that fluid, at least fo some time. If, however, the animal has not, in th structure of its organs of motion, some adaptation t the water, progressive motion through the water i far more fatiguing to it than progressive motio through the air with the earth as a fulcrum fro which to start each successive movement. Ther are two causes explanatory of this: in the first plac the motion of the animal has far more resistance t overcome in the water than it has in the air; and i the second place the fluidity of the water makes give way to the stroke of the foot, in such a manne as that great part of the effort is wasted in the recoi and it is only the surplus after this waste which ca go to the progressive motion in the animal. W have a very familiar but very forcible illustration this, in the different rate of current which a man ca stem with ease in the air from what he can stem i the water. The wind or atmospheric current ma be blowing at the rate of twenty, fifty, or even mor miles in the hour, and yet a man who leans forwar upon it, and gives himself the advantage of the ber leg in front and the straightened leg in the rear, ca not only keep his ground but make tolerably rapi progress against it. If, however, a current of th water sets even nearly as fast as a man can walk o land against a pretty stiff breeze, the current of th water bears him along with it in spite of his utmos efforts. There is no doubt that, on the land, the ma has the advantage of the solid fulcrum to spring fron and also of the comparatively small resistance of th gaseous fluid against which to make his advance while, in the water, he has to make his way agains the resistance of the denser fluid, and at the sam time the current bears his fulcrum away from hir with a rapidity proportional to its velocity.

It is not difficult to give a rude estimate of th different resistances with which the man has to con tend in these cases. In round numbers, the weigh or power of resistance in water is about 800 times a much as that in atmospheric air; and, as it is gene rally understood that the impetus or effect of bodie in motion is directly as their quantities of matter, an inversely as the squares of their velocities, if a man' body presented the same surface to the wind as t the water, the mere resistance of the water alon without any motion would be equivalent to that of current of air having a velocity of about twenty-eigh miles in the hour. But as a man does not swi through the water as he walks through the air, it i not easy to state the proportion of the resistances i any thing like correct terms. It is also to be take

into the account that the arms tell much more in swimming than they do in walking. In walking, from the comparatively trifling resistance in the air, the arms can be regarded as very little else than balancers; whereas in swimming they are real organs of progressive motion; and as in advancing them to the front they can be feathered, as a rower feathers his oar, so as to offer much less surface to the water than they do when striking against it to give the forward impulse, skilful management may convert them into very efficient swimming instruments. There are several circumstances connected with the pressure of water, when the body pressed on is completely immersed and under the surface, which are not unworthy of attention. Among these we may mention how much more easily the body of an animal is lacerated, or any substance cut by a sharp instrument. The substance stands up to the instrument, both on account of the compactness of its parts, from the pressure (if it be a compressible body), and also from the water's keeping it against the cutting substance, being so much greater than that of atmospheric air. Owing to these effects of water, many substances can be cut when submerged by means which have no influence upon them, when the attempt is made in the common air. As an instance of this, it is said that, under water, glass may be cut into any shape by means of a pair of common scissors; whereas, in the atmosphere, it cannot be cut by the same instruments without a very great effort, and that effort splinters it to pieces instead of cutting it in any definite direction.

So far as we are aware, atmospheric air and water are the only fluids in which any of the mammalia can live, if they are fairly submerged, or included in the volume of them. The common mammalia which require very frequent respiration of the free air cannot remain for any length of time under water; and therefore, in their progressive motions through that liquid, which are not swimming in the proper sense of the term, but merely a species of walking, except in the case of man, who brings into play in this situation his arms and hands which are not available for locomotion in ordinary cases, they require to keep the nostrils, or entrances to the breathing apparatus, above the surface, otherwise they soon get suffocated by the entrance of water into the lungs. The vulgar notion is that the water thus taken into the cavity of the land mammalia when they are submerged is taken into the stomach, but this is a mistake, for nothing can be taken into the stomach but by an effort of swallowing; and even though water were taken into that viscus, in as great quantity as the pressure of a moderate depth could force it, it would do no great harm, if it did any harm at all. But when the water gets into the cells of the lungs, the case is very different. It not only prevents the contact of atmospheric air with the capillary vessels for the time that the animal is in the water, but it lodges in the cells; and as the lungs are capable of expelling only air, together with the quantity of water which it may hold in a state of vapour, and this differs in different mammalia according to their temperature, there are no natural means of expelling the water or restoring the animal, without it can be so inverted as to make the water run out, and that the lungs can be so excited by some stimulus as to promote the expulsion.

The old opinion was, that in the human subject, and by inference in all the other land mammalia, if the *foramen ovale* or internal passage between the systematic side of the heart and the pulmonary, which exists in the fœtal state, could be kept open, life would be preserved for a long time under water. This, however, is not the case, for it is the want of atmospheric stimulus to the blood and not the want of passage which causes strangulation, in drowning, and in every other case in which atmospheric air is not freely admitted into the lungs; and this particular passage in the heart is of use only as long as the young animal receives its nourishment from the arterial blood of the mother, which blood has already undergone the requisite operation of the air in respiration, and though it were kept open in after-life it could be of no service whatever.

Mammalia, whose habit it is to remain for a considerable time under water, do not so remain in consequence of any passage in the heart resembling the foramen ovale. They so remain, because the volume of their lungs is proportionally larger than that in animals which must breathe more frequently and therefore cannot remain so long under water; and besides this, such animals are generally provided with some sort of valves closing by pressure from without, by means of which water is excluded from the lungs, and the more completely excluded in proportion as its pressure is the greater. We find a provision of this kind in the otter and the seal, and in the cetacea it increases in proportion to the length of time which the animals can remain under water. In the fresh water cetacea it is less perfect than in the marine ones which inhabit near the shores; and in them again it is less perfect than in those which range wide oceans, and are capable of descending to great depths, as is the case with the whale. The blow-holes are the proper breathing apertures of such animals, and their mechanism is perfect in proportion as the animals are capable of plunging. It must be borne in mind, that though these animals throw up jets of water when they blow, they do not do this always when they breathe; and that when they do it, the water has never by any chance come from the lungs, any more than substances which are sometimes returned by the nostrils of land animals come from their lungs. The water thus discharged is the current which sets toward the gullet of the animal in its feeding, and as both the gullet and the entrance of the trachea are shut against it, it is carried upward to certain cavities in the bones of the head, to which the under passage is by valves opening inward of the cavity, and the upper passage by valves opening outward. When these cavities are full of water the expired breath from the lungs blows it out with considerable force, which is the cause of the jets which are sent up from the blow-holes. There are, however, many circumstances in the adaptation of aquatic mammalia to the element in which they spend the greater part of their time, that it would be impossible to notice in a sketch so limited as this; and so we must proceed to our notice of the organs of motion as fitted for the land, and the several adaptations which are connected with them.

As is the case with mammalia which originate the individual portions of their motion from a fluid fulcrum, so with those which originate these from a solid fulcrum, there are two sub-classes or orders; namely, climbers or those which ascend or descend upon trees, or other substances standing up from the surface of the earth, and walkers, or those which have the line of their motion parallel to the earth's surface,

whether that surface is level, or an ascent, or is descending. In the case of ascent or descent, there is of course a degree of inclination, beyond which no walking animal can execute its motion, though there are great differences in this respect arising from the structure of the organs of locomotion. Thus, for instance, if the fore legs of the animal are short in proportion to the hind ones, as in the hare for instance, the long hind legs project the body very readily and conveniently up hill in running; whereas, if an animal so formed attempts to proceed rapidly down hill, it is in continual danger of tumbling heels over head. Hence, coursed hares always endeavour to take the hill of the dogs, if there is one accessible to them; and if there is a sufficient length of hill they are safe, if not too much exhausted before; but if they are compelled to run down hill, they very speedily become the prey of their pursuers.

These two sub-classes, or orders of motion originating from solid fulcra, admit of far more diversity in the mode of performance, and require a much greater variety of organs, than motions in which air or water is the fulcrum. The reason of this is very obvious. Air and water are very uniform in their consistency. There is very little difference in the density of water at different depths, because water cannot be much compressed even by very heavy pressure. The movement of an animal through water, therefore, differs scarcely any thing in species, whether the depth be greater or less, and therefore the very same organisation serves equally for motion through it, whether the animal is near the surface or farther down. Atmospheric air differs from water in being more compressible, and consequently it varies more in density at different elevations above the mean level of the earth's surface. But still there is very little difference to a flying animal arising from this; for the resistance of the air to the progressive motion of the animal diminishes at probably a greater, and certainly as great a rate as its density. Something depends on the velocity with which the animal flies against the air; and the theoretical view of the matter being that the resistance is directly as the density of the medium and the square of the velocity jointly, a comparison might be instituted. This theoretical view never can be made, however, to agree with experience, or rather experience does not agree with it; for though it is nearly correct for moderate rates, yet, when we come to great velocities against the same resisting medium, we do not find the actual resistance to increase nearly so fast as the square of the velocity. For the purposes of natural history it is not necessary to go into those niceties; and we may assume that a flying animal gets along with nearly equal exertion in proportion to the rate of its motion at whatever height it may happen to be in the atmosphere. Or if there is a deviation from this, the circumstances of the case would lead us to conclude that flight is more easy on a high course than on a low one, for we invariably find that even birds of heavy flight rise high in the sky when they are to perform long aerial journeys.

Thus in all the flying mammalia, and also in all the swimming ones, there is little diversity required in the organs of motion; and when we have described those organs in one species, either of the one or the other, we are in possession of the knowledge of them all, excepting in so far as they may be modified by a participation in other habits, in addition to the flying or the swimming. There is another circumstance which further simplifies the structural study of both these descriptions of mammalia; their extremities are never any thing else than organs of motion, unless they happen also to be weapons of defence, as is the case with the tail of the whale. In no case, however, do they in any way assist the animal in the seizing of its food, they merely conduct it to the locality in which the food is to be found, and thus we can study their system of motion, as a simple system unmixed with any other.

When, however, we come to the land animals, or those which take their movements from solid fulcra, the case is very different, and this renders their motions and their organs of motion a far more intricate study. There are no doubt some of them which are incapable of making much, if any, use of their organs of motion, except in moving from place to place; but the number of these among walking animals is comparatively limited; and among climbing animals there are scarcely any. The climbing foot is, from the use to which it is applied, almost necessarily prehensile in some respect or other, either in grasping like a hand, or in holding on by means of claws. When it takes the hand form, however much it may differ from the human hand, which is a universal instrument and not a grasping one, it is of course equally fit for laying hold of the food, as for grasping the branch of a tree or whatever else is the means of support in climbing. An animal which climbs by grasping, always requires to have clavicles, in order to support the shoulder joints in those cross motions which the action of reaching from branch to branch requires; the same may be said of climbing animals which use membranes, or even simply their spread out legs, to protract their fall when they leap; and so also do animals which climb by grasping the bole of a tree, or other comparatively slender substance between the feet in climbing. But, with the exception of the winged mammalia, and they have a little of it, all mammalia which have a cross motion of the fore legs, have also a motion of them forwards and backwards. Hence every such animal can bring the fore foot to the mouth, and when an animal can do this, it always uses that foot more or less in the management of the food. We see remarkable instances of this in the ape and monkey tribes, some of the former of which are so expert in the use of the hands or fore paws in this way, that they not only gather their food with them, and clear it from refuse if necessary, but they make use of the finger in picking their teeth, if any substance adhering to these or sticking between them gives them uneasiness. The squirrels and other climbing animals which do not grasp, but retain their hold or their footing by the toes and claws, have also remarkable power over the anterior extremities; and they carry their food to the mouth with their paws, and use the paws in preventing it from falling, when it requires considerable action of the jaws to reduce it to the necessary form.

Even those animals which do not subsist upon fruits which they pull from trees, or upon insects and other things which they draw from the holes of trees, but which are predatory in their climbing, and catch living animals, very generally use the foot, either for grasping the prey by means of crooked claws, or by striking it against the branch, and holding it there, until they can seize it, and if necessary dress it with the mouth.

Indeed there is scarcely any of the climbing mammalia which does not combine in its anterior extremities at least some other action besides that of mere climbing; and in consequence of this we never can have a clear understanding of the extent to which animals of this kind possess the power of locomotion considered simply in itself.

Even in walking animals which do not climb, or gain any height which they cannot reach at a single bound from a place of rest for all the feet, the fore legs very often have compound action. Thus, for instance, the elephant appears to have as ungainly a foot, and as ill adapted for any thing in addition to mere motion, as one can well suppose; and yet the elephant contrives to turn this apparently clumsy and unmanageable foot into no bad substitute for a hand, to co-operate with its curious proboscis in performing rather nice operations. The very tame and playful elephant which the Duke of Devonshire had at Chiswick, and which was equally a favourite for its mild disposition and its mechanical dexterity, held a soda water bottle very neatly with its foot at such an angle as not to spill the water that it contained, until it had extracted the cork with what may be called the thumb and finger of its proboscis; and after it had done this, and then drank the water from the bottle, it could hold the empty bottle in the same manner till it replaced the cork.

Very many other vegetable and miscellaneous feeders use the foot in the obtaining their food. Sometimes to hold the one end of the food till they seize the other with the mouth, and either cut off what they require with the teeth, or pull it asunder with a jerk of the head. Most animals that feed on the leaves of trees, occasionally use the foot in striking down the branches; and not a few of those which have to find their subsistence under the snow, employ the foot in scraping off the snow, in order to reach what they eat. The solid hoofed animals, whose native localities appear to be those margins of the deserts where the pools and the streams get very shallow during the drought, have the habit of scraping a little pit with the foot, in order to obtain a sufficient depth of water for quenching their thirst. The pig makes great use of the foot in feeding, both in holding on till he tears it, and in keeping down the ground while he draws up roots, after he has nozzled off the surface mould, so as to reach the blanched part, which is his favourite morsel. So strong and so natural is the habit now mentioned in this species of animal, that they do not forget it in a state of domestication, and where they have not occasion either to pull roots, or to hold on till their food is divided. The countryman's criticism upon Morland's three pigs feeding, is an illustration very much in point here. That talented but eccentric artist was particularly fond of painting pigs, and equally faithful in his delineations of their forms. The three pigs was looked upon as a *chef d'œuvre* in animal painting, and the countryman was brought to see it, as something of the merits of which he could judge, and which, from its supposed faithfulness to nature he could not fail to admire. He studied it for some time with much attention, and upon being asked what he thought of it, replied, "They are much the shape and colour of pigs certainly, but after all they are not pigs."—"What in the name of wonder induces you to think so?" asked his cicerone with some astonishment. "Why, who on earth ever saw three pigs feeding without one on 'em having his foot in the trough?" replied the countryman, clearly showing, that how well soever Morland had studied the forms of pigs, this countryman had been far more attentive to their habits.

There are few, indeed, of the walking mammalia where we do not find some use of their fore feet in addition to the mere operation of walking; and there are not a few which use the fore-feet, and especially the hind ones, as weapons of defence, and sometimes of attack. This last circumstance, however, does not interfere so much with any other habit of the animal as those which we have formerly mentioned. The particular way in which the foot assists in feeding depends not a little upon the nature of the food; and we have therefore to study the feet of those animals both with regard to the kind of their food and the places where they obtain it; the last of which is a very extensive and varied inquiry, and demands a good deal of acquaintance with natural geography before it can be turned to proper account. This, however, is an advantage rather than otherwise, for we have a double profit and a treble pleasure when the study of one science induces, or even compels us, to study another. Each science is in itself both a pleasure and a profit, and then there is superadded the higher and more mental pleasure which we derive from tracing the connexion between them.

When we think of the localities for which climbing or walking animals of some description or other must be adapted, in order that no portion of nature's great pasture may lie waste, we must look at the world in every zone and in every latitude, ascertain the character of every surface, both with regard to its form, its fertility, and the plants which it produces, we must take careful note of the peculiarities of climate and of seasons which belong to each, and we must take into consideration the general vegetation, and the other animals. We must do all these things, because in every place which is left to the course of nature all the parts of nature harmonise: and if we can once possess ourselves of the principle of this harmony, it furnishes a ready and an easy key to a vast number of particulars. This is in fact the grand generalisation to which all our inquiries into natural history ought to tend; and the mammalia are far preferable to any other productions of nature for being our first and best guides in this delightful and all-instructive path. The mammalia of a country are its most permanent animated inhabitants; they summer and winter there, and do not quit, unless the physical circumstances of the country alter, or the animals themselves are driven into other places, or extirpated by man. We must, however, leave the general subject, and proceed to some particular illustrations.

Organs of Climbing.—Mammalia climb upon such varied substances and for purposes so different, that it is not easy to contrive any general description which will include the whole of them. Trees are, however, the chief resort of climbing mammalia, and the most characteristic ones are the quadrumana or four-handed animals; in all their divisions, including apes, baboons, and the different species of monkus. Then there are some other animals which climb with less perfect hands, such as the lemurs, the loris, the galago, the ai-ai, and a few others. Bears and some other animals climb by clasping with the legs, and partly also by the help of their claws; and there

are several others which use the claws chiefly in ascent, such for instance as the climbing cats, and some other tree animals, the greater part of which are inhabitants of India. The squirrel tribe have a compound mode of climbing; they ascend the thick trunks of trees by the help of the claws, by leaping, and by supporting themselves with their flying membranes, and their very much produced tails, which act as parachutes, as the peculiar character of their fur takes a considerable hold on the air. They thus leap among the small branches, more after the manner of birds than of common mammalia, though none of them can take a fresh impulse from the air itself. Among the flexible branches and twigs of a tree, a squirrel, however, derives an advantage in leaping, something similar to that which a stage tumbler derives from his elastic boards. The animal alights on the flexible branch or twig from a considerable distance, and with a good deal of impetus, so that the force with which it bends the branch is much greater than could be given by the pressure of its weight. This force is impulsive, and therefore its effect lasts only for a moment, and when it is over the twig recoils against the mere weight of the animal, and assists in giving it impetus for a fresh spring. The rapid march of the squirrel along the tops of the trees is therefore not nearly so fatiguing as might be imagined by those who do not reflect upon the assistance which it gets from the elasticity of the tree. In ascending or descending from near the extremity of one branch to near that of another, these animals, and indeed all animals which ascend or descend by these, derive similar advantages, though the mode in which they derive it is not exactly the same in the ascent and the descent. When the animal ascends and catches an elastic branch, whether it catch it with a grasping hand or by any other means, the recoil of the branch throws it upward, so that it can reach a higher one at the next spring than it could do if it started from a nonelastic support; and thus it proceeds until it gains the elevation at which it either finds its food, or gets beyond the reach of its enemies. In descending the recoil of the branch tends to throw the animal upward, and this enables it to descend upon the next branch with more velocity, and by this means leaves it with more command of its grasping organs. In fact, the elasticity of the branch adds very much in the way of a parachute in breaking the fall of the animal, so that an animal incapable of grasping while it descends, falls through the elastic twigs of a tree from a considerable height with much less injury than if it fell through a half, or even a third, of the same height without any elastic interruption. Every twig or yielding branch that it touches, takes off a considerable portion of the velocity which it has acquired during the previous fall; and it would not be difficult to suppose branches so tangled and so elastic, that a man might tumble through twenty thirty, or forty feet of them, and reach the ground without any material injury.

Among all this variety of mammalia which ascend and descend on trees, besides several others which climb rocks and other steep surfaces, solely by bounding in some cases, and partially by the claws in others, the true climbers are those which are capable of comparatively little motion upon the ground, and are very seldom found upon it, except when they have to make their comparatively slow and ungainly journeys from tree to tree, or from the trees to the water. There is, however, a gradual change of character in the climbing organs, even in the quadrumana, until they ultimately terminate in what may be termed simple hooks rather than hands, having the fingers, or strictly speaking the toes, furnished with long sharp and bent claws, so that they climb either by bending the toes across a branch, or make their way longitudinally clinging by means of the claws and the spread of the toes. Animals which have this structure are all nocturnal, living in obscurity in the depths of the forests, and feeders upon insects, small birds, and very small mammalia, upon which they steal in the dark; and therefore we are but little acquainted with their habits in a state of nature, and capable of judging only very imperfectly of the manner in which they use their feet in climbing.

Perhaps the most typical of the climbing animals, which climb by means of hands, or more correctly grasping feet, for there is really no true hand in the whole range of animated nature except the hand of man, are the apes properly so called, namely the tailless ones, which have no appendage to the sacral extremity of the vertebral column, either as a balance in their motions, or as an additional grasping instrument.

Attempts have often been made to institute a parallel between those animals, more especially the chimpansee and the human subject; and it has been supposed that this parallel extended even to the length of intellectual sagacity. This last, however, is completely without foundation, and even the mere animal motions differ in kind and not in degree. In the fore foot of the chimpansee, and of all those apes which take their food with the paw, and prepare it if necessary by means of the two paws; the paw has a double function to perform, being equally a climbing instrument, and a prehensile one in the article of their food, and along with the mere prehension, it can break that food or otherwise prepare it, which may be considered as an inferior kind of working, though it is really a part, and a necessary part, of the act of prehension; in proof of which we find it exercised to a very considerable extent by some of the clutching and the climbing birds. In addition to these, its double functions, when the ape is in the tree, the fore leg has a third function to perform, in the exercise of which the great development of the paws, and their pliable structure, are disadvantageous to it. This is the act of walking, when the animal finds it necessary to be on the ground.

The three functions are perhaps more complete in the chimpansee than in any other of the apes, and therefore its fore paws can be applied to a greater number of purposes. These purposes may, however, be, generally speaking, reduced to modifications of three—taking food, climbing, and doing mischief, that is tearing things to pieces. An animal of this kind may be taught to sit at table, to use a knife and fork, or to drink out of a glass, which latter operation is sketched in the figure on the following page.

In all these, however, and in every action which such an animal can be made to perform, there is not the slightest resemblance to the action of the human hands, any farther than that there is a mere grasping. That grasping is performed chiefly by the long fingers, to which the thumb acts merely as a point of resistance, and no way directs the general motion of the paw, whereas in the human subject, though the thumb contains a joint fewer than the fingers, its revolving

notion upon its centre, acts more efficiently in directing the fingers than if it had as many joints as they, because when their extremities meet with the thumb at its greatest extent, any of the fingers is bent to a right angle at the second joint from the extremity, or this degree of bending is parted among the different joints.

If the chimpansee were to bring its fingers with their tips in contact with the thumb, they would be so much more bent than they are in the human hand, and the thumb is in itself so short, that scarcely any motion could be given to the point of contact between the thumb and fingers, by action of the parts distant from the metacarpal joints. When, therefore, the chimpansee (and the case applies more to any other ape) holds a small object between the tips of its fingers and that of the thumb, all the motion which it can give to that object must be produced by the joints of the wrist, the elbow, and the shoulder. In human labour, especially in the nicer operations, much of the work is done, with all above the wrist, and not a little of it with the wrist itself, in a state of perfect repose, unless when the entire hand requires to be shifted from one place to another. Such a hand, therefore, can work a long time at the more nice and delicate operations which are confined to moving the joints of the hand itself, without in the least fatiguing the arm or any other part of the body. In like manner, if a little more range in space be required, and the wrist be in consequence put in requisition, all the motions may still be performed without in the least disturbing the elbow joint, or fatiguing any of the muscles which are inserted upon the humerus. So also, if a more extended range in working calls the elbow joint into play, that may be put in motion without in the least disturbing the shoulder, or disturbing the scapular and pectoral muscles; and if it becomes necessary to call the shoulder joint into requisition, that may be done while the body generally is in a state of perfect repose. This may be reversed: the shoulder may be moved, and so may the elbow, the wrist, and all the other joints to the last phalanges of the fingers, without in the least moving any of the joints which are more distant, or fatiguing the muscles which produce the motions of these joints.

In the human subject, therefore, when properly formed and in a state of health, there is a perfectly distinct command over every joint and part moved upon that joint, so that whichever of them is required for any purpose is always ready for that purpose, leaving the rest in a state of repose, though they are all ready to act in concert, when the action required is so complicated as to require their joint action. This is the true character of a working hand, a hand destined to do something higher and more noble than the mere animal functions of climbing, seizing food, breaking it if necessary, and carrying it to the mouth, and occasional walking, to which the fore paw of the apes, even in what is regarded as the most perfect of their species, is necessarily confined. It is certain that the great majority of mankind do not educate this hand in the way that it ought to be educated, and perhaps there are none who do so properly, and yet there is an inexhaustible fund of ingenuity in it; and, excepting where it is limited by physical resistance, or by distance too great for its reach, it would be a bold assertion to state one thing which it might not be made capable of doing. We find that even the rudest people soon begin the education of the hand; and the weapons of the houseless savages of the Australian bush, and also their fishing hooks and basket work, would perfectly astonish those of our rustics who are confined to the mattock and the spade, and such other heavy instruments as require the exertion of the whole body rather than that of the hand.

When we speak of "educating" the hand, we speak of man as being endowed with mind and capable of general education, both as respects knowing and as respects doing. There is something beautifully poetical in the two simple words, in which in the Systema Naturæ,' the illustrious Linnæus draws the discriminating character of man: "Knowing himself," says the Swedish naturalist, and he says no more; but in this single touch the picture is perfect, for, of all the varied living creatures which people the earth, this can be predicated of man alone.

If the other animals knew themselves, that is if they were acquainted, or could make themselves acquainted, with the structures of their own organs, the modes of action in those organs, and the principles upon which they act, they would be certain to improve themselves by education; but the fact of their never rising above the original instinct, in the individual or in successive generations, is a proof that they have no such power. The instruction which some of them are capable of receiving, by care on the part of man, is no evidence of the slightest approximation to self-educating on the part of themselves; and the best trained horse and dog, which are favourites with their masters, and to a certain extent treasures to them, remain just as ignorant of their own structure and their own capabilities as the wild ass in the desert, and the dingo in the Australian jungles.

Now, notwithstanding all the fancied similarity to man in the structure of their bodies, and the similarity in the internal parts is as great as in the external, if not greater, there is not half as much susceptibility of imposed education in any of them as there is in the dog or the horse, or even in the seal. By nature they are gregarious animals, living more or less in troops; and the gregarious instinct is just as constant to the animal as any other instinct. Such animals follow each other, both in change of place and in action; and when they are separated from their kind, brought into a domestic state, and familiarised to the sight of other animals or of man, they

follow these, are fond of their sight, impatient of loneliness, and, so far as their organisation permits, they follow them in action as well as in locality.

The food and feeding of the chimpansee and the other more typical apes, both in the teeth and the digestive organs, resemble those of man much more closely than those of any other animals do; and therefore it is perfectly natural to suppose that, as in a state of nature they seize their food and bring it to their mouths by means of their grasping paws, they should follow man in the use of a fork, a spoon, or any other intermediate instrument. Nor is it the slightest evidence of intellect of any kind on their part that they should occasionally be found, even in a state of nature, making use of a stick to help them in their clumsy march, or to strike down a fruit which they cannot reach with the paw; for when they are on the ground they help themselves along by grasping the bushes; and, on the trees, branches and stems are the means of all their progressive motions.

In the search of their food, however, except merely reaching it by climbing, very little resource is required. It is true that they have to climb, and to look, and sometimes search with the fore paw among the branches, for those fruits which form their chief subsistence, but they require no stratagem, and no powers of pursuit, inasmuch as their food is fixed to the tree or lying still on the ground, so that if they can see it, and it is accessible, they have nothing more to do than to seize it with the paw, against which operation it cannot from its nature make the smallest resistance. Hence the reason why the ape tribe can never be trained to do any thing useful, however they may appear to imitate man in those actions which accord with their structure and with their habits in a state of nature.

There is therefore no gradation from man through the apes to the other animals, except in the bodily structure, and there it is very slight. Every species of ape, under what subdivision soever it may be placed by naturalists, is peculiarly fitted by its organisation for a certain locality, and out of that locality it is out of its element, and cannot exist without artificial means, nor prosper as it does in its own locality by all the artificial attention that can be bestowed on it. Not only this, but every species which differs structurally from another, has a different locality; and though the latitudes and the climates of those localities may be very nearly or altogether similar, it is probable that the animals could not bear a mutual exchange of place. Viewing the matter therefore in the most candid and careful manner, it is impossible even to imagine that there is any approximation to man, regarding him in his whole nature as possessing an intellectual principle, on the part of the apes, any more than there is on the part of any of the other mammalia, let their structures be as different from the structure of man as they may; all that we can say is, that each animal is adapted to a certain locality and for a certain purpose in creation, and that, though these localities and these functions vary exceedingly, the adaptation in the case of each of them is as perfect as that of any of the others.

If the apes resemble man more in their organisation than some other animals do, it only proves that their modes of life resemble, more than any other animals do, the mode of life in man when in that state in which he has the least mental resource. Nor is it unworthy of remark, as illustrative of this, that the blacks of the central parts of the eastern Archipelago, the grand home of the long-armed apes, live somewhat in the ape fashion. They dwell in the fastness of the central forests, usually in little hordes, and inhabit the trees—the hollows generally speaking, as places of shelter, but still their dwelling is the forest. They cannot climb by the grasp of the feet, as apes climb by the grasp of their hind feet; but they contrive to make a very efficient instrument for climbing of the great toe, with which they can hold on, until they get a reach upward with the hands, with much more force than we who lose the use of our toes in the luxury of shoes—and frequently gain corns as our reward—would be apt to suppose.

It appears, therefore, that though the ape can do nothing to elevate itself to the rank of man in a state of civilisation, man may remain in a state, higher than the ape certainly, but not very much higher. In this state, which of course is that of the minimum of mental development, man is more helpless than any of the animals, and in what locality of the world soever he is situated, he is more out of his element. The reason is obvious, the strength and energy of the human body must be limited as well as those of the bodies of other animals; and as all the organs of motion and action in man are fitted for many more purposes than the same structures of animals, it must follow that their adaptation to any one purpose must be inferior, and that when man attempts to play the ape in the wild forest, or any other part played by another animal, he must do it in a very inferior manner. This inferiority in any single exertion of the mere animal is, however, a very great advantage to man, for it constitutes that "necessity," which is proverbially said to be "the mother of invention;" and if we are to suppose that at any time human beings were cast on a lonely island, utterly uneducated, and without the experience of others to guide them, this necessity would be to them the beginning of mental development, though the future growth would depend upon circumstances, and would be more rapid in proportion to the necessity, unless that necessity were so great as to break down with despair, instead of stimulating with hope.

We must therefore regard the hand, or grasping fore paw of the ape, as especially an instrument fitted for enabling its possessor to reach, pull and eat the fruit on a tree, and we may naturally expect that all its organisation should be in accordance with this, for the feeding of an animal considered merely as an animal, is the main purpose to which all its external organisation is directed, and therefore the structure and the feeding are reciprocally keys to each other. If we know the nature of the organs of motion and the teeth, we can easily say when and upon what the animal feeds; and conversely, if we can say when and upon what it feeds, we can form a tolerably correct notion of what its structure must be, at least in what we may call the working parts of its body.

We have already seen that the fore paws of the ape are incapable of performing the proper functions of hands, and their chief adaptation being for climbing, they are equally ill-adapted for performing the office of walking feet. Perfect clavicles are necessary for the cross motion of the anterior extremities, and because the ape requires a greater stretch of those extremities than man does of his arms, the clavicle is rather firmer, and the articulation of the shoulder more loose. The oblique motion of the elbow joint

too by which the fore legs are made to cross each other and the paws brought together or to the mouth, give a lateral shape to those joints, and throw more strain upon the muscles than there is in animals which have those joints moveable only parallel to the mesial plane, or with very little lateral motion. The wrist joint is also loose, and the great length of the naked paw which comes to the ground, together with the motion of the thumb, so far as it has motion, being opposed to that of the fingers, makes the planting, and especially the raising of the foot both clumsy and laborious. No animals with perfect clavicles are indeed good walkers in straight forward motion, for they have to assist the action of the fore legs by the flexures of the spine, which throw the centre of gravity of the body alternately to the right and left, and thus they may be said to have a double labour to perform, compared with that which straight forward walkers require in passing over the same extent of absolute distance; they have to carry the weight of the body forward, and also to carry it alternately right and left. Hence, in bears and several other animals which are not habitually climbers, but which, though they do climb, spend in general more of their time upon the ground, the clavicles are always more or less imperfect, part of them being composed of cartilage more or less flexible according to the habits of the species.

The hind legs and feet of the apes have more exclusively a climbing character than the fore ones. They are not used in seizing the food, or in performing any other operation than that of progressive motion, or of holding on upon the branches of trees. The thumbs on them are, generally speaking, articulated far in the rear of the fingers, and turned obliquely inwards, so that they rather grasp against the opposite side of the entire sole of the foot than against the other toes. Those hind feet from their structure take a firm hold upon a branch, and they also afford a broad base for mere support. That base is indeed too broad for walking, and the hind legs are articulated in a manner which, however firm the soles of the feet were upon the ground, would give the animal very little stability upon them. But they do not even stand firmly, for the tendency of the thumb acting in a cross direction to the other parts of the foot, is to throw the foot on its external edge, a position which is the most tottering of any in the march of an animal. We have a proof of this in human beings, in whose legs there is no very apparent malformation, but who appear merely to have acquired a bad habit of turning in the toes when they walk. In this way, the foot, instead of being planted firmly on the ball of the great toe and the heel, which are the grand points of support for firm and steady motion, while the outside of the foot is a support against lateral shake, is thrown upon the central portion of the outer edge of the sole for its main support, and the ball or the heel cannot come to bear without a lateral totter. What some of the human race thus acquire, chiefly from bad habit, the apes have by nature, and that to a far greater extent.

This, however, is not the only disadvantage to which these animals are subjected in walking, in consequence of the peculiar articulations of their posterior extremities. The pelvis is remarkably narrow, which brings the articulations of the femoral bones very near to each other; and as the distance between the articulations of these bones is the base which supports the body or trunk of the animal, in the apes, this basal line is much too short for maintaining the body of the animals steady in an erect position. It may appear singular to those who have attended to the statics of dead matter, where there can be no stability but on a basal surface, that the base of an animal should be a line. It is to be recollected, however, that the stability of the animal is not the stability of rest, but a stability which must admit of motion; and this is quite incompatible with a basal surface. It must be remembered too that the line joining the articulations of the femoral or thigh bones, is the base of stability to the trunk, head, and upper extremities only, and this stability in the cross direction, or in the mesial plane of the body, is obtained by flexures of the spine, while the stability on the basal line already alluded to, as well as that in the cross direction to this line, are farther secured by the position of the arms; so that in the motions of the parts above, the animal has really the power of giving this line all the stability of a plane, at the same time that it retains the freedom of it as an axis of motion. We believe this stability in motion is necessarily peculiar to the living structure, and could not be imitated even in the slightest degree by all the complication of mechanical contrivances to which man could resort, and it is thus one of the most beautiful instances of the superiority of a power of motion in the moving thing itself, over a power of motion applied to it from without—one of the grand distinctions, in short, between an animal and a machine, and a striking proof of the great inferiority of the latter.

Even this inferior extent and stability of the basal line of the trunk is not the only imperfection which, as an upright animal, an ape sustains in consequence of the principal adaptation of the hind feet being for climbing. The possession of an *os calcis*, or heel bone, is perfectly incompatible with the action of a foot which is to grasp in the same manner as the foot of an ape does; and the absence of such a bone is incompatible with a steady upright position of two feet, as a means of support, and at the same time of motion. In the human subject, the sole of each foot presents a basal line, and consequently the two feet, in which the lines cannot be brought close together, form a basal plane, stable in itself in proportion to the lengths of the lines, and the distance which the feet are apart from each other in a lateral direction, provided they are not so far apart as to strain the muscles and destroy their free action. The method of walking with the greatest safety upon ice, or any other slippery surface, with the greatest security, is no bad illustration of this. That method is to keep the feet a considerable distance apart, to take short steps, and to hold the joints of the knees and hips, and indeed all the joints, the action of which tends to steady the body in walking, in such a state of relaxation, as that every muscle telling in those joints may be at perfect freedom to act as necessity may require.

The two firm basal lines which the human feet afford, admit of progressive motion by the alternate advance of each; because the flexures of the body and the motions of the arms can be so regulated as to keep the centre of gravity of the entire structure directly over the line which is the base for the time, and while this remains the case, the body must be

perfectly stable. It seems, however, that for general purposes a line is requisite, in order to ensure this stability. No doubt, as we see in figurantes and posture-masters, the body may be so educated as to be balanced on a single point; but then, during such balancing, it is good for nothing as respects any other kind of action, and would of course be of no use in the natural economy of any animal. The same kind of stability may also be obtained by pirouetting or whirling round on the one toe, in which the body is kept up by centrifugal force, just as a top is kept up in the motion of spinning; but this again occupies the whole of the powers and the attention, and could not be any portion of the natural movement of an animal, in whatever manner that animal were organised.

With the exception of man, none of the mammalia possesses a line of stability in the foot, whatever may be the form of that foot; for though there are many animals which walk on the tarsus, the ankle joint has no support backwards, unless there is a heel bone, which none of them possess. An ape, therefore, in common with the rest, has a yielding basal line, and not a stable one in each of the hind feet; and therefore, though many of the species can stand up, they are always tottering, incapable of much action in the erect posture, wriggling in their attempts to walk, and very speedily tired. The chimpansee is perhaps the best walker among them, because its limbs are shorter in proportion, and thus they have not so much lever power in their flexures; but still it cannot proceed far without calling in the assistance of the fore legs.

But, besides the short base between the articulations of the thigh bones, and the very imperfect basal lines furnished by the feet, the climbing structure of the hind feet of apes gives them other disqualifications for walking. The joints of the thigh bones are loose, in order to allow a great deal of motion upon the foot which holds on, while the anterior part of the animal is engaged farther up among the branches. The knee joint also has a far more rolling motion than is consistent with steady walking, and therefore, the march of an ape, whether attempted on the hind legs only, or performed upon all fours, has not the firm tread, nor does it show any of the more elegant paces either of a biped or a quadruped. That very flexibility of its legs, and also their length, enable it to leap with great agility, and, generally speaking, with agility greater in proportion as its legs are less adapted for walking. This is common in all vertebrated animals which have long, ungainly, and folded hind legs, as we may see in the frog, whose leap is longer in proportion to the size of the animal than that of a stag or a greyhound; but nobody ever saw a frog walking. It is something the same with the apes, and it may be stated as a general truth, that the longer their legs are, they are the more agile leapers, and the less capable of walking. Hence we see that in proportion as the limbs of those animals are better organised for one particular species of action, they are worse fitted for every other.

This is a very important principle in the study of the animal economy. It not only shows us that the supply of resource in every animal is so nicely adapted to the animal's necessity for that resource, that there is neither waste nor want, but a perfect sufficiency joined to an equally perfect economy. It shows us farther, that in studying the structure and economy of any animal, or of any well-arranged group of animals, we have only one general character to study, which, when fully understood, carries us readily and briefly through all the details. Were it not for this last circumstance a knowledge of natural history would be altogether beyond the ability of the most zealous and long-lived member of the human race, because the acquired knowledge would never afford a means of arriving at the knowledge sought; and we should have the old simile of the bundle of rods with the band broken, and the strength dependent upon unity gone.

The larger apes of the south-east of Asia are perhaps still better organised for climbing than the chimpansee, and in proportion as they are better adapted for that they are less so for walking. They are more exclusively forest animals, and march among the branches with so much rapidity that it requires a tolerably swift animal to keep pace with them on the ground below. Their anterior extremities are exceedingly lengthened, and thus they can extend their grasp to long distances in proportion to their size and weight. The great extent to which their legs fold without any straining of the joints, and the circumstance of their fore paws reaching the ground when the spine is not very greatly depressed from the horizontal position, enables them to spring from all four at once; and thus, when pursued upon the ground by enemies, if they can get near a tree they can spring and seize a branch at a considerable elevation. They, and indeed almost all the apes of the eastern continent, can also rest their limbs by reposing in a sitting posture, and embracing the tree with one limb. They are enabled to do this for a greater length of time than almost any other animal could, in consequence of the pads of callous and elastic matter with which the posterior parts of the body are provided; and though their habits during sleep are not much known, it is probable that many of them repose in the trees in this position.

The baboons are perhaps not so exclusively tree animals as the apes, but are more on the ground, and more habitually upon all fours. They climb well, but they do not leap with so much agility as the long-limbed foresters; they are therefore exposed to more danger from ground enemies, and therefore nature has given them more surly dispositions, and more powerful weapons of defence, in their long and strong canine teeth. We may remark that, though the teeth of the apes bear a very considerable resemblance to those of man, and that the baboons, notwithstanding their large canines, have no carnivorous cheek-teeth, yet that the whole of the race, even down to those of comparatively small size, have very powerful action of the jaws and bite desperately, more severely even than carnivorous animals of the same size and weight, though their bite is a cutting and not a tearing one. This strength of the jaws, and power of bite, are closely connected with the climbing character of the animals; for many of the fruits upon which they subsist are enclosed in such hard external coverings, that great force is required in order to get at the part fit for nourishment.

The very numerous species and genera of quadrumana of the eastern continent, known by the common but ill-defined name of monkeys, all climb nearly in the same manner as the apes, and being more slender in their bodies, and thus capable of inhabiting smaller twigs, they are more frequently seen. They are, generally speaking, better walkers than the others,

and they perform their climbings and other motions in the trees, by leaping and by grasping jointly. Their tails, which in some of the species are very long, assist in steadying their bodies, both when they leap and when they walk, which they do upon all fours, and though with a leaping and shambling motion, yet a good deal more steadily than the quadrumana that have no tails. That their superior powers of locomotion on the ground correspond with the peculiarity of their organisation, is proved both by the observation of them in a state of confinement, and by the fact of their assembling in troops, and marching considerable distances, in order to plunder in the plantations of the people in the countries which they inhabit thickly.

When we turn our attention to the quadrumana of the American continent, we find considerable differences in their organs of climbing, and these are accompanied by certain differences in the number of the teeth. The most remarkable difference in their climbing organs, which however is not common to the whole, is the addition of a fifth one, which is equally efficient with the other four, if indeed it is not more so. This is a prehensile tail, or a tail capable of laying hold by curling once or oftener round the branch or other substance by which the animal wishes to support itself; and if we except the kangaroo, whose tail assists as a third foot and as a weapon of defence, there is not, in the whole of the mammalia, a tail of anything like the efficiency of that possessed by those American quadrumana. In some of the species it is longer than the whole body, and yet the bodies are of a very lengthened form in proportion to the size or weight. A considerable portion of the tail toward the extremity is covered with naked skin on the under side, very similar to that with which the prehensile paws have the palms and undersides of the fingers covered. The animals which are furnished with this appendage, have all the limbs exceedingly long, the joints with very loose and varied motions, and the whole frame supple, so that it readily bends in any direction. The hands, or climbing paws, are less perfectly formed than those of the apes which have no prehensile tail, and especially those which have no tail at all, but which depend entirely on the feet both for the extent and the direction of their motions. On the ground they are very helpless animals, and they are more helpless in appearance than they are in reality. But the rapidity with which they can ascend a tree, and the distance to which they can swing themselves from one tree to another, are both much greater than one would suppose, from the apparent feebleness of the animals upon the ground. It signifies little in what direction the motion is taken, or which end of the animal is made the point of rest, and which is ready to seize the new support. They can catch hold with the tail, swing till they have got the requisite momentum, and then project themselves till they can lay hold of a branch, and if the next branch is at a distance, they can swing again upon the fore leg, and project themselves so as to lay hold with the tail. In this way they tumble about with astonishing rapidity, and apparently often for mere sport. There are many species of them, differing a little from each other in many particulars, but all agreeing in the use of this prehensile instrument. Under the article Ateles will be found figures and descriptions of two of the most remarkable of the long-legged species, and we shall here present a figure of another, of which the limbs are not so long, but the tail is perhaps longer in proportion; and in order to convey some idea of the action of these animals we have represented it in the action of swinging by the tail.

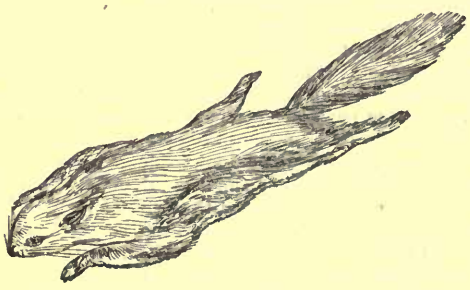
This species, and several others of the section to which it belongs, are remarkable for the loud and disagreeable sound of their voices. The bone of the tongue in many of the quadrumana is far more produced than in the human subject; and it is furnished with a large cavity or sac, by means of which, as it is understood, these creatures are enabled to produce that loud and dismal voice from which they obtain the popular name of howlers. In them there are five fingers on all the paws, but the thumbs even of the anterior extremities have very little freedom of motion, so that their principal mode of grasping is with the paw itself like a hook. Others again, the very long-legged ones to which we have alluded above, have the thumbs of the fore paws concealed under the skin, and incapable of any kind of action against the fingers.

To these succeed others which have the tails long, but not prehensile, and the fingers furnished with crooked claws, instead of flat nails like those possessed by the more characteristic hand climbers. These last approach the squirrels in their style of motion among the branches, holding on partly by the grasp of the fingers and partly by the points of the claws, while the tail, which is covered with soft and rather long hair for the whole of its length, and which though not prehensile is very muscular, is understood to serve as a parachute, which is the purpose of the produced tails of all the climbing animals which have not perfect grasping paws, or extensile skin, to assist them in their motions from branch to branch.

It would, however, be impossible to notice in a general sketch of the mammalia all the varieties of the hand or grasping paw at the extremity of the leg as a climbing organ. In proportion as the food of the animals ceases to be wholly or chiefly of a vegetable nature, the paws begin to assume a compound character, retaining still the power of grasping, and often having a thumb free in its articulation, but not acting directly against the fingers, sometimes having a mere tubercle against which the fingers act when

bent, and gradually passing into a sort of termination to the foot, resembling that of birds in a slight degree, as we find in the squirrels, and in some of the marsupial animals of New Holland which are inhabitants of trees, and furnished with extensible membranes, which act as parachutes in breaking their fall. All those membranes which are used for this purpose are to be understood as really belonging to the organs of climbing, though they are vulgarly termed organs of flying. There are no means of a flying action in any animal which has those membranes, whether broad or narrow, extending nearly from the fore leg to the hind, and leaving the foot of the former as well as that of the latter entirely free, so that each of them is still efficient both for walking and for climbing. There is no flying membrane among the mammalia, except one which stretches on the produced bones of the fore feet, and has the shoulder joints articulated something in the manner of those of a bird. This is the character of the bats, of which we have already spoken, and other than them there are no known mammalia which possess it.

Animals which have those membranes of the parachute character generally have the feet well constructed for climbing, though they climb by holding on with the points of the claws acting towards the centre of the foot, and thus in so far against each other. They are also, generally speaking, broad and flat in their bodies, and covered with a profusion of long hair, so that the weight is but small in proportion to the apparent bulk. They are also very agile animals, and capable of a good deal of motion without being fatigued. Our present concern is with their means of climbing, however; for though there is no power of upward motion in these membranes, but on the contrary the animal must sink below the direction in which it originally takes its spring, yet they prevent it from falling so low as it otherwise would do, which is at all events an indirect method of raising it. Animals of this kind are also all inhabitants of trees; and one principal purpose which the produced membranes, in large tail and lengthened fur answers, is that of enabling it to pass from tree to tree, or from branch to branch, without the necessity of descending and climbing up again by the help of the feet, which would be a much more severe labour. In ordinary cases, such as in the thick trees which our common squirrels inhabit, much production of membrane is not necessary, because the leap is sufficient upon ordinary occasions; but when the trees are farther apart, the membranes are turned to account. The following figure will give an idea of the



attitude of a climbing animal, using its membranes as a parachute; and further particulars will be found in the articles Rodentia and Squirrel.

A considerable number of the ground rodentia, such as many of the rats and others, have the feet formed so as to act partially as organs of climbing; and the mode of their action does not differ greatly from the action of the feet of squirrels, independently of the membranes and other produced appendages of the latter. It is therefore not necessary to give a particular account of them as distinct modifications of the climbing foot, neither is it necessary to notice the feet of various small nocturnal animals of prey which are to be met with chiefly in the south-east of Asia, because their feet are also constructed upon nearly the same principle, only modified according to the kind of footing which they generally have, and the rate at which they move.

The climbing of bears is, however, so peculiar a modification of this species of action, that we cannot with propriety pass it without some notice. Bears may be said to have three climbing organisations, or more strictly three modifications of the same climbing organs. They climb by hugging the object which they ascend between the fore legs, if that object is a tree, or any thing which they can embrace with the stretch of their ample legs and paws. They also climb by holding on with the claws, and indeed the claws of the hind feet are the points of support, by means of which they hold their place on the trunk of a smooth tree, while they advance the fore feet in the hugging operation. The claws of the fore feet are also of some use in climbing; but they are of much less than the feet themselves, for these can be converted into most efficient hooks, by means of which the animal, even though a very heavy one, can ascend very rapidly if there are inequalities upon which these strong hooks can lay hold. The "Bear and rugged Staff" have long been associated together, and the association is not one of those fanciful ones which have, in many instances, arisen from the corruption of language; for a staff, or rather pole of that description, is the kind of ladder by means of which a bear can climb with the greatest ease and rapidity. The plantigrade form of the feet also gives the bear a great advantage in climbing as it enables him to stand on a comparatively narrow base, and raise himself up till he gets a fresh hold with the paws. When a bear-pit is furnished with poles of the proper form, the climbing of the bears, the ease with which they balance themselves on the tops of the poles, and the rapidity with which they can descend, hugging the pole all the way, are no bad specimens of the mechanical action of animals.

Climbing is not confined to those bears which are more exclusively inhabitants of the forests; for they exercise it in every locality which they inhabit. The polar bear very speedily gets from the water upon the ice, even although that ice floats at a considerable height above the surface; and when on the ice, and wishing to "scent" the horizon for the direction in which prey is to be found, he very speedily gains the top of the hummock which suits his purpose. Neither he nor indeed any of the bears can climb up a surface which is perpendicular, or very nearly so, and does not afford holds for the single paws as hooks, or for the two in hugging; but if these are furnished, this bear is a sure, though not an elegant, climber.

In all the localities which bears inhabit, in a state of nature, climbing may indeed be regarded as a necessary part of their economy. They are not, in any part of the world, inhabitants of the open plains,

though they occasionally traverse them. Their march is more rapid, and they can continue it longer, than one would readily suppose; but still they are not well adapted for giving chace, even when they seek for animal food; and their subsistence is often wild honey, and fruits, and other succulent vegetable matters, which they can procure only by climbing. Woods and places with rough and rocky surfaces are, therefore, their proper localities; and their peculiar organisation enables them to climb the rock and the tree with equal ease, which is beyond the power of the handed or grasping animals, whose chief locality is in the forest, and the only pathway on which they are quite at home is the branches.

Some particulars of the Indian species will be found in the article Bear; but we may mention here, for the sake of illustrating the climbing powers of these animals, that the jungle bear, the Malay bear, and probably some other species or varieties which inhabit that paradise of succulent fruits—the south-east of Asia, and the adjacent isles, live habitually on fruits, for which they have to climb, and that often to a considerable height. Nor do they merely ascend and pull what they want, for they can reach the fruit of a lofty palm, and break the shell, or they can get to the more central bud, bite it off, and extract the copious supply of sweet juice which flows from the wound. This habitual feeding upon sweets is said to affect them with a greater loss of teeth than is known among the average of the mammalia in a wild state. The feats of these bears in climbing are different in character from those of the handed animals, but they equally entitle them to the character of climbers; and although, in common language, the bear is usually taken as the very model of clumsiness, yet when we come to examine his organisation and his action, we find that he is an animal of no ordinary resources, and that there are none of the mammalia better fitted for holding their place and playing their part in the grand system of nature.

The bear may in fact be considered as the typical animal of climbers of one class, as the ape is the typical animal of another. All the plantigrade mammalia are climbers to some extent or other; and it is obvious to accommodate this climbing habit that they are plantigrade. For mere walking this would be a disadvantage, because a plantigrade motion is slower and performed with more difficulty than a motion on the toes. To have given these, which are chiefly predatory animals, a worse walking motion than others have, without any compensation for it, would have been contrary to all that we meet with in the rest of nature; and this alone is sufficient to lead us to the conclusion that they have some other office to perform with their feet.

Advantage, though given to each in a different way, is yet given so equally to all animals that if we find any animal worse adapted than another for the performance of any one function, we may be certain that the one which is less adapted for that particular function is capable of some other function which can counterbalance the deficiency; and this is our grand inducement to find out the additional one. This equality of endowment possessed by all the living children of nature, taken on the average of their several species, is one of the greatest encouragements and helps to all who wish to study nature.

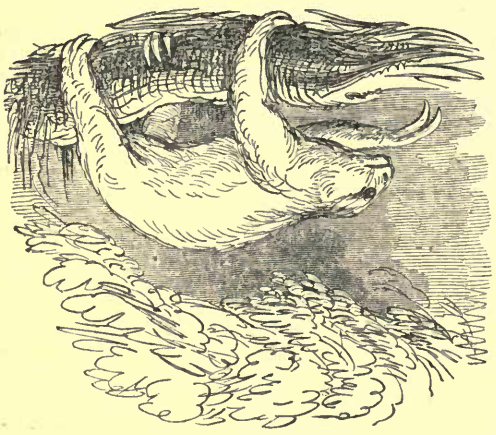
We shall not enumerate all the modifications of the climbing habit of the plantigrade mammalia. None of them possesses the same power of hugging with the fore legs as the bear, but the general manner is the same; and this is the compensation for the inferiority of their walking motion as being plantigrade; in like manner as the climbing of the quadrumana and the flying of the bats are their compensations for the same; and in all the three, the deficiency on the one hand and the compensation on the other are in proportion, and balanced with the greatest nicety. The annexed sketch will show the position of the paws in bears and other plantigrade mammalia, when they hold on or climb by means of these as hooks.

We shall mention only another modification of the climbing organs of mammalia, namely the form in which they appear in the sloths. The organisation of the limbs of these animals is such that they cannot walk, except at an exceedingly slow and crawling pace, and with the utmost fatigue and difficulty. They do not make their way readily along the upper side of a horizontal or sloping branch, and they climb the upright trunk of a tree very slowly. In all situations indeed in which the weight of the body is supported from below, their powers of locomotion work to a disadvantage, and are cramped and effectless.

Sloths are in fact the reverse of all other mammalia, in respect of the position in which they have the most easy repose and the most vigorous action. Other mammalia sleep with the belly, or at any rate the side, to the ground; and the natural position of action in all the rest, whether that action is in the air, in the water, on trees, on the ground, or under the ground, is with the back uppermost. Some of the climbers can indeed move along the under side of a branch, or at all events hold on in that position; but it is unnatural to them, they cannot continue in it for any length of time, and, if they were to get asleep, they would inevitably tumble to the ground. Not so with sloths, for their whole organisation is so well adapted for maintaining them firmly in this reverse position, that it is the only one in which they can be said to be perfectly stable. Their feet are formed as hooks, by which the weight of the body is hung, and they do not answer at all for bearing it up after the manner of ordinary legs. Inhabiting higher in the trees than any other mammalia, and subsisting entirely on the leaves which are between them and the sky, their hanging position is the one in which they can have most command over their food. Even their fore feet are never used for seizing the food, or conveying it to the mouth, for their claws and toes are not adapted for grasping, unless when they are pulled against by the weight of the body. They are closed down upon the sole, not by the exertion of flexor muscles, but by elastic ligaments; and as those ligaments are more powerful than the extensor muscle, by means of which the animal moves along the branch, or from

one branch to another, they are efficient for hardly any purpose, save this very peculiar motion ; and thus they are perhaps more exclusively climbing instruments than the fore feet of any other tree animal. The hind legs have the same twisting articulation as those of the tree apes, so that when they are on the ground the outer edges of the feet are points of such rest as the animal possesses there. They are necessarily very unstable points of rest ; and as the animals have besides great difficulty in stretching their legs, and cannot possibly stretch them all at the same time, their progress on the ground is exceedingly slow, and performed with great apparent labour and pain. The labour and pain are, however, only apparent, not real ; but the animals are gentle and timid in their dispositions ; and as they have not the power of escaping from enemies, they are much alarmed, and, like all animals when alarmed, they utter plaintive cries. They have been pitied and described as helpless, and even imperfectly formed, in consequence of this want of adaptation for walking, which is vulgarly regarded as the characteristic of the mammalia. To understand their organisation aright, we must, however, look at them in their proper place ; for a sloth upon the ground is just as much out of its element as a race-horse in a deep quagmire, or a hawk in the sea.

Under the article Ai there will be found some details of the history of the three-toed sloth ; and we here introduce a figure of the two-toed one, for the purpose of illustrating the mode in which these singular creatures make their way, which is always when the forests are agitated by strong winds. That the sloths do not tumble even upon such occasions, unless where the trees are actually broken by the wind, shows how well they are fitted for their place in nature.



There is reason to believe that sloths are far more numerous than is generally supposed. They inhabit the deepest forests that are known in any part of the globe, ranging from Guyana to the dry country southward of Upper Peru, and enjoy a depth both of solitude and of shade, to which there is nothing equal in any other part of the world. It is for the very fastnesses of those forests that they are adapted. The difficulty they have in descending and ascending again, necessarily stops them wherever there is an opening in the forest ; while the agility of their neighbours the monkeys, adapts them better for the margins of those openings than for the thickest parts of the forests. Those forests are in many places so exceedingly close and dark, and so frequently flooded or covered with stagnant water among the roots of the trees, that there are perhaps hardly any mammalia in them except sloths, except it be the manate in the waters. Thus we see that their curious structure, and equally curious mode of life, are given them for the wisest purposes, and that mammalia differently constructed, could not subsist in those localities which they inhabit. There is no food for any herbivorous animal of this class lower down than the dwelling of the sloths ; and unless in places where there are herbivorous ones to supply food for them, there can of course be no carnivorous ones. The peccaries and other herbivorous mammalia of South America are found in the openings, and not the depths of the vast woods of that country, and therefore the jaguars and other predatory animals are found in the same. Thus, in the depths of the forests the sloths dwell in peace and safety, perhaps more so than any known race of animals. Nor must we suppose that the part which they act in nature is an unimportant one. Those luxuriant forests are places of great productiveness and plenty ; and it is a law traceable through the whole of nature, that wherever productiveness is in excess, there is always provided a sufficient number of consumers for keeping it within those bounds which appear to be essential to the health and preservation of the whole. The reason of this is equally obvious and traceable through the whole of nature. Every production of nature must exercise its productive powers within certain limits, otherwise it exercises them to its own destruction. We observe in a neglected garden or field, that natural weeds first put down the cultivated plants, and then one weed puts down another, until some one gets the mastery, exterminates all the rest, and quickly follows them to oblivion. That the powers of vegetation are very great in those American forests must be admitted, but still if they were left to be overwhelmed in the ruins of their own leaves, they would perish in time ; and to prevent this appears to be the principal service rendered by the sloth.

The sloths may be considered as the most lofty-inhabiting of all the tree animals, and indeed of all climbing mammalia, that is to say, if we estimate their abode from the ground immediately under them. They also approach in some of their characters the grazing ruminantia, much as they differ from these in other characters. Their feet are simply organs of locomotion, not applied, and from their structure not very applicable, to any other purpose. With them therefore we shall close our brief survey of the climbing organs of animals. There are a few other animals which can climb, as, for instance, the goats and antelopes which inhabit high and rocky mountains. These however, climb by bounding, in which the elasticity of the body comes into play, and not by grasping in any manner with the feet, which are not fitted for any such purpose ; and though the animals are, in some of the species exceedingly expert in gaining heights, yet they belong to the walking animals rather than to the climbers. The few remarks which we have to offer concerning them, can therefore be introduced with more propriety and effect in our notice of these.

Organs of Walking.—All these may be considered as belonging to one general class, though there are great diversities in their forms, in the modes of using them, and also in the other purposes which

they serve, besides conveying the animals to the places where their food is found.

They may be regarded as forming three principal divisions: first, feet which serve for walking, and for hardly any other purpose; secondly, feet which serve for walking and also for preparing a den or burrow in the earth, in which the animal shelters itself, or finds a security for its young; and thirdly, feet which in addition to the function of walking, serve the animal as prehensile instruments in immediately seizing its prey.

The foot which performs the single function of walking, we need hardly say, performs that function better than any of the rest do, upon the obvious principle that an organ which has more than one function to perform, cannot work with its whole energy in the performance of either of them; and thus a certain portion of the power of the animal lies idle while it is performing either the one or the other. We accordingly find that those animals which use their feet simply for walking, are larger, and also subsist on coarser food, or food which requires to be taken in larger quantities than that of animals with double functioned feet. Those which use the feet in burrowing are, generally speaking, small animals, but strong in proportion to their size. This is obviously necessary in consequence of the additional labour which they are required to perform. A common mole, for instance, is much stronger in proportion to its size than an elephant; and the labour which it has to perform in making its way under ground is far greater than that of almost any animal which lives upon the surface without burrowing. In proportion, however, as it is better adapted for making its way through the earth, it is worse adapted for walking on the surface. An outward motion is required in the digging feet, and this is inconsistent with the best form of articulation in the legs, and also in the feet for a free forward motion in walking, with nothing but its own weight to carry. The case is similar with all other animals which are expert burrowers, for they cannot obtain that faculty except at the sacrifice of a certain portion of their power in walking.

With those animals which use the feet as prehensile instruments, the case is somewhat similar, and as these are wholly or nearly all carnivorous, it becomes necessary that they should be capable of exerting more power occasionally than they can continue to exert for any length of time. Their prey is more substantial, however, than that of any other mammalia, and thus they are able to enjoy longer intervals of repose; their lives being made up of short and violent exertions, interspersed with much indolence. The cat tribe, more especially lions, tigers, and the other more powerful ones, afford good illustrations of what has been now stated.

Those predatory animals which course their prey, or follow it on the scent, furnish a different species of illustration. Generally speaking, they do not require that violence of temporary exertion which the others must practise, and therefore they can make more continual exertions. Their most violent exercise is that of running; and though some of them strike down their prey with the foot, and others turn it by the motion of the head, yet none of them can be said to clutch their prey by means of their claws. They generally also have more or less of a digging or burrowing habit when in a state of nature; for though some of the domesticated breeds of dogs have not much tendency to burrowing, we can draw no conclusions from them with regard to the habits of dogs in a state of nature.

We might, from the mere consideration of their structure and habits, be led to conclude that mammalia which have walking feet, should be by far the most useful to man. Like him, their proper habitation in all the principal parts of their economy is on the surface of the ground. Like man too, their feet are simply walking feet, and whatever other operations they have to perform, are performed by other parts of their bodies. It is true that they walk upon four feet, while man walks only on two; but in the grand operation of finding their subsistence, the mouth is the only instrument with which they are furnished in addition to their walking feet, and as this operation in them is from the nature of their food and its abundance, an exceedingly simple one, the mouth is quite adequate to the performance of it; and if the food requires to be "gathered in," as is the case with that of most animals which graze, a peculiar prehensile power is given to the lip, so that that organ secures what is divided by means of the jaws. This provision is of great service to these animals, inasmuch as, in the majority of this species, they must find their food nearly on a level with the ground on which they stand, and thus it has to be carried up to the throat against the resistance of gravitation.

Mammalia of this description do not require the same resources as those which prey upon animals; but still as the breadth of surface which they have to range is considerable, and as many of them have to move from place to place with the seasons, they have more animal sagacity than one would suppose. Indeed, as they are the animals chiefly preyed on by the more powerful carnivora, they require a considerable degree of watchfulness and resource, in order to avoid their enemies.

There is another circumstance which tends farther to adapt those animals to the use of man, and that is, the fact of their being all gregarious, or social in a state of nature. This circumstance of sociality is in a great measure the basis of domestication; for animals which live solitary, or in single pairs in the wild state, though they may be kept in confinement, cannot be domesticated without the greatest difficulty. Even in the same genus of animals, if we find a species inhabiting by the single pair, while the other species are social, it is an almost invariable proof that this species will be far more difficult to bring into a state of domestication than the others. Among the deer, for instance, the roebuck is, of the species with which we are well acquainted, the only one which lives in single pairs apart from each other; and the wildness of the roebuck as compared with the fallow deer, or even with the stag, is quite proverbial.

The same leading ground of domestication occurs in other animals, even in those which are predatory. The dog family, including the hyæna, may be said to be the only race of predatory animals which have been domesticated for generally useful purposes; for the domesticated cats are kept avowedly in order that they may pursue in houses the same habits which the smaller ones of the genus pursue in wild nature; and though they have a knowledge of persons as well as of places, at least to a certain extent, they do not evince any thing which can be called attachment to or affection for, even those who are most kind to

them. It is quite impossible to teach a cat docility by the application of the whip, and an animal of this species cannot read the expression of the human countenance, but looks on with most perfect indifference whether those who are about her be angry or pleased. When threatened, she always endeavours to escape, and if this is prevented, she shows battle in her own defence. A dog, on the other hand, not only crouches down to lick the hand which has just been chastising him, but he interprets every look, and he will fight to death in defence of his master, or even of his master's property if he gets charge of it, and has been trained to watch.

The distinction between those two races of house animals, with which every body is familiar in one or other of their varieties, is one which throws no inconsiderable light on the general principle of domestication, and the connexion which it has with the structure of the animal on which the experiment has to be tried. We have already mentioned that the fore feet of the cat family, in all its varieties, are quite as much prehensile instruments in seizing the prey as they are walking feet; the whole race too are leaping animals, which bring the elasticity of the back bone largely into play when they take their leaps; and the smaller ones which prey much upon birds, are capable of climbing trees, partly by leaping, and partly by holding on by the claws. Though they can walk, they are not therefore exclusively walking animals; and it is worthy of remark, as tending to establish the connexion between exclusively walking feet and domestication, that the hunting leopards of India which are trained for the chase, and are the only animals of the cat family which can be made available for such a purpose, have the claws only very partially retractile, and therefore not nearly so efficient clutching instruments as the claws of common cats, while there is a resemblance to the dog family in the general cast of the body of these leopards.

The dog family, in those races which are still in a state of nature, and in such of the dogs, properly so called, as have relapsed nearly to that state, are social, and they are more active and more brave than the cat family. It seems, indeed, that social animals can borrow courage from each other, much in the same manner as many soldiers stand in battle because their regiments stand, who would otherwise take to their heels; and this proves that the instinct which unites animals into packs or societies is much stronger and more intimately connected with their general nature than we would be apt to suppose. One mountain sheep will endeavour to escape by flight from the fox, whereas, if there are a considerable number, they will advance in a crescent upon him, and make him retreat, or beat him flat with repeated blows of their foreheads, if he so far forgets his native cunning as to wait till they have enclosed him.

It is not from the society of animals of their own species only that social animals, whether predatory or not, appear to derive confidence. If one meet a solitary dog on the hill, and show as much disposition to attack him as the mere demonstration of bowing down to lift up a stone, the dog will scamper off with drooping tail and all other signs of fear. If, on the other hand, a dog of the same description, or even the same dog, is with his master or with sheep, or in charge of property, he will show a disposition to repel any offered hostility; and if he approaches a remote cottage, he will come to a considerable distance offering hostilities to a stranger. All domesticated animals show courage in the presence of human beings; and the constancy of this increase of courage, or confidence, or whatever else it may be called, from society of any kind, leaves no doubt that it is their social disposition which attaches them to their home and their herd in a state of domestication.

The foundation of the principle of taming, and the real value to which animals can be turned by man in a domestic state, are among the most useful practical points in the natural history of the mammalia. Besides the use of the flesh of animals as food, and the coverings of their bodies and appendages in the arts, it is clear that an animal can be directly useful to man only in so far as it renders his labour lighter or his condition more secure. We have already said that in the general view of the matter, the walking animal is necessarily the one which can render man the most assistance in these ways. We do not now speak of the flesh of animals, of their skins, their wool, their horns, or any other parts of their bodies as being valuable in the arts; for all these are useful only as substances, and though they are the produce of animals, they are not available for any purpose in the arts, until after they have ceased to be animate. The service we derive from them is not therefore the service of animals; and there is perhaps no animal substance used in this way for which a proper substitute might not be found in the vegetable or the mineral kingdom. The true animal service is that which, if not performed by the animal, would require, if performed at all, to be performed by man himself. Even as this service is usually estimated, there are some parts of it, and those by no means the lightest or the least important parts, which are not of a genuine animal character in the restricted and proper sense of the term. In all cases where a mechanical or chemical power, such as the motion of the wind, the fall of water, or the production and condensation of steam in an engine can be substituted for the power of animals, the application of the animal is not strictly legitimate, and though the use of it may in many such cases be unavoidable, it should seem that it is always used to a disadvantage, because only one part of it, its mere mechanical strength, is brought into play, and the sagacity of the animal, which is frequently the most valuable part of it, lies unemployed.

Thus, for instance, when a horse is applied to turn the wheel of a mill or gin, to drag a boat along a canal, or to perform any other labour along a continuous and invariable path, there comes nothing into action but the main strength of the horse; and if it be possible to substitute some mechanical power instead of the horse, it will always be better to do it, because the horse may be more advantageously employed in some other situation where his sagacity as well as his mechanical strength can be turned to account.

There is, however, a limit to even this mechanical substitution, and perhaps, for purposes of genuine economy, it is a much more narrow limit than many persons believe, more especially in an age of great mania for mechanical power, both on the part of those who make a profit not of the actual application of such power, but of the proposed application of it in the first instance, and on the part of those who ignorant of every principle and every application of mechanics, are carried away by a fond but unfounded expectation of a gambling game greater than ex-

perience tells them they can make by the exercise of their proper calling.

This, however, is a question of political economy rather than of natural history, although it is one very closely connected with the usefulness of the mammalia in a state of domestication, and also with the consideration as to which of them can be made the most useful for domestic purposes. We shall not enter upon the details; but we may mention the principle for the sake of those who may be fond of turning their thoughts to such matters. It is a principle easily stated: the mechanical substitute, whatever may be its name, its form, or the means by which it is made to act, has no sagacity, it has merely the capacity of doing so much mechanical labour, which may be always reduced to a very simple standard, namely, the raising of a given weight a certain number of feet in a given time. The animal again has sagacity, and may be used to the full extent of this sagacity, as well as to that of its mechanical strength. Therefore, if no sagacity is required in the work to be done, and the continuance and quantity of the work are sufficient to cover the expense, the mechanical powers deserve the preference. On the other hand, if sagacity is required, or if the work is merely temporary, animal power is far better.

In considering what animals ought to be used in preference to others for assisting man in the performance of his labours, there are various considerations to be made. There are only two ways of applying animal power: the first is, by the weight of the animal acting at the end of a lever, or along the circumference of a wheel, which is nothing more than a succession of levers. An animal of some sagacity is required for this purpose, because it must continue going always in the same direction. The turn-spit dog is an example of this kind, though one which it is now rare to meet with in use. The dog attempts to climb a series of steps in the inside of the ring of a wheel; and if the wheel is of a diameter properly adjusted to his weight, his weight makes him descend just as fast as he ascends; and thus while he turns the wheel he remains at the same relative point in space, the wheel gliding away from under him as he endeavours to advance. This is well, and also wittily expressed by the poet:—

> "—— a dog that turns a spit,
> Bestirs himself, and plies his feet
> To mount the wheel, but all in vain—
> His own weight brings him down again."

Dogs are almost the only animals which have sufficient sagacity for being employed in this way; but they are not unfrequently employed to turn light machinery, in cases where the work required to be done is too limited for requiring a greater and more expensive power. The tread-mill which is now used as a species of hard labour for human delinquents, acts upon the very same principle as the dog-wheel: but the parties sent there are compelled to work, from the injury that they would receive by the wheel if they did not get upon the steps.

The second mode of applying the power of animals to useful purposes is that which takes advantage of their powers of locomotion, and considers the resistance which they can overcome when moving at a certain rate without injury to themselves, though the last consideration is sometimes neglected in a manner disgraceful to the feelings, and not very conducive to the pecuniary interests of the parties. This, though to a considerable extent it involves the structure of the animal, and the form of its organs of locomotion is, in the details, a matter of practical mechanics, having little to do with the natural history of animals, and not a very great deal with the mechanics of their structures; for it forms no part of the study of the animal in a state of free nature, but is merely an application by man of the power of the domesticated animal.

Moving a load or quantity of matter from one place to another, either by carrying it, or by pulling it, are the chief forms of this mode of applying animal power, and as it is the only one in which the power of animals is at all extensively employed, it is the one which deserves the chief attention.

In this respect there are necessarily a great many differences, arising from the nature of the work which the animal has to perform, and the character of the ground over which it has to move; and much of the decision in this case must necessarily depend upon the structure of the animal's feet. The feet of working animals are of two kinds, feet with toes and feet with hoofs, and the latter are either single, or consist of two real ones, on which the animal walks. In addition to these it is necessary to include the elephants and the camels, whose feet are not, strictly speaking, of either class. The feet of the camel are adapted for travelling over dry and sandy surfaces, and those of the elephant suit better with soft ground which is covered with rank herbage. The feet of the camel have only two toes, furnished with nails rather than with hoofs, which are united on the under side, and the sole of the foot is covered with a soft pad, which is equally ill-adapted for hard or stony substances and for humid ones. Accustomed to traverse the sandy deserts, in quest of the hard and scanty vegetation upon which it subsists, the camel lifts its feet straight up, in order to clear the sand. Its march is thus exceedingly dodging, and camel-riding is no very agreeable exercise for those who are unaccustomed to it. It is this high lifting of the feet, and consequent planting of them down with the weight of the body ramming them against the ground, which disqualify the camel for walking with ease on the surfaces which we have mentioned. This jars the leg, shakes the body, and pains the sole of the foot when on a hard pavement; and it is painful to look at a camel when led through the streets of one of our towns, where it has to tread upon unyielding granite. This is most remarkably the case with the dromedary or single humped camel, which is more feeble than the one with the two humps, and also lifts its feet proportionally higher. The same circumstances which enable the two humped or Bactrian camel to travel more easily over hard surfaces than the dromedary enable it to do so over humid surfaces, and thus it is useful over a greater range of country than the other.

Still camels are useful only as beasts of burden, and for long marches they are expensive animals. Their pace, besides its jolting character already described, is but slow, and the pain with which they walk over hard surfaces, renders them of no use whatever for draught. They are in fact fit only for countries which are in great part deserts; and in proportion as mankind inhabit more closely together, and have more of the accommodations of civilised life, camels become less and less useful to them.

Elephants are animals of great strength, and capable of supporting, and occasionally of drawing, very heavy

weights. They cannot, however, be profitably reared in a domesticated state, and therefore the use of them is necessarily restricted to a very limited space in the vicinity of their native forests. In the peculiar style of walking, both of camels and of elephants, at their usual moderate pace, at which they can continue for a considerable time without rest, we see examples of one of the disqualifications for labour in animals which are not deficient either in size or in strength. It will readily be understood that every motion which deflects the centre of gravity of the body of an animal from the straight line of its march, whether the deflection be right and left or up and down, increases the labour of the animal by the burden of its own weight carried over the whole measures of those deflections. Thus for instance, if the step of a camel in its slow march is two feet and a half (the actual measure is a matter of no consequence), and the dodging raises the centre of gravity three inches at the one part of the step, and moves it three inches laterally in the other part, then in addition to the step of thirty inches it has carried its own body six inches in absolute space, and the straining and new momentum necessary to be acquired at every turn may be reckoned at four inches more. By means of this constant moving of the centre of gravity, therefore, such an animal must exert one-third more strength in order to get over the ground than an animal which carries the centre of gravity forward in a direct line. The loss must be the same in the case of the load which it carries as in that of its own body; and therefore, even as beasts of burden, camels work at a very great disadvantage, both in respect of their own bodies and in that of the burdens which they can carry. The disadvantages in the case of the elephant are probably not less, but the great strength of the elephant, and the fact of its being employed chiefly in cases where show is the object rather than economy, do not bring it within the limits of ordinary calculation.

None of the toed animals are of sufficient size for being employed as beasts of burden, or for purposes of draught, except for very light weights, or in such numbers as to be inconvenient in thickly inhabited countries. Dogs are indeed used for drawing trucks and other light carriages, and they are the animals exclusively made use of by the Esquimaux for drawing their sledges over the snow. They are much more hardy and less subject to fatigue than almost any other animals; and at their common walking or running pace, in which the elasticity of the spine does not come into action, they are well formed for such weights as they are able to draw. When they run, however, they jerk the body so much up and down by the action of the spine that they are inefficient in short harness. When yoked by long thongs, as the Esquimaux yoke them, they are more effective when put to their speed; but then the difficulty of getting them to pull together more than counterbalances the advantages derived from the freedom of their action; and the loss of power in this way renders it necessary to employ more than double the number that would be requisite if they could pull fairly together. We cannot, however, consider the employment of the dog generally as a working animal, as the most economical use of them. The leading character of the dog, taken in the average of the breeds, is not his physical strength, but his courage and sagacity taken jointly; and when he is made a merely mechanical labourer, what ought to be considered as his most valuable properties are left unemployed.

Our field of examination, as to the advantages of the mammalia for mere labour in the service of man, is therefore narrowed to the hoofed animals, and even for general purposes to a few of them. The solid hoof is preferable, as a general base from which to overcome a resistance in traction, to the divided hoof, although as the divided hoof takes a firmer hold on its support, there are some cases in which it deserves the preference.

Of solid-hoofed animals the horse possesses advantages over every other, in beauty of form, in steadiness to the line of motion in most of his paces, and in fitness for every description of climate; and of the animals with divided hoofs the preference must be given to the ox tribe, in their superior strength, docility of manners, and adaptation to climate. We need not go into any details of either of those animals, because every reader has opportunities of observing them for himself. Whoever chooses to observe will perceive that in all the paces of a well-bred horse there is very little swing of the centre of gravity, and that the principal motions are performed by the limbs, and not by the spine. In slow motion the centre of gravity in the ox is also steady, and therefore an ox can take a strong pull in comparison to his weight and strength. Such animals are, however, not well adapted for rapid motion, and consequently their chief use is in the labour of the field, or in the bearing of burdens along difficult roads, in the latter of which respects they are not equal to mules, either in sure-footedness or in patience of endurance, and consequently wherever mules can be procured for roads which are too difficult for horses they are preferred. Mules of superior quality cannot be obtained, however, except in comparatively warm countries, because the ass degenerates much more from severity of climate than the horse does, and the good qualities of the mule appear to depend much more on those of the ass than on those of the horse. Among the hoofed animals there is a modification of the style of walking, and consequently of their organisation as adapted to that style, which is worthy of notice, namely, the difference between galloping animals and leaping or bounding ones. Goats, sheep, and antelopes, and also deer, are all bounding animals—that is, they can throw themselves to a considerable height from the ground, and project themselves to a considerable distance. Such motion is perfectly incompatible with the carrying of riders or burdens, or with drawing in short harness, and therefore none of the animals are used for any such purposes. These naturally, therefore, are left more in a state of nature, or sought for only on account of the substance of their bodies, than the races which have not this bounding style in their rapid motion. The only exception worth notice is the rein deer, which is so effective in drawing the sledges of the Laplanders, and that animal draws in comparatively long traces, and could be but little effective in applying its weight to the rapid traction of a vehicle with shafts.

Organs of Leaping.—The last mentioned ruminant animals, which bound along with incredible swiftness, and rise high and project themselves far in some of the species, are, notwithstanding their agility, and the splendid style of their motions, not strictly speaking leaping animals. Their anterior and posterior extremities are nearly of the same length; and though

they always deliver themselves in leaping from the hoofs of the hind feet, they receive the whole weight of the body upon the fore ones, which support it until the hind feet are brought up, as the points from which to take a fresh leap. This is often done with so much rapidity, and the body projected to so great a distance, that we cannot observe the bringing up of the hind feet, or the rest upon the fore ones, while this is performing; but whenever we see an animal in this kind of action, it appears always to have the fore feet at full stretch in advance, and the hind ones equally so in the rear, and our conception is that it trips along upon the points of the hoofs, without any flexure of the legs. This however is not the case, for all the joints of the legs, the muscles of the shoulders and haunches, and partially also the spine, are brought into equally violent and rapid action in this magnificent style of progressive motion. The spine, indeed, has but little flexibility in such animals, because a flexible spine would shorten the leap; but still in as far as it admits of change of flexure, the spine of these animals comes as much into action during their violent motions as any other part of their body. This bounding motion is therefore only a higher style of galloping than that practised by such an animal as the racehorse; and when an antelope bounds over the lofty bushes, its action does not differ in kind from that of a hunter when he clears a hedge or takes a lofty gate.

The leaping animals, properly so called, walk with difficulty and a hopping motion, even when their pace is at the utmost, and never exhibit the steady straight-forward pace of the true walkers.

The leaping animals among the placental mammalia almost all belong to the order *Rodentia*, or the gnawing animals. To these must be added the kangaroo among marsupial animals, which are the most characteristic leapers among the whole, as well as the largest in size.

The placental leapers belong to three distinct genera, of which, however, it is unnecessary to give a particular account here. The first and least effective are the hares, which run rather than leap, at least as standing erect on the hind legs, and they differ from the others in having the tail exceedingly short, and of comparatively no use either in directing their motion or assisting to support them when they move. The following cut will furnish an idea of the position of the hare when moving up hill, the kind of ground upon which her motions are by far the most effective.

It will be seen from the cut that the fore legs are very short and slender, as compared with the hind ones, which last are the chief organs of motion; the bound taken upon them extending at least three times as far as any that could be taken on the fore legs. When the long hind legs are brought forward, the rump is greatly elevated compared with what it is when they are stretched out; and this is the reason why a hare when running appears to be constantly elevating the white or under part of the tail. It is unnecessary to enter into any further particulars of the motions of the hare, because it is an animal with which every body is very familiar; we may mention, however, that from the kind of food on which they have sometimes to subsist, and the way in which they have to arrive at it, hares have sometimes to use their feet as a sort of imperfect hands, that is, they have not only to bring them to their mouth in feeding, but to use them in climbing up to gnaw the bark of bushes and young trees, at the season when there is no other food for them in the fields; in order that they may have the cross motion of the fore feet necessary for bringing them to the mouth, they have some sort of point of support to prevent the shoulders from approaching each other, and thus defeating the grasping motion; and this is done by means of imperfect clavicles. Perfect clavicles are necessary for the performance of a perfect cross motion; but as with the hare such a motion is only occasional, the clavicles are not complete, and thus they do not interfere so much with the running of the animal as they would do if perfect.

The next gradation of leapers are the small animals vulgarly known by the name of jumping hares (*Pedetes*). Only one species of this animal is known. It is a native of Southern Africa, about the size of a rabbit, and burrows deeply in the ground. Its fore feet, which are very well formed as compared with the hind ones, have five toes; and it uses them both as hands in conveying the food to the mouth, and in digging the burrows which it inhabits. It is a nocturnal animal, and during the dry season it has to find its food by reaching upwards. Many of the mice have this property to a considerable extent.

The third, and perhaps the most expert leapers among placental mammalia, are the jerboas properly so called, of which there are several species, inhabitants of the dry countries in Northern Africa and Western Central Asia. In them the fore legs are so short in proportion to the hind ones, that they are rarely brought to the ground when the animal walks. The deficiency of the fore legs is to a great extent supplied by the size of the tail, which is longer than the body of the animal, and which serves to balance it in an upright position as it jumps along, springing from and alighting on the hind feet, the soles of which are provided with very large pads by which its fall is broken.

The tail of the jerboa is merely a balancing instrument, and it possesses no great muscular power, all the vertebræ of that organ being long and slender, and destitute of any processes to which powerful muscles could be attached. It has therefore less motion than the tails of many animals, which are far shorter. From the point of its insertion being so far from the ground, it derives, however, a considerable lever power; and as the animal folds its short fore legs down on the breast when it leaps, and holds the body in nearly an erect position, the hind feet come to the ground again, almost directly under the centre of gravity; reckoning from the articulations of the thigh bones, the hind legs are at least six times the length of the fore ones; and there is a peculiar formation in the central part of the hind foot, which, inde-

pendently of the pads with which the soles are provided, gives the animal great firmness as well as concentration on these feet. Some of the family have only three toes upon them, and some have five; but in the latter the two lateral toes are so little produced that they do not contribute much to the size of the foot. In order to give the requisite firmness, the metatarsal bones are very much produced, and united into a single piece as far as the three principal toes are concerned, thus forming a true canon bone, the same as is found in the feet of animals which are characteristically walkers. The hind feet are thus walking feet of the very best description; and they are so large and strong in proportion to the fore part of the body of the animal, that they make no bad substitute for all the four feet of animals which use the fore ones as well as the hind for no other purpose but that of walking. In consequence of the elasticity, the jerboa, though comparatively a small animal, can easily jump to the distance of five or six feet; and it sometimes takes its spring from the toes only, and sometimes from the entire sole of the foot. The latter affords the most vigorous leap, from the velocity with which the rapid unbending of the ankle-joint propels the animal in an upward direction.

The most characteristic of the leaping animals, however, is the kanguroo. Opportunities now occur at almost every zoological collection, especially those in ample gardens, where the animals can display their natural action much better than they could possibly have done in the old-fashioned places where they had scarcely room to stretch themselves; but still even in these places the manners of an animal so peculiar in its form and its action, and also in the localities which it inhabits, cannot be seen to their proper advantage. The annexed cut will furnish some idea of it, both in its reposing and in its leaping attitude; and the reposing one, being nearer in the representation, and therefore on a larger scale, may

be regarded as a very faithful portrait of the animal. It will be seen from both figures that the fore legs are exceedingly small; and that the body of the animal tapers, from the setting on of the hind legs, all the way to the extremity of the nose. But though the fore legs are very small, the extremities of them are very well made out. They are each furnished with five toes having a free motion, and armed with claws very strong in proportion to the size of the members themselves, only the two lateral ones are considerably shorter than the rest. The elbow-joints have very free motion, so that the fore arm can perform a complete revolution, or rather rotation, in the articulation of the radius. The hind legs, though much more produced and powerful than the fore ones, have not the toes on them so well developed. The whole strength of that part of the foot is thrown upon a single bone in the metatarsus, as in the jerboas; but this bone does not consist of three bones soldered together as in them, it consists of one bone supporting one toe. This bone is remarkable for its size, the toe is very strong, and instead of a claw it is furnished with a true hoof of large dimensions at the extremity. In consequence of this, when the kanguroo springs from the hind feet, it springs from one principal point of support in each, in the same manner as the single hoofed animals. The feet contain other three toes, much shorter and feebler than the middle one; so that, though they assist in preserving the balance of the animal when it has the whole length of the tarsus upon the ground, they do not interfere with the free action of the central and powerful toe when the animal leaps. In their bones those three toes make only two; for the two internal ones are completely united, with the exception of being furnished with two claws, which are not hoofs like those on the middle ones. These lateral claws are long, but they are very feeble as compared with the middle one; they are metatarsal bones, having little more than the one hundred and fiftieth part of its section, and consequently of its strength. There is not so remarkable a difference between the strength of the bones of the toes, in any other known genus of living mammalia; and indeed in as far as efficiency, when the animal is on the toes, is concerned, they serve little other purpose than the small hoofs, behind the principal ones, with which animals which divide the hoof are generally speaking supplied. This great enlargement of the central toe, and corresponding reduction of the others, is a striking proof that concentration is a most essential requisite in those extremities from which an animal is to take powerful leaps. The tail of the kanguroo is a still more efficient organ of balancing than that of the jerboas; and, as will be seen upon looking back at the figures, no other of the mammalia is provided with a tail of equal weight and strength; in volume it is scarcely less than the entire body, anterior of the portion which is supported directly by the hind legs; and therefore the animal has its centre of gravity very near the articulations of the thigh bones. The internal structure of the tail indicates as powerful an action in that organ as its form and size indicate weight. The vertebræ of which it is composed are provided with numerous and well developed processes for giving origin and insertion to a vast number of muscles; and the power of the tail, both in the firmness of any position which it assumes, and the rapidity with which it changes from one position to another, gives it very nearly the efficiency of a third foot, whether in supporting the animal, in enabling it to balance itself, or change its direction, or in being used as a weapon against an enemy by which it may be pursued. It is reported indeed that when the kanguroo is chased by the wild dogs of Australia, or by the dogs of the colonists, it does not stand up and take the tremen-

dous leaps which it does when ranging its pastures, but runs on all fours something after the manner of a hare, so that it has always the tail ready to strike the enemy when that enemy comes near. The march of the kanguroo, and its organs of marching, are really unique among the mammalia; and it is impossible to associate it closely with any other animal, whether marsupial or not. The tail of the beaver is perhaps the one that comes nearest to it in dimensions; but that is a swimming tail, or if it has any other appropriate function it consists in supporting or propping up the animal, when in the act of constructing or repairing its curious dwelling. In the length of their posterior extremities as compared with the anterior ones, and also in the length of their tails, the jerboas approximate the kanguroos; but in their mode of action they are altogether different; and though they too are very different in their forms from the mammalia with which we are more familiar, they still leave the kanguroo alone in its peculiarity.

Those which we have noticed are the most remarkble of the leaping animals; and, with the exception of hares, which, with some slight differences, are found in most parts of the world, except the locality of the kanguroo, they are all confined to places resembling each other in their physical characters. The regions which they inhabit are not exactly barren; but they consist of deserts for the greater part, with only a patch of vegetation here and there. The leaping enables the animals to clear those sandy spots which they must pass, but which are too loose in their texture for bearing the tread of even such comparatively small animals as the jerboas. They are thus enabled to subsist in pastures which could maintain no other animals; and in the case of the kanguroo, which is far larger than the others, there is a considerable range in the way of food; for though the principal subsistence is vegetable, the animal can eat animal food in case of necessity; and it is by no means unprovided with weapons for killing its prey, in case living prey should come in its way and be necessary. In this respect it has some slight resemblance to the bears, which are vegetable feeders in the main, though they occasionally resort to animal food. It has not indeed the terrible hug of the more powerful bears; but still it can keep a firm hold with its fore legs, and the hoof on the hind foot is a far more murderous weapon in wounding than the claws on the hind foot of the bear, and it is used nearly in the same manner.

Digging or Burrowing Organs.—We have already made some allusion to the structure of foot best adapted for making way under ground, in speaking of the common mole; and we resume the subject now only for the purpose of pointing out what particular habits of animals are connected with the possession of feet adapted for this purpose. They belong to several of the order of mammalia, as arranged according to their internal organisation, by which is meant more exclusively the system of nutrition than any other part of the animal, or than the whole structure of the animal, as indicating a disposition, or rather adaptation, for the performance of certain kinds of action more than others. We shall have occasion briefly to advert to the principles of this method of arrangement in a future section, but we may now mention that the grand distinctions are founded upon the nature of the food; and as the different kinds of food are found in different localities, the adaptation of the animal to the locality where its food is principally to be found, follows as a matter of course, upon that general principle, that all the provisions of nature are the very best, in respect both of maximum of accomplishment, and minimum of exertion required for that accomplishment.

The three divisions dependent upon food are, warm-blooded or vertebrated animals; invertebrated animals, generally expressed under the name insects, though these form only one class of the grand division; and vegetable substances, which include almost every part of vegetable bodies, from soft pulpy fruits to dry wood. With the exception of a very limited number of invertebrated animals, some of them permanently and some only in certain stages of their changeable being, there are no animals which live under the surface of the ground; and therefore we may be prepared to expect that the insectivorous mammalia, who have their habitual dwellings, and find the whole of their food there, must be but few in number. There are, however, many insects, especially in countries of ardent climate and great fertility, which make their dwellings under ground, or construct them immediately upon the surface, though they find their food above the surface. It is not our present province to enter into the details of those animals; but we may mention that the majority of them, though not the whole, are consumers of decaying vegetable matter, and perform the same office in nature as animals, that the fungi do as vegetables. Those creatures exist in numbers beyond all arithmetic, and even all imagination, and in most situations where they are found the use of them is seasonal. There must therefore be, according to the general law of nature, which is that the waste of every species tends to the destruction of that species, if not removed by being applied to some new purpose of usefulness, a corresponding provision of animals to prey upon and regulate the myriads of those creatures. For this purpose, ground animals are required; and both their protection from enemies and from the heat of the day, and their means of arriving readily at their food, require that they should be burrowing animals, or possessed of feet adapted for digging into the ground. During the day the prey of those animals is, generally speaking, scattered abroad; and this renders it necessary that the animals themselves should be night preyers. In the countries where those animals abound the most, the difference of temperature between the night and the day is greater than in more temperate climates, and day and night are much more nearly upon an equality throughout the year. Exposure to great differences of temperature is one of the severest trials to which the animal system can be subjected; and as the animals of which we are speaking do not require to feed or make any other exertion during the heat of the day, it would be subjecting them to useless waste of the system, and thus contrary to that wisdom which pervades all nature, to have them exposed to the ardent heat of the sun. To avoid this they are almost without exception adapted for digging burrows, in which they may pass their time during the heat, though of course the natural instinct which leads them to dig the burrow, leads them also to avail themselves of any natural hole or crevice, which will afford them that shelter in which they may not feel the painful sensations produced by exposure to the air. For this reason, we find that a foot adapted for digging is very general among insectivorous mammalia, whether they belong to one order or another in the systematic arrangement.

Vegetables, generally speaking, grow partly in the earth and partly in the air over it; and in those vegetables which have annual stems in the air but roots in the earth, lasting for more than one year, the part in the earth is the only existing part at some seasons, and the most succulent part; and therefore the most nutritious food for animals at all seasons; unless when a particular portion of the root has brought its annual stem, its flower, and its seeds to maturity, and thus, having performed its grand function in nature's economy, is completely exhausted, and its remains pass to the general store of inorganic matter, without any assistance from a preying animal. In warm countries especially, and in all countries where the great alternation of the seasons is wet and dry, there is a necessary perishing of annual surface vegetation, unless in those succulent plants which, from the peculiar texture of their covering, are proof against the action of heat; and even in them the flowers, flowering stems, and all other parts immediately conducive to the annual production of seeds, are subject to the same fate. In such countries the drought penetrates to a far greater depth, and scorches and withers with far more severity, than it does even in those long continued courses of dry weather which leave our pastures without a blade of grass. Therefore, in such countries, the herbaceous plant must be provided for in a manner corresponding to the severity to which it is exposed. This is effected by a bulb or tuber of some description or other, sometimes seated above ground, sometimes placed under it, and sometimes partly the one and partly the other; and from the nature of the case, it must partake more or less of the properties of the succulent plant, which endures the ardours of a tropical sun upon the surface during the dry season, according as it is more or less exposed.

Here again there is an ample store provided for those mammalia which feed upon succulent vegetables, and this store requires a digging foot, in order that it may be arrived at with the least labour by the animals which subsist upon it. But in the dry season of such countries the nether air and the surface of the earth react in consequence of the surface of the earth sinking lower in temperature than the air over it does; and the variation not being diminished to the same extent from its extending freely to the cloudless sky, this occasions a heavy fall of dew, which softens the surface, as well as makes "the scent" of those bulbs upon which the animal feed, "lie," as the sportsmen express it. Those circumstances taken together tend to render such animals nocturnal feeders; and the very same reason which makes the nocturnal feeders, formerly alluded to, burrowers, applies to those under consideration, so that even the vegetable feeders of those burnt up countries live in burrows during the day, and come abroad only during the night.

Succulent vegetable matter, such as that which is found in bulbs and tubers, and often in roots differently formed from those, while they remain in the earth, without any strong action of parts in the air, may be considered as a sort of intermediate link between the flesh of animals and the leaves of fibrous parts of plants, which have been elaborated under the influence of the atmosphere, and especially of light. We do not mean to say, that in a physiological point of view, this matter is as much akin to animal matter as to vegetable, for it is strictly vegetable matter; but when we consider it merely as the food of mammalia, or indeed of any animals, it holds the medium place which we have assigned it. It is the same with the farinaceous part of the seeds of vegetables, which elaborated under a protection from the severe action of light, and are all pulps in the inmature state, and in so far reducible to pulp again by the action of heat and moisture, without the immediate contact of the free atmosphere, and the immediate influence of the rays of the sun. This is the same whether those seeds are produced on perennial trees and shrubs, or upon annual stems, and the seeds are shed and scattered on the ground, at the very time when the annual stemmed plant, which has a root of more than one year's duration, or produces new roots every season, is down in the bulb, stemless, and in a state of comparative repose. Those seeds do not, under ordinary circumstances, get so deep under the surface as the roots do, but they fall in concealment among the remains of that vegetation which has performed its functions during the season, and is passing into decay. Those seeds are in fertile places so exceedingly numerous, that if a very large portion of them were not removed, they would have no room to vegetate, but would perish by whole races every year. The prevention of this requires a great number of small ground animals, of which the rat family may be considered as the chief; and the vast numbers in which these animals occur in almost every country under the canopy of heaven, is a proof of their high importance in the economy of nature. The jerboas already alluded to are members of this great family, and though they are the most characteristic leapers, and the most decidedly formed for the purpose of leaping, the hind legs of all are more or less provided with canon bones, and the fore legs have more or less of cross motion, and the toes well developed and free, so that they can answer partially as hands, both for conveying the food to the mouth and for grasping while the animal stands erect on the hind legs, or holding the food, until it is divided by the action of the incisive teeth, which are remarkably free, well-formed, and powerful in all such animals.

The food of this family, and the places in which they have to seek for it, point to a nocturnal habit, and the possession of digging feet, as well as those of the feeders upon ground insects and the roots of plants; and observation shows that the manners of the animals are in perfect accordance with this. During the heat of the day, or in the clear light, "there is not a mouse stirring;" and in towns rats take up their habitations by thousands in the common sewers and drainages. It is the same with the whole family; for they inhabit in darkness during the day even where they come freely abroad during the night. They are all furnished with eyes of remarkable brightness; and from this we may conclude that they see objects by far dimmer light than any animal can do, though there is no reason to suppose that even they can distinguish objects by vision in the very darkness of night. It is highly probable that scent is their most powerful sense; for we find that traps set for the capture of rats and mice must be baited with odoriferous substances; but it is also probable that their hearing is also acute. They do not require this for conducting their own labours in the finding of their food, so much as they require the sense of smelling, because their chief food does not stir or make a noise so that they could be guided to it by the ear.

As the vegetable food of all the ground feeders of nocturnal habits and with digging feet is of that kind which we have described as being considered as food intermediate between animal matter and vegetable matter, it is natural to suppose that all these animals should be more or less omnivorous, or capable of subsisting on the flesh of vertebrated animals, on that of invertebrated ones, or on vegetables; though it does not follow that they could, at least in many of the species, subsist upon green leaves or vegetable fibres; because their cheek teeth are not adapted to the preparation, or their alimentary apparatus to the digesting of these. We find that in this again we are borne out by observation in every case where our observation can be applied. Rats, and even mice, are great consumers of insects; and in some places where the lower apartments of houses are infested with cockroaches, the inhabitants find it necessary to encourage mice for the purpose of getting rid of these more destructive and far more loathsome creatures. The pulpy and farinaceous matter, upon which all the ground mammalia to which we have alluded as vegetable feeders subsist, must be considered as *vegetable fat*, that is, as holding the same place in the vegetable kingdom as fat does in the animal: that is to say, neither of them is a perfectly organised substance, but each is an assimilated matter, the one vegetable and the other animal, ready for the supply of materials of organisation, when these are either too imperfectly developed, or in a state of too much exhaustion for being capable of performing the necessary labour of assimilation for themselves. True to this correspondence between their vegetable and their animal food, those mammalia prefer fatty or partially organised substances, or substances not organised at all, to those of which the organisation is perfect. Cheese and bacon are proverbially the staple baits for a rat-trap; and mice attack these substances in the larder in preference to joints of the finest meat, nor is it probable, except in cases of extreme hunger, that any of these animals will gnaw the tough fibres of a well-organised muscle.

The structure of the digging foot with which those ground mammalia, to what order soever they belong in the system, are provided, requires no lengthened detail, and indeed no mention. To give good effect to a digging foot it must not be too long, for that would render it less effective, because the muscles having to act against a greater length of lever, would have their power proportionally diminished. On this principle the short fore-leg of the jerboa is a far better digging leg than the hind leg would be, which is six times the length, although it is just as inferior a walking one, and that from the very cause which makes it so superior for digging.

It may be worth while to notice the mechanical principle upon which this difference depends, and the adaptation of that principle to the scene of action in both cases. In the foot for rapid or powerful motion in the air, originating from a solid base, or point of resistance in the earth, the grand desideratum is velocity. The resistance of the air to the passage of any of the average size of the mammalia is but small, and from every kind of experimental knowledge which we have of substances projected from a fixed point on the earth into the air, we have reason to conclude that the range depends wholly upon the velocity. But the way to obtain velocity in the jointed limbs of an animal is to have the origin of the muscle which is to move a distal bone, placed as far as possible, proximal of the joint, upon a long bone. This portion, taken to the centre of articulation in the joint, may be considered as one arm of the lever; and at any supposed flexure of the joint, the other arm of the lever, which represents the power of the muscle, is the perpendicular from the centre of motion at this point; and in proportion as this is less than the other, its power would be reduced in moving the distal bone. But because the muscle is in itself exactly the same in what ratio soever it is apportioned to the two bones, its power must be the same, upon the obvious principle that a quantity remains the same in its total amount into whatever ratio of parts it is divided. In consequence of this, if the power is reduced to one-tenth, the velocity will be increased ten-fold, and so on in the case of every other proportion. This is the real reason why all fleet animals have long legs, but we deferred mentioning it until we could contrast it with the reason for animals having short legs.

In the feet of a digging animal, it is strength and not velocity which is necessary; and therefore the bones require to be short, so that the lever power of the muscle may be a maximum; and in proportion as the length, from the origin upon the one bone to the joint, becomes less in proportion to the distance from the joint to the insertion on the other bone, the power of an equal muscle is increased, and the velocity with which it can move the bone diminished in the same ratio. It follows from this, that an animal, the whole of whose feet are adapted for digging, must of necessity be a slow walker, and this is the reason why, when the peculiar nature of the posture of an animal of this kind renders a quick motion along the surface necessary, the hind legs are produced to so disproportionate a length compared with the fore ones. This structure would not suit an animal which had to seek its food by perpetual burrowing under the ground; because such an animal requires a powerful action of the hind legs as well as the fore ones, and does not require a greater capacity of swift motion in the one pair than in the other. When, however, the burrowing is only an occasional operation, as that of digging a lodging in the ground, or scraping away the earth to arrive at a bulb or other root, the hind legs admit of that production which is essential for quick motion along the surface of the ground; and, as has been already observed, such animals must necessarily perform their rapid motions by leaping, and not by running or galloping. In this double adaptation of the animal, there is necessarily some waste of its whole power, just as there is waste of the whole power of a single organ, in all cases where that organ has a double function to perform. The two adaptations of the whole animal are, however, in all cases, as beautifully proportioned to the relative use which it has for the two kinds of action, as those of the single organ are adapted to the use made of its two functions. If one predominates greatly above the other, the adaptation is correspondingly great; and in proportion as the uses of them approach to an equality the adaptations do the same; so that, though a loss upon the whole is, from the very nature of the case, inseparable from a double adaptation, there is never more than the average loss in any one instance.

The same rule applies in the mechanical action of the human body, and there is a good deal of practical instruction to be derived from attending to it in that

point of view. The universality, so to speak of the human mechanism, necessarily renders man less efficient, in proportion to his general muscular strength, for some one particular kind of natural action, than any one animal with which a comparison can be instituted. The same holds good in those manual and mechanical operations which man learns from experience, as from the exercise of his mental faculties. There is perfect truth in the proverb "Jack of all trades and master of none," and this applies to every mechanical trade, whether the manipulation which it requires be simple or complex. The more simple that it is, however, the greater the practical advantage, because the same practice necessarily gives greater dexterity and expertness. If, for example, it is a single and simple mechanical operation, which does not admit of two individuals being employed at it, then the handicraft labourer may be said to work to the greatest possible advantage to which he can work; and were it possible to reduce all the manual operations in the arts to this state of the ultimate division of labour, the whole of events would derive the greatest possible advantage from the least possible exertion.

This advantage of the division of labour is not confined to merely manual operations, for it applies equally to every kind of doing, however philosophical the principle may be upon which that doing proceeds. This will be readily understood, if it is borne in mind that we derive our original knowledge of every property of material substance by the exercise of bodily sensation alone. What use we may make of this observation afterwards is quite a different matter, and has not necessarily anything to do with the acuteness of the bodily sense. It is here that the mental part of our nature takes up the subject, and by comparing the results of observations after they have become mental perceptions, discovers their relations, and the purposes or uses to which those relations may be applied. When we come to the application again, we are thrown completely upon the bodily sense and the muscular exertions of the body, which are necessary as consequences of the information of the senses as to the nature of the materials immediately under our hands. In this case, therefore, the same as in a single case of sensation, mental perception, and consequent action, it is only the middle part, or the *vinculum*, by which the other two are as it were tied together in the sequence, which is mental or intellectual, and peculiar to man and all the animated creatures of which we have any direct experience. Take away this, and leave only the sensation and the action, and man would be placed exactly on a level with the other animals; that is, both his sensation and his action would be more feeble and imperfect upon every single subject, in proportion to the greater number and variety to which they were turned.

The parallel between man and the other animals in respect to increase of power from diminution of range, goes even a good deal further than this; for it reaches the directing of others, as well as the practical management of our own affairs; and in proportion as the range in either of those cases is more limited, the efficiency with equal exertion is increased not only in respect of the individual subject of attention, but in respect of the total practical value of the exertion. It is natural, and indeed necessary, to suppose that this should be the case; for, in so far as observation unwarped by any hypothesis or theory goes, we find all animals proceed upon the same principle, varied almost without end in the different species, but still radically and substantially the same. Man, considered as animal, is produced, grows, is nourished, and dies, exactly upon the same principle as the other mammalia; and in proportion as they resemble him in their alimentary system, they are nourished the better by the same food, injured more certainly by the same changes, and killed more certainly by the same poisons. So that, in every point of view in which man considered merely as an animal can be placed, he follows that general law which is common to all animals, and his physical advantages and disadvantages depend upon circumstances precisely similar. This perfect coincidence, in general principles, between ourselves and the other animals, in the merely animal part of our nature, is one of the most important applications that can be made of the natural history of animals, because it enables us to bring our mental powers to bear upon them, and to profit, so to speak, by their experience as well as by our own. "Go to the beasts and they shall instruct, to the fowls of heaven and they shall teach knowledge," says an authority which cannot be doubted, and we have practical demonstration of it in the proper analysis of the case. This analysis consists in a careful separation of all that portion of our progress from sensation to action which is animal, from that which is intellectual, and the general conclusion taught to us by the mammalia, which, as they resemble us the most, are our fittest instructors; and the conclusion we arrive at is this—that to this purely animal part the principle of the division of labour cannot be too constantly or too rigidly applied, and that the perfection of the profitable use of this part of our compound nature consists in dividing it down to the individual sensation and the individual act. It is true that this is a degree of perfection which cannot be arrived at, or even very closely approximated, by all the members of any community, or even by any single individual; but our imperfections do not invalidate the principle, and so the further that we can carry it in every case, the greater is our reward in proportion to the duration and severity of our labour.

But we must be on our guard against applying this conclusion to what we arrive at by the most legitimate philosophical means, respecting the one part of our compound nature, to the other part of it. The examination of one of the parts of this compound nature of man would therefore be not only imperfect, but it would be apt, and even certain, to mislead those who are not conversant with such inquiries, if it were not accompanied by some notice of at least the leading principle of the other part. Now though, according to the foundations of our judgment of matter, we have nothing but negative perceptions and consequently negative definitions of mind, those negatives enable us, though not to say what it is in itself, yet to say in what it differs from matter. The essential and inseparable property of matter which belongs to it in all its forms and in all their modifications is gravitation, or a certain tendency the action of which cannot be restrained, or turned into a different direction from the straight line joining the centres of gravity in two pieces of matter, except by the operation of some force. The quantity of this operation is all that is resolvable into two elements—time and force, of which, when they can be stated in numbers, the product is the expression for the energy of the force or power; and, as in the case of the same force or power, this

product must be a constant quantity, the two elements power and time are in reciprocal proportion, that is, the one of them increases as the other diminishes, at such a rate as that the product shall remain the same. Thus, for instance, if the whole force is expressible by the number 16, and the power and time are supposed equal, each will be expressed by the number 4; if one of them is multiplied by any number, the other must be divided by the same, as, for instance, if the power, 4, is doubled so as to become 8, the other, the time, must be halved so as to become 2; and so on in all other proportions, their proportion to each other being the greater equal to the less multiplied by the square of the number, which multiplied the one and divided the other in the case of their numerical equality. In consequence of this law of variation, either the power or the time requisite for the performance of any given effect may be imagined to become as small as we please, provided the other increases as much by multiplication as this one diminishes by division. Neither of them can, however, in any imaginable case become nothing, or arithmetically speaking equal to 0, because if one of two factors is 0 the product is 0, whether the other factor be great or small.

The necessary inference from this is, that every action of a material creature, whether it consist in observation by the senses, or in the mechanical exercise of the muscles, must require both exertion and time for its performance. We do not require to state the numerical relation of these to each other, because that varies in every particular case; but we must bear in mind that this is the general principle, and when we apply it to animals we must distinctly understand that both elements enter into every possible animal effort, whether quick or slow, feeble or energetic, and that this holds in the case of all animals, in consequence of the bodies of animals being material, and as such necessarily subject to the law of gravitation, to the exact amount of the quantity of matter concerned in the parts by and upon which the animal action is performed.

Mind, from the very definition of it, is completely absolved from this law of gravitation; and consequently the action of mind, whatever it may be, requires neither effort nor time for its performance. It does not fatigue, and it occupies no measurable duration. In consequence of this, multiplicity of thought (for thought is the general name in common language for the operation of mind) cannot by possibility diminish the capacity of thinking, on any one particular subject, in the same manner as multiplicity of observation by the senses, or of muscular effort in action, diminishes the bodily power in the individual instance. On the contrary, the greater the abundance of the materials or subjects of thought, thinking becomes the more ready. The proper function of the mind, as we feel it in ourselves and judge of it by the conduct of others, is comparison, and an inference drawn from that comparison. The correctness of the comparison, and the truth and applicability of the inference, are the valuable parts of thought; and it is impossible for us to obtain these in such a way as that the comparison may be correct, and the inference useful, unless the grounds of our judgment are complete. Nature, which is the source of all our materials of thinking, as concerns our drawing of inferences, and acting upon them through the instrumentality of the body, is one system, all the parts of which have an intimate relation to each other; and consequently the foundations of our comparison must fall short of accuracy, in every case, in proportion as we are ignorant of the nature and relations of the whole.

It follows from this, that, as mind is the opposite of matter in definition, the perfection of its exercise must be the opposite of that of the exercise of matter; and that *combination* of thought is as essential to the useful exercise of the mind, as the *division* of labour is to the useful exercise of the body.

This distinction between the most profitable uses of the two parts of the compound nature of man may be said to be the very key of knowledge, and from want of it, or ignorance of the use of it, countless thousands of men in all ages have drudged in thought during the whole period of their lives, in a manner scarcely more profitable than if they had never thought at all.

It is to be regretted that there is a wonderful proneness to this confounding of mind and matter, and making the latter the model or example of the former. We see the advantages of the division of labour by the body, for they are at once palpable to the senses, in the improved products of bodily labour, and the successful conducting of bodily action; and as the effect of a particular mode of conducting thought is not an object of the senses in any meaning of the word, but a result which can be arrived at only by the mind itself, it is not suggested to the mind until the mind has acquired that general knowledge of relations in which it consists. This is the reason why technical men, in matters of thought, are always narrow-minded, and incapable of turning their own technical knowledge to that use to which it might be turned. To use a homely simile, they are in possession of a single bone of the skeleton, loosened from its connexion, and thus are unable to come to any conclusions as to the structure and the functions of that species of animal to which the bone belongs.

To some this may seem irrelevant to the study of the mammalia, but the truth is exactly the reverse; and we have a remarkable instance of it in the case of the late Baron Cuvier. Before the time of that most illustrious of generalising naturalists, there were conjectures about the extinct mammalia, of which single bones are found buried in the soil; and there were classifications of mammalia, better in some instances and worse in others, but all imperfect. Cuvier did not sit down to dote and dream over the fossil bone, and eke out the scanty information which it afforded by foundationless conjectures. He went straight to the living mammalia, dissected them bone by bone, in an immense number of different species; and in every case he took heed of the leading functions which were inseparably connected with every varied form of the skeleton. By patient, skilful, and most truly philosophical labour in this way, he learned to make a single bone an index to the general character of an animal; and by this means he caused the extinct races to stand up before the intelligent mind, clothed with sinews and with flesh, and performing their functions as palpably and as intelligibly to the understanding as if they were now tenanting the earth in the living state.

The result of this was the classification of animals in the "Regne Animal," of which we shall give a brief outline in the sequel; and which, at least in those parts which were moulded by his master hand,

is the greatest treasure that ever was given to the student of nature for sure guidance in his delightful task. There are imperfections in many minor points of this work, because no length of life and no assiduity of labour could put one man in possession of all the facts, and no man can be wise beyond the limits of his actual knowledge. The chain of organisation is also broken in many parts of the animal kingdom, and in none more than in the mammalia; and, as a new means of judgment has to be introduced after each breach, the difficulty is thereby increased, and the sources of error multiplied. In spite of these circumstances, Cuvier has brought the classification of the mammalia, and, what is more valuable, the practical application of that classification, into the light of day; and if he has not done exactly the same with the other three classes of the vertebrated animals, he has delivered even them from the dominion of "Chaos and Old Night." In consequence of the sure foundation which he has thus laid, every succeeding observer of nature and reasoner upon the analogies of nature is enabled to add something to a fabric of science proof against the casualties of time and opinion, instead of, as heretofore, building on the shifting sand, and being at the mercy of every wind of hypothesis and every flood of merely authoritative assertion.

But though this, as being among the last varieties of the organs of most conspicuous external action in animals, is the proper branch of our general subject under which to introduce these few remarks, we must close them, and return to matters of more humble import.

We have said that the digging foot is so similar in its general structure in all the mammalia which have a digging habit, that it is not necessary to go into the details of its modifications, we shall, however, for the sake of those who may be less familiar with the subject, introduce a few figures of the more remarkable of those same digging feet.

The common mole is perhaps the most completely a ground animal of any of the digging race; but a representation of its foot would be superfluous. In order to enable this animal to exercise its fore feet with the requisite degree of vigour, the sternum is more firm than in any other of the mammalia excepting the bats; and it is furnished with a mesial crest as in these, for giving a firm origin to those pectoral muscles, which tear down the earth with a degree of rapidity of which those who have not marked its progress could have but little conception. The head is elongated to a point, in order that it may better pierce its way, and it is furnished with an additional bone in the extremity. The muscles of the neck are also of great power for the size of the animal; and altogether it is remarkably well constructed for the performance of its subterranean labours.

The common mole is decidedly a flesh eater, and though in a state of nature, its principal food consists of earthworms and ground insects and their larvæ, it is so voracious and so determined in the gratification of its appetite, that if two hungry moles are confined together, they speedily engage in desperate battle, and do not give it over until one conquers the other, and when this is done, the victor, like a true cannibal, very speedily kills and eats the vanquished, or rather tears open its belly and begins to devour its bowels while it is yet alive.

The next figure of a digging foot which we shall introduce is that of one of the rodentia family, connected with the rats by the older naturalists, but distinguished from them by very marked characters:

Rat Mole.

It is one of the most singular animals, or rather genera of animals (for there are at least two known species with which we are acquainted)—the rat-mole (*Spalax*). Its head is large, its feet remarkably short, and it has no eyes visible external of the skin, though under it there is a small production of a black colour resembling an extremely minute eye. It lives under ground, and forms a subterranean passage in the same way as the common mole does; but its feeding is different, as it consists chiefly of the roots of vegetables. The blind rat-mole, of which the above is a figure, is rather larger than the common rat; but there is one in Java and the other Isles of the Oriental Archipelago which is as large as a rabbit.

The animal whose digging foot is figured in the above cut belongs to the rodentia, and we shall next introduce one belonging to the edentata, or toothless animals. This is the foot of the Cape animal, vulgarly termed the ground hog. The animal is about

Ground Hog.

the size of a badger, and burrows in the ground with amazing rapidity, all its fore feet being from the structure of the toes remarkably well adapted for burrowing, and also for tearing open ant-hills and other nests of insects upon which the animal feeds. Its nose is very much produced, and its head and ears have some slight resemblance to those of a pig. It is destitute of any efficient teeth, and seizes its insect prey by means of its long and slender protrusile tongue.

The next digging foot which we shall introduce is that of the great ant-eater, an animal which has very great power in its fore paws, the nails of which are curved almost to semicircles, and turned inwards, when the animal walks, in order to protect their sharp points. These feet are not well adapted for ordinary digging; but they can tear an ant-hill to pieces with wonderful

facility, and the animal very speedily transfers them to its mouth by means of its protrusile tongue performing this operation with the greatest rapidity.

The last digging foot which we shall introduce is that of one of the armadilloes, which, from its shortness, its strength, and the immense claws with which it is armed, is one of the most efficient of digging

feet. The particulars of these curious animals, and the distinctions of their several species will be found mentioned in the article Armadillo, so that we need not repeat them here.

There is one other animal, an extinct one, of the fore foot of which we shall give a figure, because, though the mode of its life is not known, the immense production of some of the bones of the foot indicate that it has perhaps been a digging animal, though it is possible that in reality its manners may have resembled those of the sloths, though what sort of trees could have supported an animal whose skeleton makes that of the elephant itself seem a very slender fabric in comparison, it is impossible for us at the present day to determine. Being an extinct animal, nothing of it is known but the skeleton, which, however, has been found entire in the alluvial deposits of South America, and at a great depth below the surface, which clearly proves that the placing of it there is by no means a recent event. The enormous size, singular formation, and vastly produced processes of the bones of this animal, together with the fact of its skeleton having been found entire in the fossil state, render it one of the most interesting of the extinct mammalia. It is the *Megatherium* of authors, which simply means, "the great wild beast." The following is a sketch of the foot of this animal.

There is one other digging organ which is worthy of notice, as in the animal which we shall select for illustration, it is not accompanied by feet in any way adapted for burrowing, or even for simply turning up the earth at the surface. There are several of the digging animals, besides the common mole, that use their snouts for assisting them in their operations under ground; and one of these, the star-nosed mole of North America has the snout so peculiarly formed at the extremity, that it is not easy to say what specific purpose it serves in the economy of the animal. The extremity of it is surrounded with a number of cartilaginous points formed like a star, and each capable of considerable motion. The genus, or perhaps rather the family to which we particularly allude, as using only the snout in digging, is the hog family, and the common hog as the typical animal, will serve as our example better than any of the others, because it is very common and easily observed. We need not say that the neck of the hog is remarkably strong for the size of the animal, and that it is furnished with very powerful muscles for moving the jaws; for the bare inspection of the animal will at once convince any one of these facts. The bone of the nose is very long, and the frontal sinuses are large and divided, or ramified into a vast number of cells, so that there is most ample provision made for the development of the membrane containing the olfactory nerves. The rhinoceros is the only animal, the

relative size of whose nasal bone bears any proportion to that of the hog, and though it is much stronger in proportion, it is not so much produced anteriorly. In fact, the enlargement of this bone in the rhinoceros answers a very different purpose from that which it answers in the hog. In the former it seems intended chiefly to support the horn, as it is called, or the two horns in the species which has that number of those appendages. This horn, or these horns, have no core of bone like the horns of oxen and many other ruminating mammalia. They are wholly a production of the skin, and each may be regarded as a great tuft of bristles, somewhat resembling baleen in their texture, but far more firmly soldered together than the fibres of that substance. This horn is a terrible weapon in the rhinoceros, and the bone is made strong in proportion to the action of the appendage. The nasal bone in the hog has no such appendage to support, and therefore it is lengthened, but inferior in breath and in thickness of substance. Its office is to support the snout and its peculiar bone, and this, though very efficient for the purpose to to which the hog applies it, is so far from being fit for a weapon of any kind, that a slight blow upon it pains the animal more than a severe one upon any other part of its body. The snout bone of the hog rests at its under part upon the intermaxillary bones, in front of the sockets which receive the incisive teeth, and at the upper part it is united to the nasal bone by cartilage. Its distal extremity supports the peculiar organ which forms the snout properly so called. This is composed internally of cartilaginous fibres, and its termination, which is nearly circular, is flat, but slopes inwards on the under side. It is naked and full of follicles, which keep the surface moist, and prevent its delicacy from being injured by long exposure to humid earth. The extremity of it forms a kind of elevated ring, and the tissue with which it is enveloped is most abundantly supplied with nerves and blood-vessels. This curious organ is put in motion by two large muscles on each side, the upper one inserted in the boundary of the cavity which receives the canine teeth, and the under one in the lower part of that cavity. These muscles, as well as the muscles which work the jaws are much larger than they are in any animal which has the nose merely as an organ of smell; and their tendons divide into a vast number of fibres, which terminate in the tissue that forms the envelope of the snout. Those fibres take a great many directions, straight, oblique, and spiral, so that the motions which they can communicate to the organ, though limited in range, are very various in direction. The great supply of nerves and blood-vessels point out the sensibility of the organ; for though, as we have said, we are not warranted in concluding that nerves alone, and without the other systems, are or could be organs of sensation, yet it is certain that where there are no nerves there is no direct sensation, and perhaps not much sensibility. The opening of the nostrils terminate in the disc of the snout, and its elongation beyond the nasal bone gives farther scope for the development of the organs of smelling, so that it is highly probable that this sense is most acute in the hog. The sense of smelling is not, however, the proper sense which is allocated in the disc and naked part of the snout; for it is also a very sensitive organ to what is called touch. The elevated ring with which the upper part of the disc of the snout is furnished, and which the animal can elevate and depress, and move in a great many ways, is the instrument with which it "roots" or turns up the soil. Its action is not unlike that of a plough with a double mould board which turns the furrow both ways, and the projecting ring performs an office something similar to that of the cutting feather of the sock, only it turns up the soil as well as cuts it, without any necessary elevation of the head. It is in quest of the succulent roots of plants that the hog performs this operation, or in the wild state it is in quest of acorns, beech mast, and other forest fruits, which are covered up with fallen leaves, and the mud which is collected or produced by these. When seeking this description of food in places where it is naturally to be found, the hog has comparatively light work; but in moist places where the roots of plants are large and succulent, its labour is more severe. Even in such places, however, it "nozzles" away with great satisfaction, and utters a grunt of apparent delight when it comes to a root more rich or racy than the rest. As the animal is not very handsome in its form, or particularly cleanly in its manners, it is no great favourite with any body, except those who make a profit of it; but still it is an animal whose economy is worth studying, and the structure and action of whose ploughing apparatus are highly curious. It does its work with such apparent ease, that we are not aware of either the complication of structure, or the strength of muscle which it requires, but they are both very great. The following figure affords a slight idea of the external form of this peculiar organ; but its action, and the internal organisation which fit it for this action, are both studies of intricacy as well as instruction to every one who wishes to understand the mechanical action of animals.

There is another short lesson which we may learn from this instrument, and that is the limitation even of the acutest senses of animals to the uses which the animals have for them. There is little doubt that the sense of smelling in the hog is far more acute than the same sense in man; and it is probable also that no single portion of the surface of the human body is so completely endowed with what is called touch, as the naked extremity of this organ. But notwithstanding this sensitiveness in both respects, it does not extend beyond the discriminating and finding of the animal's food, in either of them. The keen-nosed hog is proverbially indifferent to the most offensive odours; and its highly sensitive snout can poke about among substances which we would reckon in the highest degree harsh and grating to the touch. There is no feeling of pleasure or of pain resulting from odour or from touch in the animal; and if he should find food in the one place, and not in the other, "the reek o' the rotten fens" would be far more

grateful to "piggy" than all the "spicy groves" of the fragrant east.

In this, and it is no doubt the same in the case of the senses of all the mammalia, there is a very marked difference from the same sense in man; and this difference alone might, if properly studied, of itself teach us that in man there is something more than the mere animal. We too have our animal sensations, the desires arising from which extend no farther than the supply of our bodily wants. But in addition to these there is something higher, more refined and exquisite, and more enduring. In the case of the animals, when the sense has produced its animal purpose it remains quiescent until that purpose demands a new service: in man, on the other hand, "the eye is never satisfied with seeing or the ear with hearing;" and it is after we have satisfied ourselves with the banquet that we feel the greatest desire for the perfume, and derive the most pleasure from it.

Farther than this, those supplemental pleasures which we derive from our senses, over and above what the animal wants of the body require, are capable of an unlimited degree of cultivation, second only to the general cultivation of the mind in knowledge, and second to that only because they are less general and more immediately allied to the senses. It is impossible to be endowed with the capacity of making a comparison and drawing an inference, without perceiving that there is a trace of immateriality and consequent immortality in this; and any branch of any inquiry is never so profitable as when it leads to a result of this kind, because this result, independently of its own intrinsic value, invariably heightens the usefulness of that from which it arises.

We have gone more fully into the structure and use of digging organs, and the habits of the animals which possess them, than we have done into some others which may at first sight appear to be of more real importance. We have done this for two reasons; first, because the animals which possess them are, on account of other parts of their structures scattered through the system, and there is no work with which we are acquainted, that can afford to a common reader even a glance at them in their juxtaposition; and secondly, because this portion of the mammalia, from the peculiarities of the races which it includes, is calculated to give origin to many trains of thought which, from their unexpectedness, as well as their beauty, are eminently calculated to promote a love of nature and a consequent desire to know it, and at the same time to call forth, in the most pure and lively manner, our admiration of the power, wisdom, and goodness of nature's Author. We regret that our limits do not permit us to enter more largely into those speculations, but as any single one of them is ample subject for a volume, and as we must confine ourselves to a few pages, we must leave them, and pass to another division of our general subject.

Sec. IV.—*Organs of Feeding.*—The grand purpose for which the mammalia, and indeed all animated beings, exist in nature, is that of feeding, and to this all the systems of their organisation, and even the faculty of continuing the race in the several species, are obviously subservient. There is in fact a very strong confirmation of the general position, in fact an absolute demonstration of it in this last circumstance. Each animal is, in a state of nature, perfectly constant to its species—lions produce nothing but lions, bears nothing but bears, and so on through the whole catalogue. The mules, or mixed breeds, which are produced between some species, in a state of domestication, furnish no objection against this, for they prove only that domestication in so far changes the nature of the animals. We believe that there is no recorded instance of a wild female of any species being the mother of a mule, though there are instances of mules between tame females and wild males. This shows us by the way, that the instinct of preserving the species unbroken is committed chiefly to the female. Those crosses, even when both animals are in a state of complete domestication, and when every art is used to bring them about, in consequence of the superiority of the next progeny over pure blood for certain purposes, can only take place between species which, in all the leading points of their organisation, and all the essential parts of their economy, bear a close resemblance to each other. Even when the mule has been obtained, it cannot maintain itself for even one successive generation. There is not a single instance of the progeny of two perfect mules, that is mules of the first cross, although mules are perfect animals, as well as those of the pure blood of either parent. Their tendency to propagate is much weaker indeed than that of the pure animal of either species, but though weak it does exist, and the male will, in the language of breeders, "breed back to the pure blood," and the more readily the more nearly pure that blood is. We must consider it, therefore, as a general law of the animal economy, that there is in each species a power not only of continuing itself by successive generations, but a power of preserving its species pure and unmixed, which in a state of nature is never broken in upon by contingent circumstances.

The question naturally arises, what is the purpose of this power? What end does it serve in that general system of nature, of which all the parts are so harmonious, that each may be said to be made for the other, as obviously as are the different organs of the same animal? The answer to these questions is easily given. Every distinct species has a distinct part to act in nature's economy, to which part it is, in a state of nature, as strictly confined as the successive generations of each species are confined to that species. This is clearly established by historical testimony and by monumental record. There are countless regions of the world from which, not only since the records of the human race began, but within the period of modern history, races of animals have entirely vanished, though they were once so numerous as to form characteristic features of their several localities.

Within the modern period we cannot regard those extinctions of animals as purely natural occurrences, for man has come in to play his part; and in very many instances, where he did not choose to domesticate he has destroyed, it may be sometimes not with "absolute wisdom." The bones of the animals which speak from the dust give evidence of a more purely natural kind, and therefore more to the purpose. We are not to suppose that the elephant of Siberia was exterminated by human means, or the valley of the Ohio was less wooded or less wild when the mighty volume of the mastodon trode its savannahs. As little are we to suppose that those animals which are found in the earth abundantly in many parts of Europe, and of which the nearest living types are to be found in the tropical parts of the eastern or western continent, were exterminated by human means. Animals slumber

together in one common charnel house, deep under a covering of earth which nature has thrown upon them; and so slumber in Europe; but the living type of the one, or the lingering species of a genus which had once been numerous, is found in South-eastern Asia; that of another is found in Southern Africa, and that of a third in South America. They have not yet been met with we believe, but it is by no means impossible that those ancient sepulchres may contain the bones of the marsupial animals of Australia, widely as they differ from the existing mammalia of every other region on the surface of the globe. Those monumental bones are, in very many of the species, found in no stinted numbers, but in heaps which, ere the mould covered them in the lapse of years, must have cumbered the surface. They have clearly perished by what may be called the hand of nature, that is, they have become extinct in virtue of that law which God has given for the earth's government. That law is a law of infinite wisdom and goodness; and therefore, whether the numbers of an animal have remained stationary, whether they have increased, whether they have diminished, or whether they have become extinct—recently or so remotely that no record of the time remains, we must conclude that all those changes, in every case where they have not been brought about by the interference of man's partial and imperfect knowledge and judgment, have been all for the very best.

If therefore we ask why nature has blotted out, from her living catalogue, such and such a race? the answer is plain and palpable—there remained no longer any place in nature for the exterminated species, it had no useful office to perform for the general benefit of the system, and therefore it was cast away as a vain and unprofitable thing.

We have no room to enter upon the train of inquiry to which this naturally gives rise, as to whether the extinction of so many races of animals is an evidence that our globe is waxing old, and must one day or other, in spite of the powers of local renovation which are contained in it, undergo at some time or other that doom to which its most tiny inhabitant is destined. We have adduced the circumstance merely as a proof, the most exclusively natural which we can have, that every species of animal has its distinct place and office assigned it in the system, from which place and office it can no more of itself depart than the earth or any other planet can of itself break away from the governing influence of the sun, and career as a devious wanderer through the regions of space.

The continuation of the race is, as we have shown, only to keep the necessary office in nature full, and according as the general working of nature maintains steadily, increases, diminishes, or abolishes the office, the numbers of the animal remain stationary, augment, fall off, or finally depart. The only other use, considered with reference to nature, is, as we have hinted, the feeding; that which the animal consumes is a surplus which, if suffered to remain, would injure the rest, destroy the balance, and derange the whole system of nature. This, however, is guarded against in the most effectual manner. In South America for instance, the gigantic megatherium has been laid in the dust, it may be to make room for the ox and the horse, imported from Europe, and now the chief wealth of the inhabitants. In other parts of the world the change has been similar. It is the mighty that are fallen; and it may be that because the feeble arm of man is unable "to draw out leviathan with a hook, or guide behemoth with a bridle," that those giant creatures have been taken out of his way, in order that he might clothe the hills with flocks, people the meadows with herds, turn the furrow by the labour of the all tractable horse, and thus subdue the earth and reign over it, according to the gracious promise made to him at his creation. This is a part of the study of the mammalia which is truly inviting, but we dare not enter further upon it, lest it should tempt us beyond the bounds even of rational speculation.

The animal is not only useful in removing that superfluous substance, animal or vegetable, which it appropriates as its food, for the refuse of that food, the portion of it which is unfit for assimilation by the animal, together with the remains of the animal itself after it has performed its appointed work, and rendered up its life, are most useful in promoting the growth of the vegetable tribes, which in their turn supply the food of by far the greater number of land animals, whether mammalia or any other class. There is thus in the system a perfect cycle of reciprocity by one supporting another, that other a third, the third a fourth, and so on till, at the end of a succession which we do not see, the last supports the first; and thus the system of terrestrial nature has all the stability and returning into itself which we find in the orbit of a celestial body, at the same time that it admits of a countless number of motions and changes.

We must not, however, endeavour to trace this cycle in any one of the kingdoms of nature taken alone; for, if we do, error must be the inevitable consequence. There neither is, nor can there be, a complete chain or circle of succession in any one of the kingdoms, into which, for convenience of study, we arrange the productions of nature. The chain to which we allude is not confined to the mammalia, or to animated nature taken in its utmost latitude. It extends to the earth, the air, and the sea, in all their successive phenomena, whether momentary, diurnal, annual, or for longer periods of time; it extends to the sun, whose influence furnishes the grand stimulus to the whole system of sublunary things; it even extends, though by fainter shades—shades not traceable by us, to the whole solar system; and by shades fainter still, from that system to the whole material universe, the conception of which is infinitude to the human mind.

Thus, it has always happened, that when a zoologist, a botanist, or any other labourer in one detached portion of the great field of nature, has attempted to trace a regular succession in the productions of that portion, from the most simple to the most complicated, it has invariably been a failure, and wherever there has been candour enough to own it, the breaks in the pretended chain have been more numerous than the continuities. The balance and perfection are in the whole; and in order to preserve these, one department must necessarily be frequently breaking in upon another, and the grand innovator time changing the whole, by degrees too slow no doubt for our perceiving them by immediate observation, but still not the less certain upon that account. A very little reflection may suffice to convince any one that it cannot be otherwise. The whole, however extensive it may be, must partake of the general characters of the parts of which it is made up. Now there is no individual production of nature which is not in a state of

constant change. The progress of this change, so as to be perceivable by us, may require a longer or a shorter time, a moment for instance, for the appearance and reappearance of the lightning's flash, and millions of years (we know not how many) before a world or a system of worlds shall require to be renovated. But still it is sound philosophy to conclude that as are the parts so must be the whole, and the difference is a question only as to time.

Some such general views as these are necessary to put us on our guard, when we endeavour to examine the natural uses of the productions of nature; and when we attempt to define one production as the used and another as the user, we bring ourselves under the lash of the philosophic satirist:—

> Proud man exclaims, "see all things for my use!"
> "See man for mine," exclaims a pampered goose!

With the understanding that the great use of the animal to nature is its feeding, and the reciprocal use of nature to the animal is the food and the other means of life which the animal affords, we may proceed to take a brief glance at the feeding organs in the mammalia. Those organs may be conveniently divided into three sections:—Organs of prehension, that is, organs for bringing the food within the possession of the animal after that animal has, by means of its organs of locomotion, arrived at the place where the food exists. Organs of preparation, or those by means of which the animal dresses the food so as to be fit for the ultimate process of being changed into the substance of the animal. Organs of assimilation, including the stomach and intestinal canal, and also the various apparatus through which the chyle or prepared food passes, before it mingles with the blood of the animal. The succession here might indeed be carried much further than the three steps which have been enumerated; for we might at least attempt to ascertain by what organisation and what process the food of the animal, which enters the blood apparently as one simple substance, is changed into each of those numerous textures of which the body of the animal is made up. Here, however, we fall upon a difficulty the solution of which is beyond the reach of the human powers; for these operations have no apparatus other than the organ which is formed; and therefore each of them involves the question of the principle of life, a principle of which, in any thing but its mere phenomena, we must remain for ever ignorant.

Organs of Prehension.—Of some of these we have already spoken, when noticing the other functions which they perform, and which in many instances are their predominating, or more essential and appropriate functions—as for instance, the paw of the ape, though the animal may seize its food with it, is yet more useful to it in a state of nature, in climbing to the place where that food is obtained. Those which we have noticed under their prehensile function, as simply taking hold, we shall not again repeat; and thus the subjects of our present remarks will be reduced within a much narrower compass. They will fall under the following heads: prehensile noses, prehensile lips, prehensile teeth, and prehensile feet; it being understood, in the case of the last, that the foot is used exclusively in seizing the food.

A prehensile nose, or proboscis, as it is termed, is a rare organ among the mammalia; the only instance in which it decidedly appears being that of the elephant. In both the Asiatic and African species of that splendid animal, the proboscis is, however, one of the most important organs of the whole range of the mammalia; and it may with truth be said, that while no organ is more perfect in its structure, there is none for which the possessor is so totally without a substitute. In this, of course, we allude to external organs, for if any of the internal organs of an animal is entirely destroyed or removed, that animal must perish as a matter of course. Among the other mammalia we scarcely know of any external organ for which there is not some substitute, so that, however severe may be the privation, and however great the inconvenience, which the animal suffers from the want of it, still it is not utterly wretched, the functions of life can still be carried on, and various actions can be performed by the other parts of the animal, the performance of which, in ordinary cases, devolves entirely upon the one which in the case of the mutilated animal is wanting.

We have remarkable instances of this in the human subject. There are many instances recorded of persons who, being entirely deprived of sight from their infancy or from a very early period of life, yet acquired so much acuteness and tact in the remaining organs of sense, that they not only performed many operations which are usually supposed to depend entirely upon sight, but actually excelled in the performance of them.

The proboscis of the elephant is perhaps the most extraordinary instrument in the whole range of the animal kingdom, and we could not name another which is of such essential and indispensable use to its owner. Deprived of this the elephant would be utterly helpless, incapable of either eating or drinking, and therefore unable to live. Why the largest of the land mammalia should lie thus exclusively thrown upon a single instrument for the supply of all its wants, craving in proportion to its size, is a singular question in physiology, but it is one which we are quite unable to solve. From the fact, however, of there having been, in former times, an elephant in the polar countries, from the probability that the megatherium may have been a proboscised animal, and from the fact that the native grounds of the existing elephants both of Asia and Africa, have been narrowed within the period of recorded history, we must conclude that the elephant, in its proper nature belonged to a state of things which is now passed or passing away; and that in the forests near Chittagong, and by the streams of Southern Africa, the elephant stands monumental, to tell the tale of a state of things of which we have hardly any other living record. These are matters, however, into which, though fancy tempts us on, philosophy is unable to follow; and therefore we must let them remain in the class of what must be admired but cannot be understood.

Still, even within the limits which our examination can reach, and where fact and fancy go hand in hand, the proboscis or trunk of the elephant is a most extraordinary piece of animal mechanism. Hands, clutching paws, feet for holding on, prehensile tails, and all other working structures of animals with which we are acquainted, follow one general law. The basis of these consists of bones, and those bones give origin and insertion to the different muscles by which the action of the parts is produced. But the trunk of the elephant sets this—which we would be apt to

consider as the fundamental law of animal mechanics—at perfect defiance. It contains no bone upon which a muscle can be inserted; and yet it is capable of more varied motion than any other organ in the whole range of the animal kingdom. Nor need we wonder that the animal should take the utmost care to protect this instrument from those predatory animals by which it is occasionally assailed, because injury to this would be far more fatal to it than injury to any other part. Hence we find that when the elephant is compelled to submit to the spring of the tiger, it preserves its trunk with the utmost solicitude, and if it cannot receive the enemy upon the tusks, which are its natural defences, and placed in the same plane with the trunk, one on each side, as if they were expressly intended for defending that, it receives him upon some part of its body, where it can instantly lounge down and crush him under the ponderous weight of its body.

The trunk consists of a double tube or canal, being a continuation of the nostrils, lined with a fibro-tendinous membrane, the perfect flexibility of which is secured by a number of follicles which open on the surface, and constantly discharge a lubricating fluid. The canals of the trunk do not pass directly to the lungs of the animal, but have various flexures; and at the proximal extremity of the organ there are placed tendinous valves by means of which the passage to the lungs can be opened or shut at pleasure. Externally, the covering of the trunk, especially at its distal extremity, is a very keen organ of touch; and the termination, which consists of a prehensile lip and a finger-like projection, can pick up the smallest substance with all the neatness of a hand, while the organ altogether can perform many offices which no hand could possibly perform.

The interval between the two tubular openings of the trunk, and also the walls which surround them, are made up of fasciculi of muscular fibres, which, though they appear, generally speaking, to stretch longitudinally, are capable of moving in all directions. There are, generally speaking, four principal muscles in the organ, which are inserted, the two large ones on the frontal bone and the upper part of the bone of the nose, and the two others on the maxillary bone before and under the eyes. None of the other animals, which have a motion of the nose, have any thing like such powerful or produced insertion upon the bones, as is possessed by the elephant; and it is this firm basis which gives support to the very extraordinary motions of the trunk. The tapir makes a slight approximation in this respect, but even it is nothing to the elephant, which must thus be considered as standing alone among living animals, and pointing at habits and at a locality which are as peculiar as the animal itself.

Each of these pairs of muscles is composed of two kinds of fibres, the one placed longitudinally, and the other radiating in a transverse direction. These are so inserted in the external membrane of the trunk, and in the membrane which lines its two cavities internally, that, though they give it every sort of motion in extension, in contraction, and in flexure, they do not diminish the size of the internal openings, which remain the same in all the variety of its motions. Internally it may be considered both as a drinking horn and as a watering machine. It takes in a considerable quantity of water, pure if for the drink of the animal, but mixed with mud if for the purpose of ridding it of flies and other insects which annoy the skin. In taking up water of either description, it is drawn by suction as far as the valves at the base of the trunk; but these are closed the instant that the water reaches them, and thus not a drop can pass from the trunk into the lungs of the animal. When the water is for the purpose of drinking, the head is elevated, the trunk recurved till the extremity of it enters the mouth; and then an expiration of the air from the lungs opens the valves and discharges the water with no inconsiderable force. If, on the other hand, the object is merely to cool and refresh the skin, successive trunksful of water are projected over it with no inconsiderable force, and with as much certainty as if they were projected by a garden engine; so that, by means of this instrument, the elephant can remove annoyances from its skin with more ease and certainty than can be done by any animal which has merely the use of its mouth and paws.

The localities which elephants inhabit in a state of nature require such a provision as this. They are the most fertile parts of tropical countries, rank with tall vegetation, abounding in moisture, and by necessary consequence infested with insects. When we see an elephant which has been for some time exposed to the dry and cold air of our climates, its skin appears wrinkled and shrivelled, and we are apt to imagine that it is entirely destitute of feeling. This, however, is quite a mistake; and it appears to be a very general law in the character of the mammalia, that the sensibility of skin is in proportion to its thickness. This holds in the human subject as well as in every other; for we find that the skin of the palms of the hands and the soles of the feet, which is, generally speaking, the most sentient in the body, becomes, when indurated with tannin, as thick as the hide of a buffalo. There is another circumstance which shows the great sensibility of the skin of the elephant, and that is the singular power of the sub-cutaneous muscles. The action of those muscles, without the stirring of a single limb of the animal, or even without any specific motion of the body, is quite sufficient not only to rid it of any common incumbrance, but to shake off a beast of prey when clutching with its feet and grasping with its teeth. This is the ordinary way in which the elephant gets rid of any animal which attacks it; and the moment the attacker is thrown off by this singular movement of the skin, the elephant is ready to fall upon him or trample him to death.

It is in the finding of its food, however, that the efficiency of the elephant's trunk most remarkably displays itself, and displays the function not only of one hand, but absolutely of a pair of hands. While one part of it coils round a branch and brings it down, the other part lays hold of the leaves on the extremity, pulls them off, and conveys them to the mouth; and thus the elephant can feed upon vegetable matters higher above the ground than any other animal. Nor is the efficiency of this curious instrument confined to such operations as these; for in the arid season, when the ground vegetation is burnt up, and all that remains on the surface is a few withered stalks of grass, almost as hard as wire, the trunk can be applied in collecting them with a neatness which no hand can accomplish. It sweeps like a broom by its lateral motion, and coils as lithely as a serpent; and when it has swept the dried grass in sufficient quantity, it can form it into a little bundle and convey it to the

mouth, in a manner to which there is no parallel in the rest of animated nature; and thus independently of its supposed sagacity, the accounts of which have been often greatly exaggerated, the elephant is, in respect of mechanical structure, among the most wonderful of all the mammalia.

The foot, clumsy as it appears, comes wonderfully in aid of the trunk in some of the nicer operations. This foot can in no respect be compared to a hand, for the toes are completely enveloped within the the thick skin of the member; and to external appearance there is no organ in the whole animal kingdom more clumsy and ungainly than the foot of the elephant. We must not, however, judge from mere external appearances when we wish to ascertain what an animal can perform; for this foot of the elephant, clumsy as it seems to be, and incapable as it is of performing the ordinary operation of grasping, is notwithstanding a very ready instrument. The animal can press down a branch with it, or hold on a tuft of grass to prevent its being drawn out of the ground, while the trunk twists off the eatable part as neatly as if it were cut off with a pair of scissors. In tame elephants which have been taught to uncork a bottle of water and swallow the contents, we have a beautiful instance of the manner in which the foot and the trunk work to each other. The bottle is taken by the trunk in a coil near the extremity of that organ, and carefully conveyed under the side of the foot, where it is invariably placed in a direction nearly perpendicular and with the cork uppermost. The lip and finger of the trunk are then applied to it; and however small the portion of cork above the neck of the bottle is, they seize it so tightly that by the twisting motion of the oblique muscles they twirl it out almost exactly in the same manner as would be done by a cork-screw. After the cork is extracted, the animal brings the bottle to an upright position, and coiling the trunk round it conveys it to the mouth without spilling a single drop. The mode in which this is done is well worthy of attention, as showing how very wonderful an instrument the trunk is, and how much superior it is even to the human hand in the universality of its motions. Generally speaking, the most powerful curvature of the trunk is downwards, as that seems to be the mode of its action in taking the food of the animal when in a state of nature. With the water bottle, however, it can have a lateral motion, and so balance the bottle as that not a drop is spilt until the mouth is reached, though when that is arrived at, the bottle is inverted in the neatest manner. It is not easy to explain, or even to understand the singular mode of the coiling of this curious instrument. It does not lay hold by a single part, and so convey food to the mouth as is done by the hands or paws of those animals which use these instruments in feeding; for the elephant can advance the coil on the trunk, and keeping firm hold of a bundle of grass or any other substance which it wishes to convey to the mouth, it can roll it upwards in the coil, while the lip and finger of the trunk are kept ready for seizing some new object.

It would be utterly impossible for any organ composed of jointed bones to perform any thing like the number of motions of which the trunk of the elephant is capable. Generally speaking, all articulated organs have one principal plane of motion, and out of this plane they move feebly and unstably. The only way indeed that free motion of bones in all directions can be produced is by ball and socket joints, and these joints never can have a steady motion in any one direction, unless that in which antagonist muscles of nearly equal power are applied to them. There cannot be many pairs of such muscles applied to any one joint, and this is the reason why, in the knee and elbow joints, the oblique or rolling motions are effected by the application of a second bone, the action of which turns the joint round upon the centre of the principal one. The spines of the cartilaginous fishes make a slight approach to the trunk of the elephant, but even in them it is only a slight one, for the bone though flexible, is still much stiffer than cartilage, and besides it has the disadvantage of being internal or central of the muscles which move it, and thus those muscles have to act at the greatest disadvantage. The trunk of the elephant, on the other hand, has a structure resembling that of the invertebrated animals in which the muscles are inserted on the skin or crust, and thus act directly and to their full extent, without any loss of power.

It is not a little singular that, in the largest and we may add the rarest of the mammalia, and one which possesses so much intelligence and resource as are found in the elephant, we should, in its most important organ, have a complete departure from the ordinary mode of organisation among mammalia, and the part be as it were, thrown among what we are accustomed to consider inferior classes of animals. The mollusca and the annelidæ are the animals which in their structure come nearest to the trunk of the elephant; and when we examine the extensions and contractions and the various flexures of a worm or a leech, or of a slug, which are all produced by internal muscular effort without the assistance of any bones, we have before us no bad type of the action of the elephant's trunk. It is well known that a common earth worm can bore its way by muscular exertion alone, where the strength of none of the mammalia could enable them to follow it; and it is equally well known that no aperture is too small or too sinuous for preventing the passage of some of the leeches, especially of those ground-leeches which inhabit the eastern Archipelago in myriads, and are such torments to the inhabitants during the rainy season by crawling up their legs and sucking their blood at every pore. But these are motions of the whole animal, and not the working of a part; and even in their particular motions they are excelled by the trunk of the elephant. In their muscular action, whether it consists in extension, in contraction, or in flexure, the muscle passes fairly from side to side, through the centre of the body. The two tubes by which the trunk of the elephant is perforated, give it an advantage over all animals, or parts of animals which have the muscles extending the whole way from side to side. The internal sheath of the tubes, and the external covering of the organ, afford (as there are two tubes), nearly three times as much insertion for muscular fibres as there is in an animal which has its muscles extending from the covering on the one side to the covering on the other; and while both the external and internal coverings of the trunk are endowed with a very high degree of sensibility, both of them are joint all over, and one cannot help feeling admiration at the few words in which the inimitable Bard so perfectly characterises the elephant when he simply says, that it

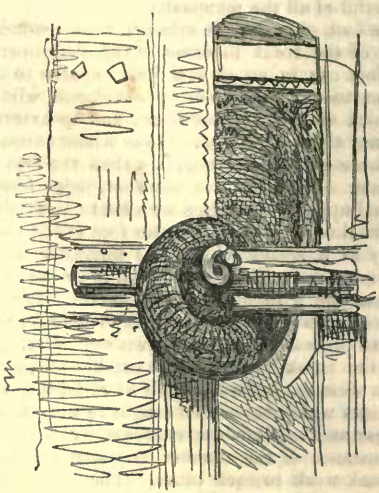
"Twines its lithe proboscis."

It is true that the most powerful action of the

elephant's trunk is in the mesial plane of the animal's body; and that, as is the case with all actions of the the body and head of mammalia, it is most energetic in the downward direction, or in drawing substances towards the mouth of the animal. Still, however, it is capable of motion in many directions, and those varied motions increase towards its distal extremity, so that that part of it can turn like a serpent.

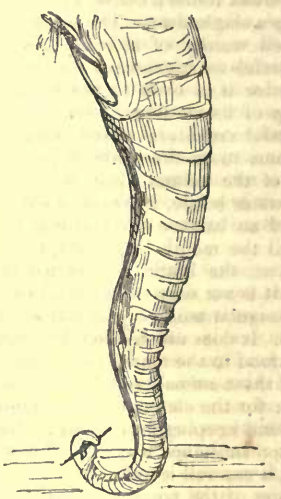
The muscles by which these motions are brought about have their origin in the individual fibres, in the cartilaginous lining of the nasal tubes, and they have their insertion in the skin of the organ, which is also firm and cartilaginous, in order to allow them a proper base for support. This transverse position of the fibres in these muscles is absolutely united with the longitudinal one, extending all the way to the bones of the face, upon which the bases of the great muscles are inserted. This produces a double muscular action, of which we have hardly another example in the whole organisation of the mammalia. The oblique fibres draw the two integuments together with a twisting motion, and the longitudinal fibres being united to them by cartilage, pull them in a proximal direction, much in the same manner as the hand pulls the string in drawing a bow. It is not easy to estimate numerically the force which those muscles possess; but we may state generally that it is more than double of what could be exerted by the same mass of fibres, if those fibres were all exerted in planes parallel to each other, and their action were confined to that simple shortening which is the operation of ordinary muscles. It is sufficient to mention that, when the longitudinal fibre draws the oblique one, then comes into operation that mechanical power with which sailors are so well acquainted, which is technically known by the name of the swig or rope power, and consists in pulling down the middle or bight of a rope, by which means it may be rigged far more tightly than it could be by any mechanical power, however great, applied simply at one end. The great strain of the rope in swigging is upon the two extremities to which it is fixed; but there is a peculiar combination of leverage and elasticity propagated along both ends from the bight; and this telling upon the oblique fibres in the trunk of the elephant, and pulling the external and internal integuments closer together, produces an absolute lengthening of the member, although the longitudinal fibres acting alone would tend to shorten it.

In these muscles, indeed, there is a very wonderful combination of general and individual power, so that while the whole trunk acts in a particular manner, the individual parts of it have their specific actions at the same time, and it twines about with even more flexibility than a serpent, at the same time that its strength and quantity of substance increase so beautifully from the extremity to the insertion on the bones of the face, that it is really more stable in all its varied motions than any organ which could possibly be formed of internal jointed bones with muscles applied to them. Nor is this the most extraordinary part of the structure, curious though it is, for the trunk is absolutely stronger than if it were composed of one entire solid. Every one in the least acquainted with mechanics must be perfectly aware that, within certain limits, a hollow tube is much stronger than a solid of the same quantity of matter. This arises from the resistance of four surfaces to a cross strain; and as the resistance in the case of a tube is merely a dead or passive resistance, while the resistance of the elephant's trunk is an animal or active one, there is in the trunk a very great advantage over every thing which can result from anything connected with inani-



Trunk of African Elephant.

mate matter. We must, however, take leave of this extraordinary organ, and as no illustration can convey an adequate idea of its action, it being impossible to represent motion by a drawing, we shall content ourselves with giving two simple cuts, one representing the trunk of the Asiatic elephant and the other that of the African.



Trunk of Asiatic Elephant.

We may however remark, in passing, that the trunk is supplied with two distinct kinds of nerves; that the one set are branches of the facial nerves, and may be regarded as more immediately concerned in what may be considered the vital or involuntary

actions of the trunk, while the others are branches of the fifth pair, or nerves which supply the organs of sensation.

The next organs of prehension, or seizing the food, to which we shall allude, are the soft parts of the mouth, of which we need not add that the chief are the lips and tongue. In carnivorous animals, and, generally speaking, in animals which seize their prey with teeth, there is very little motion in the soft parts of the mouth; and in some the most powerful action of the lips is that which draws them away from the teeth, in order to expose these more completely to the work which they have to perform, of which we have a familiar instance in the snarling of a dog. In grazing animals, on the other hand, both lips and tongue are always more or less prehensile. In those pachydermatous animals, which do not root up the earth like the hog tribe, there is always a good deal of prehensile motion in the lips, especially the upper one. The rhinoceros, the tapir, and even the hippopotamus afford examples of this prehensile lip, more or less conspicuous in the different genera, but in no case amounting to an independent prehensile instrument like the trunk of the elephant; the most efficient of them are merely auxiliary to the mouth in gathering in the vegetable matter which is cut from the surface of the ground by means of the teeth, or in bringing more elevated vegetation downward, so that these instruments can divide it. There is less of this action of the lip in the rhinoceros than in any other animal of the order; and the rhinoceros requires it less, inasmuch as its chief food is torn by the very powerful teeth with which the jaws of the animal are furnished.

The ruminant animals have also some prehensile action in the lip, and they have more in the tongue than any of the pachydermata. Perhaps the most remarkable instance is that of the giraffe, which, while it has the lips capable of seizing and conveying into the mouth the leaves, twigs, and other vegetable substances upon which it feeds, has the tongue a directly prehensile instrument, with which it can seize a branch of a tree and bring it down till the leaves are within reach of the lips.

There are some adaptations to locality in these parts of animals which are not unworthy of attention; and they are the more worthy of this attention, inasmuch as the larger mammalia, which feed upon vegetable matter, are the grand indexes to the vegetation of a country, and through that to its general physical character, as respects its value for human cultivation or the reverse. One of the most valuable of these indications is, that the country furnishes a supply of food for these larger herbivorous mammalia, which are the most profitable, on account of their milk, their labour, and the value of all the parts of their structure; and also from the great return which such animals make to the soil on which they feed. Hogs mangle the surface, and the rodent animals, even when they do not burrow, spoil the vegetation. It is therefore of use to attend to the modes of feeding. If the animal subsists chiefly by browsing the short herbage of upland downs, and other places of a similar description, there is little prehensile motion either in the lips or the tongue; and the sheep and goat may be regarded as examples of this kind. If again the animal grazes the taller vegetation of meadows and other fertile places, the tongue has more prehensile action, and it sweeps round to gather the herbage as it is divided by the teeth. The whole of the ox tribe furnish examples of this mode of action. If again the animal has, either habitually or seasonally, to gather the dried grass from the surface of the ground, the lips have more prehensile motion, as we find exemplified in the horse and the ass. Yet again, if the animal is habitually or seasonally reduced to browse trees, in consequence of the disappearance of surface vegetation from its pasture, it has the lips and also the tongue still more prehensile, as we find exemplified in the camel, and still more decidedly in the giraffe.

There is not only this gradual adaptation in these grazing animals to the peculiar nature of their different localities; but the whole organisation of the animal corresponds with this. The lengthened neck and comparatively small head of the camel and the giraffe, and also the free motion of their fore legs, and the extent to which they can stretch these from each other when circumstances render it necessary, all tend to enable the animals more conveniently to find their food, whether they are obliged to seek for it above or below the ordinary plane of the body.

We shall now take leave of those parts of the head of the mammalia which, with the exception of the teeth, are the principal organs of that part of the body used in seizing food. There are no doubt various other animals which have the tongue extensible a considerable way beyond the ribs, and capable of some prehensile action. This is the case with the bear, which is in the habit of reaching the sweet juices of vegetables in the tubes which contain them, after the animal has divided a portion with its teeth, in order to procure their admission, and which also by the same means get at honey in the holes of old trees, which they are incapable of reaching directly with the mouth. The ant-eaters have also this faculty to a considerable extent; but as their object is not to lick up substances with the tongue, but to possess themselves of insects and their larvæ, their tongues are furnished with a viscid secretion to which the insects adhere, as they do to a similar substance on the tongues of birds and reptiles which, like the mammalia in question, feed upon insects.

There is another portion of the organisation of the ant-eater, which aids the prehensile tongue in the capture of the animal's insect-food; and without this the power of the tongue could not be effectually called into operation. That to which we allude is the fore-paw of the animal; and, in order that it may be better understood, we have given a bird's-eye view of the anterior part of the animal, together with the skeleton of the fore paw, which will be found at page 163.

It will be borne in mind that this animal is entirely toothless, incapable of biting, or of offering any violence to an animal so large as a mouse; yet one of the species at least is an animal of considerable size, being more than four feet long in the body, and two feet and a half in the tail; but it is a very slow and inefficient walker. From its large size, it must require a considerable quantity of food; and as that food consists of very small insects, the finding of it must be attended with no inconsiderable degree of labour. Now, whatever may be the kind or quantity of food necessary for any animal, the organisation of the animal is in every case the best adapted for finding that food in all the three parts, of getting at the

situation where it is, taking possession of it, and turning it into nourishment. Hence if we find that the locomotive powers of the animal are slow and imperfect, we invariably discover some other more fully developed part of its organisation, which compensates for its deficiency in this respect. The ant-eaters form no exception to this. They are deficient in locomotive power, and they are destitute of teeth; but we find an ample compensation in the peculiar form and enlarged processes of the bones of the fore-paw. The scapular bone has prominent ridges upon it which give it a firm embedment among the muscles; the articulation of the head of the humerus is very free; and there is hardly another of the mammalia in which the processes on this bone are so well adapted for the insertion of powerful muscles. The elbow joint has also great power, and the projecting head of the ulna affords a lever from which a very extraordinary twisting motion can be given. The position in which the head of the animal is shown may be regarded as that of repose, or of the slow motion of the animal. In this state the powerful claws are folded down partially on the sole of the paw, and seem quite helpless, and indeed useless for any ordinary species of motion. If indeed we were to estimate this animal as the standard of walking animals which have to range over a great extent of surface for subsistence, we should feel disposed to assign to it that degree of deformity and imperfection which some authors have assigned to the sloths. When, however, we take the nature of its locality into consideration, as well as its structure, we find that no animal is more completely fitted for its place in nature. Indeed if we take the trouble of observing how strong and well made out in all their parts the bones of the fore-arm are, it is impossible for us to suppose that such a perfect instrument could have been formed without an adequate purpose. One of the toes, the middle one, and also the claw upon it, is much larger than the others, which can be regarded as little else than lateral supports to this most powerful one; and in some of the species, or at least in animals of analogous habits, the number is reduced to three, or even to two. This, however, allows of no inference against the strength of the organ; for nature, like an engineer of the most consummate skill, concentrates her work upon a single part, when she is to work to the utmost of her strength.

The lateral toes on each side are, as will be seen, gradually shorter the one than the other, so that they form excellent supports; and the carpal bones are almost as perfect as those of man himself. We cannot call this instrument a hand, because it is not adapted either for grasping with the fingers or for clutching with the claws; but notwithstanding this it is not only a hand for the purposes of the animal, but a hand ready armed with a tool by nature herself.

When the animal reaches an ant-hill, or the colony of any of those analogous insects upon which it feeds, the paw is extended, and the toes and claws bent, so that it advances like a hook; and as, from the shortness of its legs and the length of its body, the animal has a remarkably firm base upon the ground, the hook of the paw is drawn through the substance of the ant-hill with much more force than a man could draw a hoe with a single prong. The twisting motion of the elbow joint comes also into play; and altogether the breach which a single stroke makes in the ant-hill is much greater in proportion than that which an ordinary breaching battery could produce in a fort in the course of a day. The insects upon which the ant-eater feeds build their habitations with no small degree of labour; and they are seldom backward in defending them from aggression, or in making repairs where injury has been done. From this disposition of theirs, they throng to the breach made by the ant-eater in myriads; and the animal is enabled to transfer them to its mouth in great numbers, and with a rapidity which is hardly equalled in the feeding of any other animal.

Claws used for such a purpose as this require to have keen points, because the places which they attack are often very much indurated in the surface. The length of claw necessary to perform the operation of the animal properly, and also the position which it has to assume in the performance of it, are both incompatible with a retractile claw like those of the cat family; and yet the point has to be protected from the injury to which it would be liable if its point came to the ground in walking. Not only this, but the claw is not in any animal a proper base to start from in walking; and accordingly those clawed animals, which are the most decidedly digitigrade, always spring and also receive themselves upon the pads on the under parts of the feet, and never upon the claws, or directly upon the bones to which the claws are immediately attached. Whenever an animal springs from a hard point of rest, covering the extremity of the foot, that point of rest is invariably a hoof embracing the terminal bone or bones all round, and never a claw.

The flattened claws of the more characteristic burrowing animals, which are necessarily worn in the operation of digging, form no exception to this; for if the animal has the claws of moderate length and is digitigrade, the walking is performed on pads; and when the claws are very long, the foot is plantigrade. The length of claws, and the free motions of the bones of the paw which are required in the case of the ant-eater, are not compatible with even an ordinary plantigrade motion; and therefore the position of these animals when only the leg is brought into action, and not the paw, for its peculiar purpose, the foot is turned on the side as represented in the sketch above given. These ant-eaters are very peculiar animals, but they are not more peculiar than the localities which they naturally inhabit. These are the close and marshy forests of South America, in which insects swarm by myriads, and where, were it not for such animals as these, the insects would speedily get the better of every other tribe of animals, and the forest would be changed to a desert. They are necessary in these seasons, because the substance which they consume would be equally destructive if allowed to accumulate beyond a certain extent; but the law of nature controuls both, and sets regulations over them which adapt with the greatest nicety their numbers to the necessity there is for them.

There are in the American continent the remains of a race of animals of far more ample dimensions than the ant-eaters, but still bearing some resemblance to them in the structure of the feet. We have already introduced a sketch of the foot of the megatherium, the most gigantic of these animals of which we have any acquaintance; but, to save reference, we repeat it from a different specimen.

It will at once be seen that, though we have no personal knowledge of the habits of the owner of this

foot, they must have been very different from those of the ant-eater, though there is too much production

of the bones of the toes for allowing us to suppose that the foot had not some other function than simply that of walking. The foot is indeed well made out both in the form and the number of its bones; and when clothed with the soft parts and their integuments, it must have formed a very good support upon soft surfaces, even to a very ponderous animal. The great strength of the bones is, as will be seen, towards the extremities; and the claws must have been of moderate dimensions, so that the animal could walk on the entire flat of the foot; and to enable it to do this the better, there is some approximation to a heel bone, though it is very imperfect as compared with that of the human foot. It is a portion of the fore foot which we have represented; but the hind one does not differ materially, except in having the toes turned outward, which position would have been calculated to give still greater stability to the animal. We cannot of course speak positively as to the use of this foot, or guess at the economy of the animal, further than it has obviously been a vegetable feeder; and though it has sometimes been supposed that the feet have been used in digging the roots of vegetables from the marshes, we can have no certainty upon this point; neither do we know whether the animal was or was not possessed of a prehensile proboscis. The teeth are flat on the crowns, like the cheek teeth of the elephant, which are the only teeth that it can use in the grinding of its food; but the row is continued quite round the front in both jaws, and thus the animal would have been capable of dividing vegetable matter, which, from the great size of the bones of its head and their numerous processes for the insertion of muscles, there is little doubt, with a force unknown among the living mammalia.

The megalonyx, the remains of which have been met with in North America, though never in such perfection as those of the last mentioned animal have been in South America, lead to the supposition that, if really different animals, they must have been similar in their habits, though we of course are not better acquainted with the habits of the one than with those of the other. None of them belong to that period or condition of the world which comes within the scope of our authenticated history; and therefore it is probable we must for ever remain ignorant both of them and of the changes of the countries which they once inhabited, which have been taking place during the lapse of probably very many centuries. We know enough of these animals, however, for enabling us to conclude with perfect certainty that they have been both, strictly speaking, vegetable feeders, slow and unwieldy in their motions, and neither disposed to offer injury to any other animal, nor capable of doing so, unless in defending themselves against enemies, with the means of which vegetable feeders are provided very nearly in the proportion of their size.

Among the feet of animals which assist, partially at least, in the taking of their food, we ought to have given some slight additional account of the foot of the elephant. Its foot is well made out in the bones, although the parts are much concealed by the thick and loose skin by which it is enveloped; and the animal can readily turn it to account, both in holding on upon the ground, in the use of the trunk, and bending branches till they can be reached by that very singular organ. The foot of the elephant is not, however, a prehensile foot in any of the ordinary senses of the word, inasmuch as the animal can neither seize any portion of its food with it, nor convey any substance to its mouth. It is a very firm organ of support, but this is its proper function.

The feet of the extinct animals of America bear some resemblance to the foot of the elephant, but not much. In the elephant's foot the last phalanges of the toes are but little produced, while in the American animals they greatly exceed all the others, and are the portion upon which the great strength of the foot appears to be concentrated, while in the elephant the concentration is on the centre of the foot, and the bones of the ankle stand nearly perpendicular the one over the other.

We shall now offer some short remarks, and give one or two illustrations of prehensile feet of a very different character, form, and use, from those to which we have hitherto alluded; we mean those feet which are adapted for the capture and for the rending of living prey. The cat tribe are the characteristic animals of this description, though there are some which perform the same action in a slighter degree.

The leg and claw of the Lion.

We shall therefore confine our observations to them, and chiefly to the lion, as at once the most powerful and the most typical of the whole. In the preceding

cut we have given a representation, both of the form of the muscles in the leg of the lion, which perform the grand or general movements of that organ, and also of the particular formation of the toe of the lion, in consequence of which the claw when not in use is so perfectly protected from injury, and yet enabled to act so readily and so powerfully when the wants of the animal require it.

The one of these figures represents, as well as it can be done in a small sketch, the various muscles, together with their tendons and ligaments, which work the claws of the lion's fore paw; and this paw, although the hind one is also powerful, is by far the most efficient in the economy of the animal.

Upon examining that portion of the cut which represents the full length of the claws (though the integuments are in great part dissected away), and the wrist and greater part of the form arm, it will be seen that in the form and arrangement of the muscles there is no inconsiderable resemblance to the human arm. We might have been prepared to expect this from the analogy; because, though the paw of the lion is not only a better walking instrument than the human hand, but is really a very efficient instrument for this purpose, yet walking is far from being its only or even its chief operation. The paw of the lion no doubt conveys him to the place where his prey is to be met with, and he runs moderately fast, and struts and stalks on his slow march with all the majesty of a Hercules; but notwithstanding this, the muscles on the fore arm of the lion do not take a leading part, or even very powerfully assist in the walking motion. Their purpose is the working of the paw, the extensors on the upper part and the flexures on the under, just as in the human arm. Those great muscles, as will be seen in the figure, have all their tendons bound round with a very firm ligament, which forms a separate pulley for each, and they have a farther tendinous pulley between that and the claws. One part of the action of the paw is simply striking, much in the same way as the human arm strikes; and as the lion's blow is always what we call a back-handed one, it is sufficient to fell a pretty strong animal to the ground, or even to break its bones. It indeed tells with much greater proportional effect than the stroke of the human arm; for the lion has only a partial clavicle near the shoulder end, which is embedded in muscle, and terminates in cartilage, and therefore both in the lion's blow and in his pace the scapular comes partially in as a lever of motion; and in the direction of the mesial plane the paw of the lion strikes with three articulations; whereas, unless the weight of the body is delivered along with the blow, the human arm strikes only with two. There are some other advantages; the bone is of more solid substance than any other bone in the mammalia; and the system of muscles is remarkably strong all the way to the shoulder, at which place the mane of the lion preserves them from changes of temperature, and thus the first motion of the limb is, in proportion to its extent, remarkably free; and thus great velocity, as well as great weight and strength of matter, are given to this general motion of the limb.

It is only in so far as the muscular structure of the fore arm is concerned that there is the remarkable coincidence between the lion and man to which we have alluded; for though there is a similarity between the action of the lion's paw in clutching his prey and that of the human hand in grasping, the paw is very limited in the kinds of action of which it is capable, as compared with a hand. It will be seen from the position of the pulleys through which the tendons of the flexor muscles (and they are the ones principally shown in the cut), that the general action in compressing the paw is a drawing of all the claws in the direction of the centre of the foot, by which means, though there is no reversible thumb, the claws, when they take effect, are capable of holding on against each other with the firmness of a crab. Great care is also taken that this apparatus shall suffer no injury from the weight of the animal, either in walking or in straining, while the foot holds on in rending the prey. The balls of the toes which answer to the under sides of the knuckles, or balls of the fingers in the human subject, are amply provided with pads so large, so thick, and so elastic, that though the animal alights on them upon hard ground from his most vigorous and prolonged leap, the acting parts of the under side of the foot can sustain no injury.

The portion of the mechanism, however, which is most worthy of attention as illustrative of the structure of most of the carnivorous animals, is the claw itself, and the machinery by which it is worked. It is necessary to keep in mind that, in the human hand, in the lion's paw, and in the foot of every animal which has much motion of the toes, there are many muscles besides those which are situated on the fore arm. These last are as it were the large and rude parts of the machinery, fitted for strength of motion, but not for delicacy, and all the finer operations of the organ are left to the others. These secondary and smaller muscles which perform the delicate operations affect all the bones of the organ, the carpal bones, the bones of the metacarpus, and the phalanges of the fingers. In the human subject these muscles are exceedingly numerous, because of the motions, which, independently of the motions of the arm, the hand is capable of performing. The last two joints of the fingers have not, indeed, much lateral motion, for that would render them unsteady, but they have all a considerable degree of such motion on their metacarpal joints; while the thumb, different from the corresponding in even the handed animals, has such a motion on two joints, and is steady laterally only upon the last one. In consequence of this number of small muscles, and of the number or peculiarity of the bones to which they are applied, the actions of the hand are altogether beyond the power of numbers to express, and those smaller muscles become delicate in their action as they diminish in size, so that if they are not overpowered by the more habitual action of the larger muscles, the operations which the hand can perform are as nice as they are numerous. There is, however, this peculiarity in the hands as well as in every organ and every animal with which we are acquainted, that when one peculiar set of muscles is frequently and strongly employed, the energy of the organ or of the animal is habituated to that particular set of muscles, and all the rest become less capable of performing their function, than if the whole were equally exercised. The action of the lion's paw is a very limited action as compared with that of the human hand; but in proportion as it is limited, it is more energetic in all that it is capable of doing. This is in accordance with that general law of the animal economy to which we have had occasion so often to allude; and it is gratifying in the highest degree to find that a few very simple general prin-

ciples are sufficient to carry us through so extensive and complicated a study as that of the organisation of the mammalia. We must, however, advert to the particular structures of the toes and claws of the lion, and the simple yet effectual manner in which they protect the instrument, and give it effect when it is required.

Upon looking back to the smaller portion of the cut, which represents a single claw upon a larger scale, and as it is situated when the claw is retracted so as to save its point, it will be observed that the last phalange or bone of the toe, except the one which immediately carries the claw, stands nearly perpendicular, while the bone which does carry the claw is applied obliquely upon the upper side of it. An elastic ligament which is applied to the bone just at the root of the claw holds it backwards and upwards, and the tendon of the flexor muscle which pulls this joint and depresses the claw, passes down the one side of the second bone across the bottom, and up the other side; so that this tendon cannot, while the bones are in this position, move the one upon the other. When, however, the extensor muscles, which are the two whose tendons are marked uppermost, and which are inserted in the upper side of the head of the second bone, act with a powerful contraction, the opposite or under extremity of that bone is drawn upward by a very swift motion, and when that and the third bone are nearly in the same straight line, the joint supporting the claw is brought into such a position as that the tendon of the flexor muscle can obey its muscle, and depress the claw with great force. The claw itself is of a peculiarly strong form; and when the tendon of the flexor muscle draws it downwards, its point moves in the circumference of a circle, of which the centre is the same as that of the motion of its bone. When this takes place, the entire toe from the third bone to the claw is lengthened, because the three bones come much more nearly into a straight line with each other than in the state of repose. This is attended with a double advantage in the action of the claw; the pad on the second bone, which is shown of considerable thickness in the sketch, and which, as has been observed of all the pads on the lion's foot, secures the active structures at all times, is drawn upward at the very same time that the claw is descending. In consequence of this the advantage of the momentum gained both ways is given to the claw, and the point of it penetrates with much more force than would readily be believed. The pressure of the weight of the animal tends farther to elevate the pad, and while the joints are stretched, and the flexor muscle continues to act, there are very few animals that can shake off the lion, and the few that can do so are animals of great strength, great thickness of skin, and great power of action.

As both the extensor and the flexor muscles have their tendons passing through strong pulleys of ligament, situated near to each other on the wrist of the animal, the extensors spread the toes at the same time that they stretch them, and enable the ligaments to retract the claws. The flexors, on the other hand, while they stretch the distal joints, and protrude and bring down the claws, draw the points of them together. Both these sets of muscles act at the same time when the animal is strongly excited and springs with violence upon its prey; and as it bends the joints of the legs, and thus presses against the body of the animal on which it is fastened, it retains its hold very much by the bending of the joints alone, and without any great waste of muscular exertion.

The whole of the cat tribe have this peculiar structure of the claws, though of course the strength, and also the violence of the action, depend in a great measure upon the size and spirit of the animal. It is not easy to say whether, in the entire action of these most formidable instruments of prehension, the lion, or the great tiger of the Indian jungles, deserves the preference upon the whole action. The lion is perhaps the more terrible animal of the two in one single effort, because the body of the lion is more compact, and his strength is more concentrated upon the anterior part. The tiger, on the other hand, is more elongated, more graceful, more lithe, more active, and perhaps requires, as estimating weight for weight, more prey than the lion does. There is an adaptation to the principal haunts of the animals even in this difference of the forms of their bodies. The lion is a lurker and lyer in wait for his prey as well as the tiger, and therefore he is to a great extent a bush and forest animal. But the country in which he is found in greatest vigour and perfection, approaches more to the character of a desert than that of the tiger, and therefore the lion performs more of his journeyings in stalking about, or prowling in bare places, than the tiger does. The tiger's favourite haunts are those jungles upon the rich grounds, where the surface vegetation is much more vigorous than it is on the lion's pasture, and therefore the tiger is unable to stalk about as the lion does. Hence he has to leap a great deal more, in beating about for his prey. His leaps too are more of an upward character than those of the lion, as he has to clear the tall grass and reeds with which the jungles are covered in the openings between the trees, and other very tall vegetables, which rise above the tiger. This habit requires a greater equality of strength in the fore and hind legs, than the single spring of the lion upon his prey, and also more length and elasticity of the backbone; and as we associate notions of elegance or gracefulness with this peculiarity of form, and also as the tiger is more richly coloured than the lion, we are apt to regard him as the more graceful animal of the two. Each of them, however, is sufficiently powerful for vanquishing any animal upon the upper part of whose body it can retain its hold. The pulling together of the clutched feet, which, though they tear and lacerate, have not cutting edges on their under sides, is attended with vast pain to the animal on which they fasten; and at the same time the very powerful teeth are at work rending and mangling its flesh, which operation is rendered more destructive and agonising to the animal, by the continual tugging produced by the wriggling motion of the strong neck of the spoiler. It is only a very strong animal which can afford to run even a very short distance under the weight and infliction of either of those animals; for the weaker ones are struck down at once, and not unfrequently have their bones broken to pieces by the force of the spring, and are thus killed without any action of the teeth. The strong manner in which the claw comes down, and the great action and weight of the paw, cause a single claw to act with such terrible effect that it is sufficient to fracture the skull of a man, even though the tiger springs over him and hits him in no other way. Indeed, when the weight and momentum of the animal are in this manner delivered upon a

single claw, that one claw necessarily tells with much more effect than if the animal were to alight on all the claws a once. In great efforts, the body is always delivered upon the middle claws of the fore feet before the others take effect; and thus it pierces like darts projected from a powerful mechanical engine, before it clutches, though the clutch very speedily follows the other part of the operation. The whole action of those more powerful of the carnivorous animals very much resembles the projection of a war-like missile, only it is more complete, and the animal is the missile and the engine at one and the same time.

This circumstance is worthy of some consideration, inasmuch as it shows us that lions, and tigers, and all the more powerful of the cat family, are not made for the use of man, neither can their vast but momentary exertions be in any way pressed usefully into his service. This is in strict accordance with the conduct of these animals, and the increase and diminution of their numbers, when man clears away the jungles and cultivates the field, their powerful inhabitants contend for a time; but are ultimately foiled by the intellectual resources of men in a comparatively low situation, if these are in sufficient numbers, possess sufficient activity, and live in that harmonious manner which constitutes the grand strength of human societies.

If, on the other hand, from war or any other of these causes by which the numbers of mankind are thinned, the strength of their union broken, and the jungle begins again to invade the once cultivated ground, the lion, the tiger, and the other ferocious animals, reappear and reassert their dominion.

Some others of the carnivorous animals use the feet partially as prehensile instruments; though generally speaking they do so for striking down or holding their prey rather than for tearing it, they do not therefore come strictly within the list of animals with true clutching feet. Their prehensile character

is in their teeth; and as we shall have to advert to them in noticing the systematic arrangement of animals, we should be involved in repetition, were we, in the mean time, to offer any thing more than a few hints of the most general description. None of the three sets of teeth with which to some extent or other all the more completely mouthed animals are furnished, can be considered as instruments simply of prehension, without at the same time performing some other function to which, in fact, the prehensile action of the teeth is generally subservient. One of the most complete cases of this prehensile action which exists among the mammalia, is found in some varieties of the dog family; and those which have it in the greatest perfection, have always the muzzle short, the neck and those muscles which move the jaws very powerful, and they hold on with great desperation, so that one of them may be swung round and round by the animal on which it fastens without letting go its hold. One of the most remarkable instances of this occurs in the bull-dog, which has not merely the canines, but even the fore teeth, so formed as to retain their hold. The above figure, which is a sketch of a dog hanging on by the under lip of a bull, will be a sufficient illustration of this kind of action, which is, generally speaking, not a very creditable one to the parties by whom such dogs are employed.

Some of the weasel or marten tribe also hold on very desperately; but after all their bite is a wounding one, rather than merely prehensile. Some of the rodentia, as several of the rat family and others, can keep a firm hold; but they are biters. We cannot therefore consider teeth as coming very strictly within the class of organs whose leading office is prehension, though that is often part of their office. There are few animals which have the teeth more prehensile than the cat family, and yet they are, in addition, furnished with the most complete instruments for catching prey of which we have an example in the animal kingdom. This is enough to show that the mouth of no animal alone is capable of finding a subsistence for its owner in the flesh of animals of any considerable power. In their other functions, whether of cutting, of wounding, of tearing, of bruising, or of grinding, the teeth of animals are to be considered more in the character of preparers of the food for the stomach, than of mere takers of it; and as in this point of view they form the basis of much of the classification, according to the best informed and most judicious systematists, they properly belong to that branch of the view which we have endeavoured to take of the mammalia. The canines of some of the pachydermata form the most decided exceptions to this; and these exceptions are found in animals which differ not a little in the nature of their food, and their digestive organs. Of these, one of the most remarkable is the hippopotamus, whose prehensile teeth are very strong, and covered with a more compact enamel than the teeth of almost any animals. The whole mouth of this animal is indeed a rugged and most formidable looking combination of parts; and if we were to judge only from the size of the jaws, and the development and texture of the the teeth, we should be very apt to conclude that the hippopotamus was one not only of the most formidable, but of the most carnivorous animals in the whole class of the mammalia. When however we examine the feet, and see their perfectly harmless structure, and the internal parts, and discover that they are equal to the digestion of even dry sticks, we come at once to a very different conclusion, and do not fail in determining that like the other great animals of the same order, whether living or extinct, the hippopotamus is a dweller in peace with his kindred mammalia, and with all living creatures; and that,

though his means of defence against attack are exceedingly powerful, he wages no offensive war except against the vegetable kingdom. Even there, though he is not a welcome guest in cultivated countries where crops are grown close to the banks of those rivers from which he never wanders very far; yet in that wild and exuberant state of nature, which alone is compatible with the existence of the elephant, the rhinoceros, and those powerful animals of the order which are now gone, he is as completely in his place, and as useful in the system of nature, as the most graceful animal which roams the plains or browses the meadows. The tusks of the hog are another of the exceptions; and though when attacked this animal can inflict desperate wounds by means of them, their object in the natural economy of the animal is not that of wounding, but of tearing other substances than the flesh of living animals.

We cannot, however, come to any specific conclusion respecting the teeth of this order of mammalia; for whether the series was or was not complete at some former period, it is now so broken, and there is so little correspondence between one genus and another in this respect, that we cannot make a transition; and this is the reason why Cuvier, notwithstanding his profound knowledge of animal structure, and the agreement of the parts and the system with each other, was obliged to found the character of these animals upon the thickness of the skin, which is wholly of an external kind, and furnishes no guide whatever to any part of their economy, either as to what food they eat or how they procure it.

Respecting the digestive system of the mammalia, there are but few general remarks which can be made apart from those which are the foundations of the classification. It is obvious that the organs of digestion must be adapted to the nature of the food; and that therefore they must in a great measure correspond with the teeth, which are adapted to the same purpose.

The general principle is that the coarser the ordinary food of the animal is, its organs of digestion are the more enlarged and complicated. This however forms a sort of guide, though rather a loose one, to some points in the progressive history of the mammalia. The larger pachydermata are, for instance, adapted to a state of things in which vegetation is rank and coarse; and this again points to a humid condition of the surface of the earth, at least in the places inhabited by those animals. But the remains of such animals have been met with in almost every region of the world where men have had an opportunity of exploring the soil; and this leads us to the conclusion, that at some former period of its history, the earth must have abounded much more generally with water, both stagnant and running, upon the surface of the land than it does now.

We might even go further than this, were it not that it would involve us in a more extended history than that of the mammalia, and not only so, but lead us to the consideration of departed races of vertebrated animals, both swimmers and fliers, and some perhaps capable of performing both these motions, to which there is no likeness, or near approximation to a likeness, in any known animal which is now found alive. The farther investigation of this point, curious though it be, thus belongs to the general history of animated nature in its progress, or more strictly speaking to the progressive history of the globe itself, than to the history of any particular class of existing animals.

Next to the pachydermata, the animals which have the organs of digestion the most elaborate and enlarged are the ruminants, of which we shall have to say a few words afterwards; and as they have a double labour to perform both with the mouth and the stomach, part of the enlargement is of necessity taken up by this doubling. The ruminants belong to a different state of things from the pachydermatous animals; although, as both are vegetable feeders, they have a slight approximation to each other on the confines. The ruminants belong to an era of more humble, but more kindly vegetation than the pachydermata; and therefore they appear to have come later in those places of the earth where both have inhabited. Not only this, but the species or varieties which are found only in the earth, are larger than the existing ones of the same places. It is true that in several instances the domesticated varieties are often larger than what we may consider as being the extinct natives. We can, however, draw no safe conclusion from this with regard to the natural progress; for where man cultivates, he always brings a more rich and succulent vegetation over the soil, than that soil would yield without the benefit of his labour, unless in places where the natural tendency is to be overrun by forest trees, or by brushwood.

In proportion as the food of the vegetable feeder begins to partake more of the pulpy or farinaceous character, the organs of digestion become smaller and simpler. In the miscellaneous feeders they are still more so, and the decrease becomes more and more, according as the food becomes more and more animal.

It is not very easy to say what particular states of countries are best adapted for those animals whose food differs but by small shades, and which can in consequence turn readily to one when another fails.

When we come to the carnivorous animals, we must attend to the nature of their food, and the means they have of catching it; and as the more powerful ones prey chiefly upon vegetable feeders, we are sent back again to inquire what condition of the earth's surface is best adapted for furnishing an abundant supply of these. Thus when we attempt to turn the mammalia into an index to the progressive natural geography of the earth, we find that there are some doublings which carry us back very nearly to the point at which we set out, and by this means involve us in difficulties from which we are unable to escape.

The remarks which we have made in this section, and in which we have endeavoured to select the most characteristic animals, and speak of the leading functions of their organs, must suffice for this highly interesting branch of the study of the mammalia, which is, in a great measure the key to the philosophy of the whole.

Sec. VI.—Classification of the Mammalia.—There is no branch of natural history which has received more improvement at the hands of the leading naturalists of modern times, than classification; and though this may seem to be but a humble branch of the subject, it is not so in reality, at least when founded on views sufficiently extensive, and pursued in the spirit of candour and discernment. In theoretical proof of this we need only remark, that the best classifications of animals, to which part soever of the kingdom they belong, have always been projected

by naturalists of the greatest talent, and most general acquaintance, not only with every department of the animal kingdom, but with the relations which subsist between that kingdom and the other parts of the material creation.

There arises an argument from the practical utility, which completely bears out this theory, and also points out, not the advantage merely, but the absolute necessity of every one who would wish to profit by the study of animated nature, grounding himself thoroughly in the principles of classification.

It is true that empirical grounds of classification have been proposed in times comparatively recent; and that by men who have made a great deal of noise, and obtained an ample share of temporary notoriety, if not of permanent fame. While the one of these lasts it requires a good deal of penetration, exercised by one who is not a follower of the multitude, to see the distinction between it and a scientific one; they pass with the million as having equal merit; and as the man who proceeds upon his own fancies always fights for them with more zeal and clamour than any man exercises in the cause of demonstrated truth—feeling that it can maintain its own ground without support—the majority of the multitude invariably, or at least in the majority of cases, follow the impostor during the day of his vapouring, and leave true science to steal on with that unobtrusive meekness and steadiness of march which have ever been its concomitants in all its ways. The cause of the success of imposture, or folly—for it is much the same in effect, whether the party imposes on the crowd at second hand, by first imposing on himself, or whether he imposes on them at first hand, he himself not being under the influence of the imposition is obvious enough. There is a *moral* distinction: but we are not speaking of ethical principles, but of the common philosophical succession of events in the order of cause and effect; and thus far, if the effect produced by one who imposes first on himself and then upon others, and one who only imposes upon others, be exactly the same, the causes, how different soever they may be in a moral point of view, are perfectly equal in the judgment of natural philosophy, or of simple philosophy of any kind, with which moral considerations are in no ways mixed up. But to return to the subject with which we are more immediately concerned.

If there is to be any use in classification, it is nothing more than an enumeration of the relations in which the subjects classed stand to each other, and their agreements and differences. In the classification of any one branch, whether large or small, of the productions of nature, regard must be had to all the rest; for unless the reciprocal influences which they exert upon each other are known, we are ignorant both of the natural use, and of the application which we might be enabled to make of that use.

This is the reason why so extensive a knowledge is required before any one can venture to form an arrangement, and therefore if statutes for regulating the modes of knowledge could be introduced without any of the drawbacks and mischiefs usually connected with statutism, it would be no bad law to compel every projector of an innovation to prove that he were more competent than the founder of the classification upon which he sought to innovate. Such, at all events, would spare the world the trouble of a whole host of small innovators, who are constantly splitting hairs about genera and species, and waging stern war upon some such most important point, as "Whether a black nose and a grey constitute different species, different varieties, or merely point out different stages of growth in the same animal; and also whether a black nose or grey nose has made the nearest approach to those years of discretion, in the bloom of which the disputants believe themselves to be wantoning."

So much time is wasted upon matters analogous to those we have now mentioned, among the junior labourers in the field of natural science, that the subject assumes an importance, in a precautionary point of view, to which its intrinsic merits would never entitle it; nor is it altogether unamusing to observe how these doughty disputes fine away, like the tail of a streak of curl-cloud, till they melt into thin air. They put one strongly in mind of the ultimate argument of the one grammarian to the other, which is recorded to have been adduced at the end of a long and wordy disputation on the grave question as to "Whether the implied nominatives of impersonal verbs are *entities* or *quiddities?*"—"The lord confound thee for thy theory from personal verbs!" said the enraged grammarian; and at this point both language and logic broke down, so that there was a final end at that time, and the question remains as ready for fresh disputation as ever.

As we have said, the classification of natural subjects of any kind ought to be so framed as to involve their uses as much as possible, and this is the reason why a system grounded on the general organisation of animals is so superior to every other. The mammalia, as having their organisation the most complete, afford the best means of obtaining an understanding of the principle; and considering these, the system of Cuvier is superior to every other which has been proposed. The discovery of new species, and a more intimate acquaintance with the structure and habits of those which are but imperfectly known, must of course lead, and has in fact already led, to minor changes—such as the transfer of a few animals from one part of the system to another. In all this, however, there is nothing by which the fundamental principles of Cuvier's arrangement have been, or apparently can be, substantially shaken, at least until much further discovery has been made in the science. The great skill and the unwearied industry which Cuvier brought to the investigation of the structures of animals, and the fact of his taking the extinct as well as the existing, in so far as the evidence enabled him, placed him on a vantage ground which no previous classifier had occupied. Ray perhaps came the nearest to him; and, like Cuvier, he studied long before he ventured to put the knowledge he had acquired into a scientific form. Ray laboured, however, under the disadvantage of having but scanty materials as compared with the other; and therefore, though it is impossible to study his works without great profit, as well as great admiration, the labours of Cuvier are much better calculated for bringing the subject readily, clearly, and speedily before the reader. So that if any one wishes to be a naturalist, especially a student of the mammalia, the "*Règne Animal*" is the indispensable text book. Indeed, it possesses an advantage which few, if any, other text-books possess. Such books, whatever may be their subject, are, generally speaking, artificial memories of

individual facts, and for this reason they are books of reference rather than books of instruction. The "*Règne Animal*," on the other hand, is a systematic arrangement of principles, generalised with the greatest skill, and often carrying the single glance so far that the reader is astonished at the volume of light which he receives in comparison to the small number of words by which that light is produced.

In saying this, we do not mean to assert that the system is perfect, even in the mammalia, which have been more carefully examined, and are therefore more easily classified according to their structures, than any of the other classes. The arrangement has, as we have already said, both breaks and doublings in it; and thus there are intervals to pass over and returns to make which break its continuity; so that even in the arrangement of Cuvier, we cannot view the mammalia as one continued class, proceeding from man, subduing and improving the earth, to the toothless whale careering through the wide ocean, though these two may very properly be considered as the extreme limits within which all the mammalia are contained.

A little reflection will, however, show us that this is exactly what we ought to be prepared to expect. The mammalia differ, and differ greatly, from all the other productions of nature; but they do not stand independent of the rest at any one period, or remain permanent in themselves for perhaps even two consecutive moments, though time is required before the changes which they are undergoing are sufficiently great for coming within the range of our observation.

The discoveries which have been made by geologists, and the investigation of those more powerful causes which operate upon the mass of our globe, and in all probability cause sea and land to alternate with each other after long periods of time, come in to disturb our generalisations, and occasion breaks in the system which we have no means of filling up. When an old land has performed its function, and become like an old tree or an old animal, unfit for the further performance of it, the hand of death passes over it, and it is of course lifeless, plantless, streamless, worn into sand, and literally, in the language of the sacred volume, "sowed with salt." Then of course it is fit for burial, and sinks down into the great laver of the ocean, in order to be regenerated. By the same action which gathers the exhausted land to its tomb in one place, we may naturally suppose that, to preserve the economy of the earth as a globe covered with land and water, new land is raised up in another place, and amid changes more mighty than we can well comprehend, the stability of the planet remains unshaken.

But here we touch the extreme bourn of human philosophy, and are unable to tell either whence the plants and the animals of the new land come, or how they differ from those of the old one. Whether amid those mighty revolutions which shake and wrench the solid globe to its centre, yet without in the least disturbing the stability of that which remains as true to the solar influence, the major axis and the orbital of motion, as when all is tranquil;—whether amid these, "the Spirit" again "moveth on the face of the waters," and they "bring forth abundantly," so that the new land rises up planted and peopled, and ready for setting forth the wisdom and the power of the Creator in the life and enjoyment of its creatures, we cannot—we even dare not conjecture. We have evidence, however, that very large portions of the now-existing land upon our globe have, in the olden time, been very differently planted and peopled from what they are now, and not only so, but that there is a series of changes, in both of which we can tell the succession in the order of time, though we cannot form a guess at the length of time as applicable to any one of them.

The result of all this necessarily is, that our existing mammalia, which we are called upon to classify, form a fragment, or rather perhaps a number of fragments, each of which has belonged to a former state of things; and this result ought to satisfy us that we spend our time in vain if we attempt to make any thing like a perfect system of any one of the kingdoms of nature. After these preliminary remarks, we shall proceed to give an outline of the system of Cuvier.

The successive divisions established by those naturalists who knew but little of the difficulties arising from the fragmental nature of the living mammalia, were orders, genera, and species, which last admitted of varieties; and they made the transition from the class to the order, from the order to the genus, and from the genus to the species, all of the same nature and extent as if they had been uniform throughout the whole class. Cuvier has retained those established names as expressive of his principal divisions; but we must not suppose that one who was so capable of proceeding according to the organisation, as expressive of the habits and use, and who was warped by no theoretical notion before the facts, could have failed to perceive those irregularities to which we have alluded—irregularities which will perhaps one day require a breaking down of class, order, genus, and species into two or more parts, differing less than those do from each other, and thus enabling the system to take one more step toward perfection. Cuvier himself has in effect done this; for though *he*, at least—setting far more value upon the enunciation of truths than the enumeration of names—is never dogmatical in fixing what shall constitute these minor differences, yet he does not hesitate to group those formerly described genera which have too general a similarity of structure for admitting of palpable generic differences, or to separate those between which the structural differences are too great for their standing properly in the same genus.

These are apparently minor points, but it must not be supposed that they are unimportant ones. What is the use of a generic name, and an enumeration of generic characters, if those characters do not apply to every species contained in the genus; at least in all those points over which climatal and other accidental causes have no controul? On the other hand, what is the use of two generic names, and two enumerations of generic characters, if the animals are alike in all those permanent points of their characters over which climate and other external causes have little or no controul?

It is the adaptation of the characters to every animal to which the name applies, and the restriction of it to those animals, as well as the restriction of those animals to it, which constitutes the merit of any name given to a group of animals, whether that group happen to consist of few or of many; and this is best obtained, and indeed can alone be obtained, by not founding the distinctions upon particular organs, but

on the organisation generally, and the habits indicated by that organisation. The reason of this must be apparent to every reader; we want the name as a correct index to every thing named by it, as by this means, and by this means only, we can apply our knowledge of the known animal to the unknown one, and thus acquire the knowledge of it at once by analogy. If this be not the use of systematic arrangement, it does not appear likely that we shall discover any other.

It is probable that from respect to the existing authorities, who had of course been his schoolmasters in the elements, as well as from that dislike of ostentation which is inseparable from genuine talent, Cuvier made fewer changes in the nomenclature than he himself could have wished, or at least saw to be necessary. Upon a careful examination of the characters of the mammalia, as given by himself, it will be seen that some of the orders as he has left them, and even the class itself, admit of subdivision. The fundamental character of the class does not apply, at least in the same manner, to the placental and the marsupial mammalia. Then again, if there is to be any uniformity in the system, the marsupial ones cannot by any means be brought within one order, according to the general and the best foundation upon which orders can be grounded—the systems of their arriving at their food and feeding; because these animals inhabit different sorts of places, live upon different sorts of food, and collect that food in different ways and by means of different instruments. Even among those mammalia which are all regularly placental, there are some orders which would require subdivision, because a character properly expressive of no one of them would apply to another one with equal propriety. These distinctions will be better understood, however, when we come to the enumeration of the orders in which they occur; and we shall now mention their names, and offer a few remarks on them, in that succession in which Cuvier has arranged them.

There are in all nine orders: *Bimana*, or two-handed animals, of which man is the only instance, and we have no reason to believe that there ever was a different genus, or even a different species of this order, which stands alone upon peculiar grounds, which we have already explained at some length; *Quadrumana*, or four-handed animals; *Carnassiers*, or feeders wholly or chiefly upon animal substances; *Marsupialia*, or animals in which the females are furnished with an abdominal pouch, more or less developed according to circumstances; *Rodentia*, or animals which have the mouth formed for gnawing, and of which the greater part live wholly or chiefly upon vegetable matter; *Edentata*, or animals in which the teeth are defective or wanting; *Pachydermata*, or thick-skinned animals; *Ruminantia*, or animals which chew the cud; and *Cetacea*, or the whale race.

Bimana.—So much has been said in former sections respecting the general character, structure, and functions of man, that it would be quite superfluous to make any addition. As we have already observed there is only one species of mankind, though there are various races, differing from each other in the external appearance, and also in the forms of some of the bones, but all capable of breeding with each other, and having offspring which is just as fertile in the cross as in either of the races, and no greater tendency to breed back to the pure blood than to breed with exactly the same cross, or even into a new race. This is perhaps the most decided evidence we can have of sameness of species; and so when we find that it holds universally, any attempt at subdivision would be unphilosophical. We have also said, that there is no evidence whatever of any extinct species of bimana, or of any having existed in those remote times when the general vegetation of the earth was different from what it is now; and this leads us to connect the human race with the existing state of things only.

This is by no means an unimportant fact in the history of the world, or in reconciling the results of geological discovery with the history of the human race as it is recorded in the Bible anterior to the commencement of other histories, which, however, when they apply to the same subjects, always strengthen the evidence of its truth. In the sacred volume it is stated, that the earth was prepared for the reception of man, by being covered with vegetables and stocked with animals before he was created, and that the creation consisted of a single pair only. This perfectly agrees with the physiological fact of any perfect pair of the human race being still capable of, in time, peopling a country.

There is, in the shadowy and brief account of creation in the book of Genesis, something which agrees better with the supposition that new lands are successively elevated from the sea as old ones are worn out, than we should have been prepared to expect, or than would have been believed before the monumental treasures of the earth were so well explored, or the strength of those powers which are contained in the earth were so fully investigated and tried. The earth (meaning thereby the dry land, in contradistinction to the water) "without form and void, and darkness covering the face of the waters," is exactly the state of things that would be produced, if the terrible exertion of the internal forces were upheaving a continent from the depths of the Atlantic or the Pacific. The action of a single volcano, and that not to any very great extent, has been known to render the atmosphere and the earth under it well nigh as black as midnight for a considerable period of time. The space of action in these cases is generally small as compared with a single mountain, and a mere nothing when contrasted with a continent; and if we suppose that the laws of nature are not broken even in the most violent natural action, which is the only supposition that reason can make, we must be prepared to admit that the darkness arising from the ascent of a continent might be deep and durable beyond any example that we can have in the action of ordinary volcanoes. In those actions of submarine volcanos which raise islands above the surface of the water we have displays which are sublime beyond those of the land volcanoes, because of the great additional action produced by the decomposition of water and the combustion of its hydrogen. The quantity of aqueous vapour produced upon such an occasion as that to which we are alluding, would fill a vast extent of the air with vapour of water. This vapour of water would, upon the well-known fact that when salt water is evaporated the salt does not rise along with the vapour, furnish an abundant supply of fresh water for filling all the hollows of the new made land, as soon as that land was so cool that the vapour could descend in rain; and thus we have an ample provision for lakes and rivers, in the very fact of the new land

being raised from the bottom of the sea by the action of internal heat in the earth.

We are not speaking of what actually did happen, because such a scene as we are alluding to could have no material eye, and no organised being present at it, unless that organised being were so deeply buried as that the pressure over it were capable of restraining the tendency of its volatile parts to escape. Still it is important to see that there is no violation of observed fact, philosophic theory, or rational probability, in what we have now been stating. On the contrary, the facts are strongly in favour of it. There has not been explored, upon the whole surface of the globe, a single district of rugged surface in which there has obviously been in the early time a wrestling of some giant power with the rocks, in which there are not numerous instances, almost innumerable ones, of lakes which have been emptied of their contents by the wearing away of their inclosing dams during the lapse of time; and the progress which the fall of Niagara has made, and is still making, in cutting the rocky barrier, points to a time within reasonable probability when the great lakes of America shall be poured forth through the valley of the St. Lawrence, and the character of the country totally changed. The disintegrated beds of substance which have once been rock point to changes produced upon a surface which came ragged and uneven from the bottom of the deep; and as such a surface could not but remain plantless for some length of time, in which way soever we are to suppose vegetation to have been established in it, the great influence of the sun in heating and cooling the naked rock would vastly increase the quantity of evaporation from the pools and lakes in the hollows; and thus the rains would beat, cascades would dash, and streams would roll upon such a surface, in a style of violence of which we of course can have no idea, though we do know that when lakes alternate with dry rocks the quantity of rain is increased to an astonishing amount. No small portion of the western coast of the Scotch highlands, and many of the isles, are of this description; and so habitually does it rain, that visiters from the low country are in the habit of saying that it sometimes rains "*eight* days in the week"—the eighth day consisting, of course, of the weariness produced by the continual pelting or dripping of the seven.

We shall not pursue this investigation any further, because, though it bears very closely upon a most important point in the natural history of the human race, it is in great part conjectural, and does not in any part belong to the *present* natural history of any race of organic beings, animal or vegetable. The probability is, however, that there has been no violent general change of the earth since it was the abode of man; and though we know not the period which might be required to prepare it for the reception of the single pair, physiology supplies us with no reason for concluding that any more than a single pair of human beings was necessary for peopling it. More indeed would have been superfluous, and superfluity is no attribute of nature's working, whether on the great scale or on the small.

The difference of races is another matter, but it is one of minor importance; and one of which we find explanations, or at all events illustrations upon a small scale, every where around us. Human beings of the same country, of the same district, and even of the same family, are more diversified than any other animals. There are also, notwithstanding this individual diversity, likenesses which run through families, through clans, through districts, and through all associations of human beings which are much together, following the same occupations, and having similar opinions and habits.

Such being the case where we cannot fix upon any external cause for the difference, and in instances where the likeness extends only to two generations, we may be prepared to look for much greater differences when the differences of climate, habits, food, occupation, and many other things are very strikingly marked. Perhaps the best short account which we have of the original races of mankind (for they are not species, or even varieties, in the ordinary sense of these terms as applied to the rest of the mammalia) is that by Baron Cuvier, and therefore we shall give it with as much condensation as the language of so concentrating a writer admits of.

"Though," says Cuvier, "the whole human species are one, so that all the individuals can mingle together and produce fertile progeny; yet we can observe among them certain hereditary conformations, which constitute what are known by the name of races. Three of these are eminently distinguished above the others: the white, or Caucasian; the yellow, or Mongolian; and the black, or Ethiopian.

"The Caucasians, to whom we belong, are distinguished by the elegant oval form of the head; and they have given birth to the most civilised nations, or to those who have most frequently ruled the others. They vary much in the complexion and the colour of the hair.

"The Mongols are known by prominent cheek bones, narrow and oblique eyes, a scanty beard, straight black hair, and an olive complexion. They have formed the great empires of China and Japan, and often extended their conquests to the south side of the great desert; but in point of civilisation they have remained nearly stationary.

"The Ethiopian, or negro race, are confined to the southward of Mount Atlas. Their complexion is black, their hair crisp or woolly, their cranium compressed, their nose flattened, their jaw bones projecting, and their lips large and thick. They have remained in a state of comparative barbarism.

"The Caucasian race are so named because tradition generally refers their origin to the mountains of Caucasus, between the Black Sea and the Caspian; and the Circassians and Georgians are still accounted the most handsome people in the world. The different branches are known by the analogy of their language. The Armenian branch proceeded southwards, and gave origin to the Assyrians and the wild Arabs, which, after Mahomet, remained for a time nearly masters of the world. The Phœnicians, the Jews, the Abyssinians, and the ancient Egyptians, belong to the same source. This branch has been always prone to mysticism, and has given origin to some of the most widely extended and permanent religions. They have often promoted science and literature, but the former always tinged with mysticism, and the latter clothed in highly figurative language.

"The Indian, German, and Pelasgic branch has extended much further than the others, and separated at an earlier period. Still there are numerous analogies traceable between its four principal dialects—the Sanscrit of India; Pelasgic, the parent of the Greek, the Latin, and all the ancient tongues of the south of

Europe; the Teutonic or Gothic, the parent of the German, the Dutch, the English, the Danish, the Swedish, and other tongues of the north-west; and the Sclavonian, from which the Polish, Russian, and other tongues of the north-east of Europe, are descended. This branch have been generally admitted to stand foremost among the human race, having excelled all others in the arts and sciences, of which they may be said to have been the depositories and guardians for thirty generations. Previous to their arrival in Europe, it was occupied by the Celts toward the north, and the Cantabrians from Africa in the south; but these branches are now reduced within very narrow limits. The ancient Persians, as well as the Indians, belong to this branch.

"The Scythian, or Tartar branch, went at first toward the north-east, and lived a wandering life in the vast plains of Siberia. From these they often sallied forth, carrying conquest and desolation over great part of Asia. The Huns and Finlanders are hordes of these people, which have strayed in between the Goths and the Sclavonians; but on their eastern confines they are blended with Mongols, who inhabit next to them in the north of Asia.

Of the Mongol race the Kalmucks are still nomadic in the deserts. They have at times been powerful in their own country, and their warriors have carried conquest and terror into other countries. In the Japanese and Chinese, and also in some nations in the centre of Asia, these people have often displayed great civilisation and industry, and very delicate execution, though with much peculiarity of taste, in the arts."

It is not easy to determine when the inhabitants of the south-east of Asia, and of the shores of the greater islands, and also of many of the small and remote ones in the Pacific, had their origin; and the origin of the negroes of the centre of those islands, and of the extensive islands of Australia, who have perhaps made less progress in civilisation than any others of the human race, is equally obscure. The Malays, or first of these races, who are very adventurous on the sea, probably found their way from the south-east of Asia. The origin of the Americans is not well understood. In some points of their aspect they bear no inconsiderable resemblance to the Malays, but in others they differ.

Around the extreme north both of the eastern and western continents, there are diminutive races, which content themselves with the most humble fare, and live in a state of what would appear to us great misery and privation; their origin has never been clearly ascertained; and indeed much of what has been said, or can be said, upon the subject of these races, is either purely fanciful or merely tradition. The analogy of language has often been drawn upon as affording a clue to the affinities of the various branches of those races; but such an analogy is a very treacherous guide in matters of this kind. It is to be borne in mind that only a small portion of the language of any age or nation can be transmitted from generation to generation, unless by means of a written literature pretty copiously distributed among the people. We have evidence of this in the difficulty with which the older writings in the English language can now be read; and if we are to suppose a language to have no stationary means of permanence, its changes in the lapse of time would of course be much greater. In every light in which we can view the matter, indeed, the progressive history of the human race is attended with insurmountable difficulties; and almost the only general conclusion, beyond actually written history, at which we can arrive, is, that the race is substantially and originally one, notwithstanding the various aspects of the tribes and nations of which it is now composed.

Quadrumana. These form the second order in Cuvier's arrangement; and, as has been already explained at some length, when treating of organs of climbing, the character of the order is that of having all the four extremities prehensile, or capable of laying hold. The prevailing character of the whole race is the facility with which they can grasp, and the next is the power with which they can grasp in proportion to the size of the grasping instrument. We have said so much respecting them in the course of the article already, that it is unnecessary to repeat any of the details. Cuvier divides them into three groups, or sub-orders; and some of these contain a greater and some a less number of genera. The apes of the old continent form one branch of the first sub-order, and the apes of the new continent another, though in common language the small ones are all known under the common name of monkeys. The remaining groups are the ouistitis and lemurs, of all of which, as well as of the apes, monkeys, and baboons, details will be found in the general articles headed by their names, or in the particular articles referred to in them. The whole of this order are forest animals, inhabiting only the warm parts of the world; and they cannot be regarded as being in any way useful to man, or advantageous in any place which he cultivates. It is not fully ascertained whether they belong exclusively to the present state of things to which, as we have said, man appears altogether to belong; though it is highly probable that such is the case, as they do not belong to a kind of vegetation corresponding to that which must have existed when the pachydermatous animals, which are now extinct, were inhabiting the earth. No remains of any of them have hitherto, in so far as we are aware, been found in the fossil state, though it is not improbable that some may occur in the collections of rubbish which have been brought together by the rain floods of those countries in which they are at present so numerous. Altogether, they are a most useless and even offensive order, though their great powers of motion among the branches, and their ludicrous though rather slight and fancied resemblance to human beings, make them objects of interest to those who look upon natural history as a matter of curiosity rather than of use.

Carnassier. This is the third order, and it is a far more interesting one and far more extended over the world than the second order. The word "carnassier," though it has very nearly the same meaning as the word *carnivora*, has not been introduced by Cuvier without some advantage, because it accords better with the common use of language. We associate the name of a carnivorous animal, or "a beast of prey," with the notion of an animal which, by chase or by stratagem, seizes other warm-blooded animals in the living state, kills them by instruments fitted for the purpose, and eats their flesh; whereas there are numerous animals, properly included in Cuvier's great order, which do not kill warm-blooded animals; and there are a few which live in great part upon vegetable matter.

The general characters which run through the whole order are, the toes of the foot well developed; but without a thumb opposible to the toes; and they have all three sorts of teeth—incisors, canines, and cheek teeth; the second in general so produced that they act not sufficiently in wounding and killing, and the third variously formed according to the nature of the prevailing food of the animal. They all live, in part at least, upon animal substances; and those which do this the most exclusively have their cheek teeth with the most trenchant or hatchet-like edges, so that they can readily cut asunder the flesh of animals, when it is in the recent state, and cannot readily be divided by a simple bruise. Those which have some of the cheek teeth at least with turbercles on the crowns, live more or less upon vegetable matter, though upon matter of a more succulent and nourishing description than that which forms the food of the genuine and habitual vegetable feeders. Those again which have the cheek teeth beset with little sharp points on the crowns, feed more exclusively upon insects, and other small invertebrated animals; though there are some even of these last which are especially ravenous in the true carnivorous way, until they become canibals, after a violent struggle for the mastery. Even those which occasionally feed on vegetables have no lateral or grinding motion of the jaws, so that they have no means of reducing fibrous vegetable matter to anything like a pulp, so as to prepare it for the single and simple stomach with which they are furnished. The quadrumana, as well as man, have a motion of this kind, so that they can grind the food by rolling it between the cheek teeth; whereas the carnassiers can simply close their jaws upon it, without any means of dividing it. This reduction of the action of the jaws to one plane, concentrates it more than in those animals which grind their food; and thus their direct bite is more keen and steady in proportion to the degree of muscular energy exercised in producing it.

The brain in these animals is better developed than in any of the orders which follow them; but still the cerebrum is without the third lobe, and it does not form a duplicature over the cerebellum, as is the case in man and in the quadrumana. There is also no septum of bone between the temporal fossa and the orbit of the eye. Their skull is also much more compressed in proportion to its length than that of the quadrumana, even such of them as have the muzzle produced by a lengthening of the bones of the face; but though these forms of organisation are different from those of the quadrumana, we must not thence conclude that the animals themselves possess less animal sagacity, or have fewer resources. The want of the third lobe in the brain appears to have really more connexion with the absence of the power of grasping, than with that of animal sagacity; for some of the carnassiers are exceedingly cunning in a state of nature, and others are capable of more education than almost any other animal, and can be made to perform work, and valuable work, which could not be performed by any ape, and not even by man himself. A dog will find his master when no human inquirer can; and a blood hound will track that upon the slot of which he is sent, with a certainty and a perseverance which is perfectly inexplicable upon the principle that regulates the animal functions of man, and even by mind itself.

The other differences between the carnassiers and the quadrumana, are not to be regarded as fallings off of development in the latter, any more than the difference in the brain to which we have now adverted. The absence of septa, or partitions of bones between the temporal fossæ and the sockets of the eyes, gives the animals an increase of power, instead of a deficiency. By this means, they are enabled to have the eyes placed more laterally, so as to command a more extensive horizon without turning the head, and the absence of the partition and the elevation of the arch gives more room for the origin of those powerful muscles which move the jaws. Generally speaking they have clavicles more or less perfect; and they have a rolling motion in the elbow joint, so that the extremity of the fore foot commands an extent of motion in the cross direction, as well as in the backward and forward one. They are also less loaded with the organs of digestion than even the quadrumana; for the food being in most instances of a much more nourishing nature, they require less of it, and do not retain the parts unfit for assimilation so long within the cavities of the body. Simple as this last peculiarity may seem, it is attended with considerable advantages to the animals. They have to seize their food with more exertion than the other mammalia, as they have generally speaking to catch and kill before they can eat. They, therefore, require that a larger portion of their weight should be applied to external action, and a less portion to digestion; and it is a beautiful provision of nature, that the food of these, and indeed of all animals, should be nourishing in proportion to the quantity of muscular exertion which the animal must exercise in order to arrive at it. The nourishment, and the capacity of undergoing the exertion, also harmonise with each other. In proportion as the muscular system of an animal is exerted, a supply of arterial blood is required. This supply cannot be obtained in a wholesome state unless there is some chyle to mix with the returning blood ere it is sent through the heart to the lungs in order to undergo the purifying influence of atmospheric air. This is the reason why people in an extreme of hunger wax faint and are incapable of muscular exertion; and it is also the reason why the derangement of the digestive organs should have so enfeebling an effect on the muscular energy of the body, or upon the spirits, as we say in common language. The discovery that these very simple and very general principles run through the whole system of nature, is one of the greatest encouragements that we have in the study of natural history; because it shows us that no one subject which we can study has its instruction confined entirely to itself; but that on the other hand every portion of knowledge which we can acquire, at once becomes the instrument of additional knowledge which we can use with equal readiness and success.

The carnassiers, to the extent to which Cuvier carries the order, and notwithstanding the differences which prevail among the genera and species, the order is a very compact and complete one, and renders a subdivision into suborders or families necessary; and some of these suborders are so numerous that they admit of a farther division into groups before we come to the genera. Cuvier's first sub-divisions are the *Cheiroptera*, or bat family; *Insectivora*, or those which live chiefly on insects; *Carnivora*, or those

which prey most extensively and exclusively on warm blooded animals.

CHEIROPTERA.—This family consists of two genera, the great genus of the bats, and the *Galeopithecus*, which is not a flying animal as the bats are, though it resembles them in some parts both of its organisation and its habits, and is furnished with a leaping membrane or parachute of ample dimensions. The details of the structure and action of the bats have been already given in the section upon the flying organs of the mammalia; and some notice of the species, and some popular accounts of the habits, will be found in the article BAT, and the article GALEOPITHECUS.

The second family, or the insectivorous ones, are almost, if not altogether, nocturnal animals which live in and often under the ground; and most of those which inhabit cold countries, hybernate or pass the winter in a lethargic state. They feed chiefly upon insects and other small ground animals, and thus their teeth in the posterior part of the jaws are of the insectivorous character. The nature of their food renders it necessary that they should hybernate during the inclement season; because at that time the insects of such countries are gone, and the other ground animals have plunged to a considerable depth below the surface. Those which dig habitually in the ground are furnished with a keel upon the sternum in the same manner as the bats: they are also all provided with clavicles, so that the cross motions of their fore legs are powerful in proportion to their size; the hind ones, on the other hand, are often feeble, and what with the feebleness of these, and the cross motion of the anterior ones, they are very helpless upon the ground, and may be said to crawl rather than to walk. The whole of them are plantigrade, or apply the entire sole of the foot to the ground in walking; and the greater number of them scarcely raise the under part of the body clear of it. They admit of subdivision into two sections, which depend chiefly upon the form of the teeth. The one section have a slight approximation to the rodentia, only they have still the three kinds of teeth which belong to the whole of the carnassiers. Their two front incisives are their largest teeth; but these are conical and pointed, instead of being chissels, like the front teeth of the true rodentia. The other section have long canines, and very short incisive teeth; but after all, except in the most powerful teeth being at the very front of the mouth in the one section, and a little farther back in the other, there is very little difference of character between them. The hedgehogs, the shrews, the musk rats, the golden mole of Southern Africa, and a few others, belong to this section. The moles, properly so called, the star-nosed mole, and the water shrew of Canada, belong to the section with short incisives and long canines. The whole are very obscure animals in their habits; and though they lead very laborious lives they are well adapted for their labour. It is probable that of these, and of all the other small ground mammalia, which live in obscurity, and seek their prey either during the night, or altogether under ground, there are many species besides those which are at present known to naturalists.

CARNIVORA.—These animals form the third and most characteristic family of the order, though there is considerable diversity in their forms and their modes of life. There is a progress traceable to them all the way from the quadrumana, though the habits of the animal are so very different. The quadrumana, and also the cheiroptera, have perfect clavicles, and the teats of the females are situated on the breast. The insectivora have also perfect clavicles; but as pectoral teats would be inconsistent with their action upon the ground the females have these organs situated on the belly. In the family of the carnivora there are rudimental clavicles; but none of them have perfect ones, and they also have the teats on the belly; and their hind feet bear in general a greater resemblance to their fore ones, both in form and in strength. Among the carnivora, the mouth, which is the instrument that principally determines the kind of food, is uniform in the number, general structure, and distribution of the teeth, though in the form of the cheek teeth there are differences. The whole family are furnished with four large and strong canine teeth, which stand high above the others; and between these there are six front teeth in each jaw, the second one below having its root or fang deeper in the jaw than the others. The cheek teeth never have those sharp points which characterise insectivorous teeth; but some have them furnished with flat bruising tubercles, as well as sharp cutting edges.

It is of some consequence to attend to the distinctions of those cheek teeth, because the variations in their form indicate very correctly the differences of dispositions in the animals. Those next the canines are not the largest, but they are furnished with the sharpest cutting edges. It must be understood, however, that their edges are not chissels for simply dividing, but angularly pointed for tearing, or rather, in this part of the mouth for cutting asunder the flesh on which the animals feed. These are called "false molars," that is, false grinders; but the name is not very descriptive of them, or indeed of any teeth in the mouth of any of the carnassiers; for, as the jaws of their mouths have no lateral play, the one upon the other, there can of course be no grinding action in any part of the mouth. Grinding is an operation required for reducing vegetable matter to a pulp; but animal matter is pulpy enough without any such reduction, and all that it wants is catching and tearing.

Immediately behind these false molars there is, on both sides of each jaw, a tooth, much larger than either of them, and furnished with a tuberculous heel on the inside, more or less perfect in the different species. This tooth is usually called the great carnivorous tooth; and as it has the same kind of trenchant edge on the outside as the false molars, and the heel on the inside, it cuts and bruises at one and the same time. There is a very beautiful adaptation in the form of this tooth. It is the first which begins to prepare the food for the stomach; and as the bruising part is on the inside, it bruises the part cut off, and leaves that which is not cut, with the blood and other juices entire, so that there is no loss or waste in the food of the animal. The remaining teeth behind the great carnivorous ones, are the molars properly so called; but even these are trenchant in proportion as the owner subsists upon living prey. If any of them have the crowns more abundant in tubercles, they are placed farthest backward in the jaw, and they can crush vegetable matter. The dog, for instance, as a less decidedly carnivorous animal, has more of those tuberculous teeth than the cat; and the consequence

is, that the dog can much more easily reduce vegetable matter to a state fit for the stomach, though, if that matter is very hard, even the dog has more trouble in managing it. One of the hardest kinds of ordinary vegetable food with which we are acquainted (if we except the black *raggy* bread of the poor Hindoos, which has to be steeped for some time in water before they can eat it,) is a coarse ship biscuit. If a piece of this is given to a hungry dog (and a hungry dog will snap at any thing), it is not uninstructive to observe the mode in which he goes to work with it, so as to obtain, by his superior means of resource, a compensation for the want of lateral or grinding motion in the jaws. If he gets the whole buiscuit, he can readily break it by the snap of the canines, and also reduce it to smaller pieces, by means of the great carnivorous teeth ; but when it gets farther backward in the jaws his labour is more difficult ; and as he opens his mouth for every attack upon it, he twists the plane of the mouth a little either to the one side or the other, so that the action of the teeth may come upon a new portion. In doing this, he usually keeps the fore part of the jaws higher than the back part, in order that the biscuit may not slide into that part of his mouth which could not act in grinding it, and which, from being farther from the centre of motion, is less powerful in crushing, though more so in biting with a snap, in consequence of the greater velocity which the larger lever gives to it.

If a piece of the same kind of food is given to a hungry cat (and hungry cats will also attempt to eat many substances), the chewing part of the process is far more difficult ; and even a common crust of bread is eaten with much apparent labour and not a little grimace.

The different lengths of the jaws, and consequently of the head from the eyes forward in the different genera of carnivorous animals, are well worthy of notice. If the jaws are short, the dead bite, as we may call it, or that which keeps its hold and tears, is, of course, most powerful, because of the shortness of the lever ; but when the jaws are long, the snapping bite is by far the most effective, in consequence of the greater velocity afforded by the long lever. In proportion, therefore, as the jaws are shortened, we get dead strength for continued action ; and in proportion as they are lengthened, we get quick motion for momentary action. The first of these have more the character of a feeding mouth, and the last blends with this the character of a killing one. Upon the principle to which we have so often alluded, of a divided function in any organ being weaker in each of the parts, than a single function in an organ of equal power upon the whole, it follows that the mouth of the short-jawed carnivora is more completely adapted for eating flesh than that of the long-jawed ones ; but that, notwithstanding the large canines with which the more powerful ones are furnished, it is not so well adapted for killing prey—that is to say, it cannot kill prey so quickly. We find in the different genera, that the character of the teeth always agrees with this character of the jaws. If the jaws are short, the tuberculous teeth are fewer in number, and their tubercles less developed ; and where the jaws are long, the number of these teeth is greater, and the tubercles more perfect. Even in those varieties of the same species, which must be supposed to have arisen from accidental causes—that is, from causes external of the animals themselves—there is an approximation to the same character. The long-nosed dogs, snap and very generally seize upon a part where the single bite is effective ; as, for instance, a greyhound dislocates the spine of a hare, and a fox cuts the blood-vessel of a sheep's neck ; while a bull-dog lays hold wherever he can, and tears away. The smaller carnivora which are long-nosed, and at the same time very sanguinary—such, for instance, as the marten or weasel tribe—generally, if not invariably, seize upon the blood-vessels, or the vertebræ of the neck of their prey, according as the one or the other is more vulnerable ; and like expert butchers, they kill and in general suck the blood before they divide the carcases of their victims. Whether professional butchers of the human race at first took their lessons from these animals it is not worth our while to inquire ; but it is not a little curious that both should proceed in nearly the same fashion. It is also worthy of attention, that poultry killed by weasels keep longer fresh than those that are killed by animals which have a short bite.

The gradation in blood-thirstiness which we can trace among these animals, as according with their organic structure, is worthy of notice, as showing to what exquisitely nice shades animals are formed for their work. The dog and cat tribes are the most familiar, and also the best illustrations of this. The cats are decidedly the more carnivorous of the two ; and therefore they have the mouth more exclusively a feeding apparatus. To compensate for that part of the mouth in which they fall short of the dog, the clutching claws are given them ; and the two jointly are more than a match for the dog's mouth in animal murder. But the dog also has his compensation for this deficiency in the mere work of death : the whole energy of his feet is reserved for locomotion ; and thus he can chase his prey ; and taking him altogether, he is certainly not inferior in proportion to his strength ; and indeed, when we take his superior sagacity into consideration, we are constrained to admit that he is the nobler animal of the two—meaning thereby that the effect which he can produce is greater in proportion to the quantity of matter contained in his body.

We have gone somewhat at large into those general characters of the carnivora for a very obvious reason—namely, the place which they hold in wild nature. When we view nature in this way, we must put man, whether savage or civilised, and his accommodations, altogether out of the question. This is the proper way of viewing the subject ; for man is really, as we may say, supplemental to the animal kingdom, in character as well as in the epoch of his creation. The possession of the intellectual spirit takes him completely out of the class with the rest ; if we neglect to do this, our view of the irrational mammalia cannot fail in being a very distorted one. In this view the carnivora have the highest function to perform,—they are the regulators of the other mammalia, which again are the regulators of the invertebrated tribes, and jointly with these of the vegetable kingdom. The common application of "King of the beasts," which has often been given to the lion, is not, therefore, a mere fancy, and an unfounded fancy, as some have pretended to assert, who, whether they were aware of it or not, obviously, but more erroneously, have taken man for their type of animal perfection. If we suppose man banished from the world, and the present race of animals left, the lion would be "every inch a king." It must not be sup-

posed that because the lion rarely, if ever, attacks the full-grown elephant, and still more rarely the rhinoceros or hippopotamus, that this is any invasion of his kingship. Those gigantic animals seem, as we have said, to be the remains of a former race,—the Titans, the Anakims, the giants, of the animal world in the olden time; and from all that now remains, as well as from all that the record of the earth tells us, this appears to have been the golden age of the herbivorous mammalia; for coeval with what seemed to be the first extinct of the new fossil races, there does not appear to have been a single beast of prey.

The family of the carnivora is very conveniently divided into three tribes, two of the terrestrial, and one inhabiting the waters. Cuvier has named them, *Plantigrada*, or walkers on the entire sole of the foot; *Digitigrada*, or walkers on the toes only; and *Amphibia*, or dwellers both in the water and on the land, though the former is the locality in which they find the chief part of their subsistence.

Plantigrada. We have already mentioned that the distinguishing character of this tribe is marching on the flat feet, or applying the entire length of the tarsus to the ground. By this means they have a joint less in action while they walk, than those which walk on the toes. This makes them appear shorter in the legs than they really are, and also slower walkers; so that there are very few of them that can follow prey which walks on the point of the foot, or seize it in the chase. They have, however, some counterbalancing advantages: the flat foot enables them to walk more steadily, and also upon surfaces which would not bear an animal that walks on the toes. They can also stand up on their hind feet, and use their fore ones in seizing their prey; and in some of them, as in the bears for instance, there is so much motion in the wrist joint, that the fore paw acts something in the manner of a clumsy hand, though there is no opposed thumb, and the joints of the toes do not bend so far as to enable them to take hold of a slender object by acting against the heel of the tarsus. Such as have the paw formed in this manner are not inexpert climbers, and they can climb indiscriminately upon trees and the asperities of rocks. The greater number, though not the whole, are nocturnal animals; and in cold countries they pass the winter in a dormant state. The whole of the race have five toes on each of the feet; they are, generally speaking, ground animals, living in darkness and obscurity, and resembling the insectivora in many of their habits, and partially in their form; but they are more powerful animals, and sanguinary in their habits.

Bears, racoons, coatis, badgers, gluttons, and a few other genera, belong to this tribe. In general they have a thick covering of fur to protect them from the cool air of the night, or from the keen atmosphere of those regions which the most powerful of them inhabit. They may be said to be polar animals, or rather to have the locality most favourable for their development in cold regions, though there are a few in warm countries. Their teeth vary in the different species; some, as the bears, have the cheek teeth all tuberculous, and the carnivorous teeth small; while others have the carnivorous teeth and the false molars much better developed. The bears, which have the mouth of the former of these structures, may be considered as the least carnivorous of the tribe; and the gluttons, which have it of the latter, as the most carnivorous. The whole tribe are animals of unpleasant appearance; and their flesh is, generally speaking, rank and unwholesome; but the covering, of the polar ones especially, is valuable on account of the strength of the skin, and the length and closeness of the fur.

Digitigrada. These are the proper beasts of prey of the land; and the greater number of them capture their prey in a more bold and daring manner. In a state of nature, few or none of them subsist upon any thing but animal food. They do not, however, invariably kill what they eat, for not a few of them feed readily on carrion although it is in a putrid state, whilst some dig in the earth for animal substances which are buried there. Such as feed on carrion have a keener sense of smell than such as do not.

This tribe therefore perform a double operation in nature—that of regulating the numbers of the more peaceable mammalia, and that of clearing the earth of offensive substances; just as the plantigrade carnivora perform a double function in eating animal and vegetable substances. Some have only one tuberculous tooth behind the carnivorous one, and others have two; and there are others again in which the carnivorous tooth in the upper jaw is very small, and that in the under jaw entirely wanting. The last are the most carnivorous of the whole, but the first are scarcely less so; and though they are not furnished with retractile or clutching claws, they can give chase to their prey, by a peculiar sort of leaping march, in the performance of which they are greatly assisted by the length and elasticity of the spine.

The species, and also the individuals of many of them, are very numerous; and in one or other of their genera, they are distributed through all parts of the world; but the greater number of them, though not the whole, disappear before the progress of cultivation, faster than they are actually hunted down by man.

Strictly speaking they consist of several sections, each of which admits of sub-division into genera. The chief of these sections are martens, which are exceedingly numerous in some countries, dogs, civets, hyænas, and cats. In their present geographical distribution, they inhabit from the polar to the equatorial regions, nearly in the order in which we have mentioned the sections, though there are some of each section found in almost every latitude. The martens are most numerous in the cold countries of the north; and though the skins of other animals are valued as furs, the martens are the fur animals properly so called. The native locality of the dog is not known; for it should seem that man has taken possession of the whole race. The fox, which is a sub-genus of the dog, is, however, found from the extreme north to the warm latitudes. The civets and the allied genera are inhabitants of warm countries. This is also the case with the hyænas, but the cats are distributed into all latitudes. The particulars of the different sections or genera of these animals are detailed so fully under their respective names in the alphabetical order, that it is unnecessary to add any more respecting them in this general sketch.

Amphibia. It is necessary to bear in mind that the amphibia of Cuvier's system are different from those of the earlier naturalists, and also that the common notion of an amphibious animal, that of its living with equal ease on land or in the water, does not, in the sense in which it is very apt to be taken, apply to any mammalia, or indeed to any animal whatsoever, in any

one stage of its being; and as the mammalia pass through only one stage, they cannot be aquatic at one time and terrestrial at another. By *living* on land or in the water, must be understood as being capable of breathing the free air, or air through the medium of water; for as no animal can exist without breathing, no animal can be said to live where it cannot breathe.

The amphibia, though they have their teeth formed according to the general type of the carnivora, can hardly be called carnivorous animals. They are rather piscivorous, for they feed upon fish, not upon the flesh of warm-blooded animals; and though the muscles of all animals are considered as flesh in a natural history point of view, yet, in ordinary language, a very wide distinction is made between flesh and fish.

Still, besides having the same general form of teeth, those amphibia have the general structure of body, and many of them all the sagacity of the land carnivora; though the element in which they find their food requires that their organs of motion, and also the general forms of their bodies, should be different. When an animal, starting from the solid ground in its progressive motion, has to make way only against the resistance of the air, the shape of its body does not require much adaptation to the overcoming of that resistance; and as the resistance is small, much adaptation to it would be thrown away. If indeed the animal is to get through the air with great rapidity, then there is a slight adaptation; but estimating from about the average of animal motion, there may be said to be none. It is very different in the case of water; and, therefore, when mammalia are sent to seek their food in the waters, the general shapes of their bodies must be adapted to that element. This is effected by an approximation to the typical form of a fish. The feet are short, much enveloped in the skin, webbed between the toes; and the posterior ones are united with the tail. Their bodies are long in proportion to the diameter; and the spine is capable of very varied and powerful motion; so that besides their fore paws, and their compound posterior extremity, the amphibia may be said to swim with the whole body.

They do not resort to the sea, or other water, merely for the purpose of catching their prey, and come on shore to eat it, as is done by the otters, which, though web-footed, are digitigrade. They eat it in the sea; but they frequent the shores, and are partial to basking in the sun. They are indeed coast animals, and seldom found at any very great distance from land. They belong chiefly to the temperate and the cold regions, in the latter of which they are exceedingly numerous. They consist of only two genera: seals, which are by far the most numerous, both in species and in individuals; and morses, which are remarkable for the vast enlargement of the canine teeth in the upper jaw. They also want both the canines and the incisive teeth in the under jaw. It does not appear in what particular way the morse uses its immense canines, which are directed downwards from a very thick and square muzzle; but it has been supposed that it uses them partly in climbing the rocks of those wild shores which it inhabits, and partly in gathering sea-weed.

In many of the popular books, and also in the older systematic ones, this tribe of the carnivora has been confounded with some of the cetacea. The difference, however, is complete and obvious both in the external appearance of the animals and in their skeletons; and those cetacea which have been confounded with the amphibia or vegetable feeders, are chiefly inhabitants of rivers.

It was the old hypothesis that, in these amphibia, the *foramen ovale*, or internal opening from the one cavity of the heart to the other, remained open through life; and from this it was concluded, that if, in man, or in any other land animal, this passage could be kept open, they could remain as long under water as a seal or a morse. The foundation is, however, physiologically incorrect, and consequently the structure cannot stand. The passage of the blood through the heart, without going to the lungs, would not only be of no use, but it would be fatal to any of the mammalia. After the blood has once circulated through the system and is returned to the heart, it is quite unfit for stimulating the systematic ventricle of that organ, or of supplying the waste of life, until it has undergone the action of the air and respiration. Those animals, therefore, do not, any more than the land mammalia, carry on their circulation through the heart while they are under water, they can merely remain a considerable time below; and in this respect the otters make an approximation to them, and they have also valves for closing the nostrils, though less perfect than the valves of the amphibia.

We shall here venture to make a slight departure from Cuvier's arrangement, and instead of considering the marsupial animals as the fourth order in the arrangement, we shall place them as the last. This seems their proper station, if we are to make the arrangement as useful as possible by making it structural, because these animals have a distinguishing character, in an additional membrane and its supporting bones, which does not belong to any of the rest. Farther than this, the marsupial animals do not form one order according to any of the characters upon which the other orders are established; and therefore it really would appear that these curious animals ought to be made a supplement, or sub-class, to follow the true mammalia. We merely mention this, however, without recommending it to be adopted, for we are not making a system, but performing the humbler duty of attempting to explain one.

Rodentia. The animals of this order are, generally speaking, of small size, but they are exceedingly numerous, found in one species or other in every part of the world except New Holland, and sometimes in numbers so great as at certain seasons to destroy the whole vegetation. Some of the class are the most gentle of the mammalia, and some are so ferocious that, if their size and strength were in proportion, they would be exceedingly formidable. Some of the most curious in their habits also belong to this class, of which we may mention the beaver that builds houses, and there are also many which treasure up stores of provisions. Generally speaking they are more fertile than any other of the mammalia, as the period of their gestation is shorter, and their litters more numerous.

But though the animals differ greatly from each other in size, in external appearance, and in habits, the order is still a very natural one, and true to the character upon which it is founded, which character is well expressed in the name.

Rodentia, formed from the verb *rodo*, to gnaw, means gnawing animals; and this is the action of the anterior part of the mouth in the whale. The typical number

is two large and strong incisive teeth in the front of each jaw, those in the lower jaw sloping forward, and the lip often cleft and the nose shortened in order to be out of the way of those in the upper jaw. The other teeth are generally three grinders in each side of both jaws; but some of the genera have three additional ones which have sometimes been called canines, though they have nothing of the true canine character about them. None of the teeth except the front ones are capable of dividing the food, though they are very efficient in bruising it. The incisive teeth must therefore be considered as the instruments with which the food is taken, though in some species the fore-paws come in to assist. The effective part of the mouth therefore resembles a pair of pincers; and the muzzle is in most of the species rather short, and the head enlarged on the sides for better insertion of the muscles, so that the jaws may gnaw with great force, and also for a considerable length of time. In the individual structure of the teeth there is something curious, as showing how well an efficient cutting instrument among animals agrees with an instrument of the same kind as constructed by man. Man, the handed animals, and the carnassiers of all kinds, have the teeth, in the exposed part, covered wholly with enamel; and animals which grind vegetable substances with their cheek teeth, have the crowns made up of alternate portions of enamel and bone, the last of which wears down a little, and leaves ridges of the other something resembling those of a millstone. The gnawing teeth of the rodentia are different from both of these. They have the enamel placed on their external faces, with a support of bone behind it, which preserves a cutting edge of the enamel, and furnishes a support of a substance which, though not so hard, is tougher; and thus the greatest strength and efficacy jointly are given to those long teeth—teeth which have perhaps more severe labour to perform in proportion to their number than those of any other animal. This is exactly the plan to which a workman has recourse when he wishes to make a tool which shall retain the keenest and most durable edge, and which yet shall have sufficient toughness not to snap by a pretty severe cross strain. A thin piece of that description of steel which becomes hardest by tempering, is applied and fastened to the side of a thicker piece of iron. Then that which is to be the cutting edge is chamfered off on the face which has the iron to form basil; and thus while there is steel enough for all the purposes of cutting, the iron supports it up to the very edge, so that the tool can cut finely, and yet bear pretty rough usage. There is another advantage to a tool of this kind: it is more easily sharpened than if the whole of it were formed of even softer steel, because the iron is ground down much more easily than steel would be. This application of the two substances in the teeth, has the same advantage in the sharpening of them, or rather it keeps them sharp by the very fact of using them; for though the enamel does wear, the soft bone behind it has a tendency to wear faster, and by this means the edge of the tooth never gets blunt, let the animal gnaw as it will. There is also a provision against the wearing down of the teeth in their continuing to gnaw during the whole life of the animal, which is not the case with teeth that are entirely cased with enamel. The fact has not been absolutely decided, but we have reason to believe that the growth of the tooth is in proportion to its wearing, and consequently to the use that is made of it. This, however, is not absolute; because if one of the teeth in either jaw is lost, the corresponding one in the other jaw grows so long that the animal can use the mouth with difficulty. There is another circumstance which assists in this operation, and that is the form of the condyles by which the lower jaw is articulated. These are elongated from front to rear; and thus, though they admit the point of the under jaw to be advanced or drawn back as the operation of gnawing may require, they do not admit of any lateral motion. This gives great firmness to the bite of these animals; and thus, though their teeth are not calculated for inflicting punctured wounds as the canine teeth of animals are, they can bite out a piece equal to their extent much more quickly than any of the teeth which are formed for eating flesh. The cheek teeth have flat crowns with transverse ridges of enamel, and the interstices filled up with bone. These ridges in the opposite jaws nearly fit into each other, so that the grinders can act something after the fashion of the hand instrument which was used for breaking the "boon" of lint before the more expeditious and successful expedient of rollers was resorted to. The crowns of the cheek teeth are not, however, exactly of the same form in all the rodentia. If these crowns are perfectly flat, with only the exception of the transverse ridges of enamel, the owners live exclusively upon vegetable substances. If the ridges are divided into smooth tubercles, the owners are more miscellaneous in their feeding, and eat indiscriminately a variety of substances; and if the tubercles are drawn up into sharp points, their owners possess a little of the disposition and habits of the carnassiers.

The extremities of the rodentia are seldom of equal length, the hind legs being longer than the fore ones in most of the species. In proportion as these are longer, the muscular substance and power of the animal is more concentrated upon them. Their motion is, generally speaking, leaping and not walking, even when it is slow: and those which have the hind legs very long can leap to great distances compared with the size of the animals.

Though exclusive vegetable feeders in many of the genera, the rodentia have only a single stomach; but this deficiency is often made up by a cœcum of very large size. The dormice, however, have not this appendage.

The brain, in all the order, is but little marked with convolutions on its surface; and as those convolutions are popularly supposed to be some way or other connected with sagacity and resources in proportion to their development, it is customary to say that persons who have little sagacity or resource, and are giddy and wavering, are hare-brained. The eyes are placed laterally, and the form of the zygomatic or yoke arches shows that the jaws are but weak. Strength in the jaws is not the requisite, it is rather lightness, because the action is continued gnawing or nibbling, and not powerful biting. This may be seen in the different ways in which a monkey and a squirrel go about to get at the kernel of a nut. The monkey takes it between his strong jaws and cracks it at once by one lusty gripe; while the squirrel nibbles away till it makes a hole in the nut. As the fore arms have but little motion in the elbow joints, and their two bones are often united, the paw cannot turn, but has merely a hinge motion in this particular

joint. Many of them, however, have tolerably perfect clavicles, and others have imperfect ones, so that they can bring the paw to the mouth without any turning of the elbow; but as they cannot turn up the sole of the paw, they cannot bring any substance to the mouth except by holding between the two paws sideways.

In all their organisation, indeed, they are inferior to the three preceding orders; and the offices which they perform in nature are of a more humble character. Those which subsist on vegetable matter live, habitually in some cases, and seasonally in almost all cases, upon bark and twigs, and even dry sticks; and it is not a little remarkable that the beaver of the north, notwithstanding all his ingenuity in hut building, should be contented with nearly the same fare as the hippopotamus of the African rivers, which kennels in the foulest ooze that it can find. In proportion as the clavicles are firmer, the animals have more dexterity in their action; and this admits of a division of them into two sexes, which is rather convenient in the case of animals which are so very numerous, and the greater number of which, from their habits of concealment, are but little known.

The section with clavicles is by far the more numerous of the two, and contains a number of families, some of which, however, do not consist of more than a single genus, or even a single species. The first family, and those which are the most agile animals, are the squirrels, including squirrels properly so called, leaping squirrels with extended parachutes, usually called flying squirrels, the aye-aye, and perhaps a few others. They are almost exclusively tree animals, and exceedingly quick in their motions. The second family consists of the rats, of which there are thirteen or fourteen separate genera, some inhabiting the mountains, some the walls of houses, some the fields, some the margins of the waters, and, in short, almost all sorts of places that can well be imagined. They are the most numerous mammalia on the face of the earth. All of them, however, are ground animals, and some of them inhabit in vast colonies together. Their numbers show that they are of vast use in wild nature; and though most of them which frequent houses are accounted pests, yet as they multiply very fast in such situations, we must not suppose that even there they are altogether without their use. The jumping hares, the rat moles, the beavers, and various other genera, the species of which are but few, and the manners imperfectly known, also belong to the selection with clavicles.

The section without clavicles contains only three families; but some of them are animals of considerable interest. One family consists of the porcupine and the allied genera. Another consists of the hares; and the third of the cavys, including among others the chinchillas of the South American plains, the skins of which are so much esteemed for the beauty of their fur.

Several of the rodent animals are offensive, on account of their musky smell; but the flesh of the greater number is eatable, and that of many is highly prized. The skins of many besides the chinchilla are also valuable, on account of their furs, though less so than those of the marten family, inasmuch as the skin and fur are more tender, and the fur is less glossy. The vast numbers in which many of them are obtained, and the comparative easiness of the hunting of them, make some compensation in those respects.

Edentata. As the character from which this small but very singular order of the mammalia gets its name is merely a negative character, the absence of certain parts, and not the possession of them, no conclusion respecting them can be founded upon it, farther than that they are incapable of inflicting an incisive bite with the front part of their mouths. Still they have some characters in common, although those characters differ very much in the several genera which the order comprises. Those characters are the peculiar structure of the claws with which the extremities of the toes are armed, and the degree of motion. Generally speaking the claws are large, and in order to fit them for more powerful action, they embrace the terminal bones of the toes like a sort of very singularly shaped hoofs. This is the character in which they agree; and those in which they disagree are chiefly the size and form, which vary according to the purposes to which the animals most habitually apply them. There are three of those purposes: holding on upon trees, digging in the ground for the simple purpose of burrowing, or for digging up bulbous roots and earth insects, and also for digging into the bodies of dead animals, into which they enter by making a mine below. The third form is that which is more adapted for tearing open the burrows or collections of earth, chips of wood, or other materials of which those insects that live together in numerous colonies construct their habitations. The first and last of these three varieties of claws among those animals, will be found explained, both in their structure and their action, and also illustrated by sketches in the passages already given as explanatory of the feet of sloths and ant-eaters. An example of the third form occurs in the ground hog of Southern Africa, of which a figure will also be found in the course of this article. The whole order are local in their distribution, as well as peculiar in their structure and their habits. Very few of them, and these only of one of the genera, occur in temperate countries, and such as do are confined to America. Cuvier divides them into three families: *Tardigrada*, containing only the sloths of living animals, and, according to Cuvier's hypothesis, the megatherium, and those other fossil animals which are presumed to have resembled it in structure; *Ordinary Edentata*, containing the armadilloes and a few others, all of which are exceedingly expert at burrowing in the ground; and *Monotremata*, comprising the ornithorhynchus and echidna of New Holland, the one of which is a burrowing animal, and the other aquatic in its habits, and seldom coming to the surface excepting in order to breathe. These two are very peculiar animals. There is no question that both of them are mammalia, and there is as little question that they resemble the ordinary edentata in having no teeth, and also in some parts of their internal organisation; but still their peculiar character, that of having only one posterior opening to the body, is the one in which they differ from all the other known mammalia; and therefore it seems desirable that they should stand apart and be classified upon it. Enough of their physiology and manners is not yet known for enabling us to fix their place in the system with any thing like precision; and therefore we shall venture to arrange them as unclassed animals in supplement to the marsupial ones, because they too require to be classed upon different principles from the mammalia.

Pachydermata.—This is also an order which is

established upon a character which tells us but little; and the three families of which it consist differ much from each other. They are all vegetable feeders; and as such they form a pretty distinct division. Their digestive apparatus is invariably of large dimensions, but they do not ruminate; and as many of them at least are capable of dividing their food but imperfectly with the teeth, they may be said to draw a tincture from it rather than to digest it in the usual meaning of that word. None of them are furnished with claws; and the termination of the foot differs considerably. Some have short blunt toes, as for example, the elephant; others have divided toes with little hoofs, as for instance the tapir, and some have one large divided hoof, as the horse; in fact, there is no part of their external organisation in which they can be said to have very much resemblance; and the thick skin upon which Cuvier has judged it most expedient to class them, though it is very characteristic in some, is much less so in that of others. The elephant, the rhinocerus, the hog, and several others, have undoubtedly thicker skins than are to be met with in any other order of mammalia; but the skin of the horse is certainly not thicker than that of the buffalo. The three families are, *proboscidia*, ordinary pachydermata, and *solidungula*. The first of these contains only the two species of elephants, of which some notice has already been taken; and the last contain only the horse genus in its different species. Both of these are very distinct in their characters; and they are animals of peculiar interest; but they stand alone in the system, possessing little or nothing of what is called affinity to any of the rest. The second family, like that of the ordinary toothless animals, is a melange, containing animals very unlike each other, such as the hippopotamus, the different hogs, the rhinocerus, the tapir, and various extinct animals of which of course only the bones are known, and all the rest must be supplied by analogy, which, however, is a powerful instrument in the hands of one who has carefully studied the skeletons of all the living animals, and compared these with their external appearances and their habits. With the exception of the hog, and the horse, of which the original locality is not very well known, all the living genera of these animals are comparatively local, and found only in the southern parts of the true continents. The bones of the extinct ones, however, are perhaps more widely distributed than those of any other mammalia which are lost to the world in living types. Among the ordinary ones there are some, as, for instance, the tapir, which in some respects at least resemble the elephant; and in the hogs we have a divided hoof resembling, though not exactly like, that of the ruminating animals.

Ruminantia. This is to man the most valuable order of all the mammalia; and it has the advantage of being very abundant, almost universally distributed (Australia always excepted), generally speaking mild in disposition with very few exceptions, social in habits, and consequently easily tamed.

The character upon which the order is established is a very distinct one, belonging to the whole of the order, and to no other mammalia. In some others there is a stomach more or less dissected, but these do not ruminate. Ruminating animals are also the only ones which are provided with horns inserted in the bone at the upper part of the head; for the horn of the rhinoceros is merely a great tuft of hair or bristles very firmly soldered together, and attached only to the skin. All the ruminating animals are not, however, furnished with horns; and therefore, when in a state of nature, the horned and the hornless are good distinctions. In domestication, however, the case is different; because some animals which are naturally horned lose them in domestication. We believe, however, that there is not a single instance of the converse, namely, of a hornless animal acquiring horns in a domestic state, how long so ever it may be breeding them. Indeed we do not think there is a single instance in which a domestic animal acquires a single appendage, though there are many in which appendages are nearly or wholly obliterated. It should thus seem that, while domestication unquestionably softens the manners of animals, it also smooths the asperities of their forms. This fact involves some curious matter for the physiologist, though it hardly comes within the pale of legitimate natural history. We may remark, however, that all animals, when under the influence of strong and angry passion, become much more rugged than when they are pleased. The hair stands up, the muscles swell into ridges, the skin is puckered, and the animal puts on an aspect as repulsive as possible.

As ruminating, or returning the food to be chewed after it has been in the first and second stomachs, is the leading character of this most valuable order of animals, we shall say a few words on their system of nourishment generally. In some other mammalia there is a partial division of the stomach into compartments, in each of which a different function is performed; but in the ruminantia there are four distinct and separate stomachs, each of which performs its separate function, in assimilating the food of the animal. The first is the paunch, which can be viewed in no other light than that of a mere receptacle. It is very capacious, and fitted for receiving a large quantity of the grass or other matter upon which the animal feeds; but there is no gastric juice, or any other solvent fluid which enters it; and thus it is simply a receptacle. In some cases it is extended with great inconvenience to the animal, in consequence of the fermentation of its contents. This is especially the case when cattle eat clover which has been moistened by rain or dew. This moisture, unnatural to the state of the animal, causes the production of a great quantity of gas, carbonic acid generally speaking; and the quantity is so great, in some instances, that it would burst the animal if allowed to remain in the stomach. To prevent this, the skilful grazier, knowing the exact point at which the animal is safe, plunges a knife into the body of the animal, so as to enter the paunch without injuring any of the other viscera, or even dividing any blood-vessel of consequence; and when this is done the gas issues from the wound with force and violence similar to the blowing of a pair of bellows, and the animal is instantly relieved, and its functions go on as if nothing had happened. This first stomach can be regarded only as a simple receiver, but a very conspicuous one; and the ruminating animal is enabled to browse for a long time and fill the receptacle, before the proper operation of preparing the food for the stomach begins.

The food which is taken into the paunch must undergo another operation before it is even ready for the digestive organs; that is, it must return to the

mouth in order to be chewed, or ground by the lateral motion of the cheek teeth upon each other. It is this returning of the food to the mouth after it has been in the paunch, which is called "chewing the cud;" and the cud, or *quid*, which is the real meaning of the term, is not unworthy of notice, inasmuch as there is a separate organ for the preparation of it. This organ is the second stomach of the animal. It is called the bonnet, or the king's hood; and it is a viscus of a very peculiar structure. It is very muscular in its walls, and the interior of it consists of cells, which are larger or smaller according to the size of the animal, and the nature of the food upon which it more habitually subsists. The walls of these cells have the faculty of standing erect, at the same time that there is a vermiform, or twisting motion of the entire organ. By means of these cells and of this motion, the food which had been taken into the paunch is rolled into little pellets, which pellets are one by one returned to the mouth and undergo the operation of chewing; and unless this operation can be performed, and the king's hood can properly prepare and return the food to the mouth of the animal, that food can in nowise contribute to its nourishment. From spasm, or other causes, it sometimes happens, that this organ is incapable of performing its function; and when such is the case, the animal will die although still able to graze and convey the requisite quantity of food to the paunch. An intelligent observer of cattle is well aware of this peculiar species of spasm, and he is also aware that there is only one means of getting the better of it. It is a disease which no medicine can reach; and if he possessed only one animal, and that animal were taken with it, it would have no alternative but death. He therefore watches another animal of the same species, and the moment that it is bringing the cud or quid to the mouth, he snatches it out, and transfers it to the mouth of the animal which has lost the quid; and the stimulus of the warm quid so applied, rarely if ever fails in restoring the animal to the complete exercise of its function.

The cells in the second stomach vary considerably in their dimensions in the different orders of ruminating animals. In those which nibble the tender grass, such as the sheep, they are small; but in those which live on the branches of trees, or on coarse vegetation of any kind, they are comparatively large. This is especially the case in the camel, which has the cells of this second stomach of ample dimensions. The size of these cells give origin to the ridiculous story that the camel is capable of retaining in its stomach a supply of water which can not only refresh itself, but which is rendered available as drink to its master as it traverses the burning deserts. This notion has been strangely continued, even by men who in recent times have got honorary names heaped upon them for the supposed services which they have rendered to science. Notwithstanding this, there is no opinion more absurd, or more completely opposed to every principle both of chemical and physiological science; and if it were not that we have a desire to be tender of the names of those whom learned societies tag with letters, and upon whom kings bestow knightly honours, we would say that there are many of them sheer blockheads, who ought to be scouted from the province of science as unworthy usurpers.

After the food has been rolled into pellets by this second stomach, returned to the mouth and properly chewed, it is carried back again to the third stomach, which is termed the "manifold," because it consists of parallel laminæ, bearing some resemblance to the leaves of a book. These are beset all over with small tubercles, and this is the portion of the stomach in which, and in which alone, the drink of the animal mingles with its food. If, therefore, water would be sought in any one portion of the digestive apparatus of a ruminating animal, this is the portion in which alone we could by possibility find it. There is, however, no instance in which water has been met with in this viscus, unless so completely mixed with the aliment as that the one could not be separated from the other.

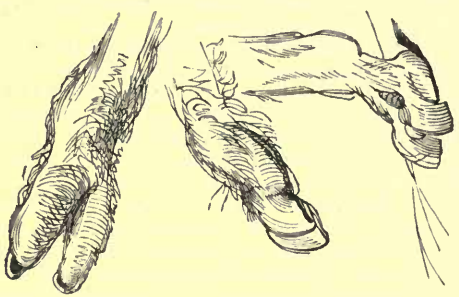
From this third stomach, the food and the drink combined, and reduced to a pulp upon which the real digestive process can be exercised, are conveyed to the fourth or truly digestive stomach of the animal, which is the only one that secretes gastric juice. This stomach is in some parts of the country known by the name of "the red," and in young animals of the ox tribe it is used for the purpose of coagulating milk in the manufacture of cheese, and gets the name of the "rennet." Such are the principal digestive organs of the ruminating mammalia, and in addition to these their intestinal canal is very long, and provided with an ample cæcum.

It is not a little remarkable that these animals, which are unquestionably the most useful to man of the whole mammalia, should be at the same time most amply provided with the means of digestion. There is another circumstance connected with their economy which is well worthy of attention, and that is the fact that they absolutely make their own pastures. If a heath-clad hill or a barren moor is perseveringly pastured on by cattle or by sheep, it will in time become a green sward of the most kindly description. The droppings of the animals no doubt contribute to this purpose, but there is a kindliness also in the very bite of a ruminant animal which appears to do good to the plant on which it feeds; there is also something peculiar in the breath and the whole economy of these animals, for there is nothing that tends so much to retard the progress of consumption in the human subject as breathing the breath of cattle, and we need hardly mention that the smallpox, formerly one of the most destructive diseases of the human race, has been well nigh banished by the counteraction of inoculating matter originally obtained from the teats of the cow.

Indeed, in whatever light we view the ruminating mammalia, they are absolutely the treasures of man above all other parts of the animal creation. For rapidity and elegance their labours are perhaps not equal to those of the horse, but in patience and strength they have hardly any parallel; and among the poor it is hardly possible to imagine a more valuable treasure than is possessed in a single cow. It is also worthy of remark, that nature appears to have been more bountiful in the distribution of the ruminantia than of mammalia of any other order. It is true that, in the wild plains of South America there were originally no animals of this description, but since they were introduced they have multiplied to an extent unprecedented in any other part of the world. It is also highly probably that they have altered the character of the surface, and that, though still seasonally arid in a high degree, the wide plains of Paraguay and Brazil do not become so burnt up in the dry season as they did

before they became the pastures of such numerous herds of cattle.

The only native ruminantia of the southern part of the American continent are the lamas, which, though much smaller animals, are somewhat allied to the camels. They are, however, fitted for treading on very different ground. The foot of the camel, which is planted with a heavy downward stamp, and lifted straight up and high, is adapted for sand; but it is a very bad foot for rough and stony surfaces. Though the lama inhabits latitudes in America which correspond very nearly with those inhabited by the camel in the eastern continent, the feet of the lama are adapted for surfaces of a very different description from those trodden upon by the camels. The camel is an animal of the sandy plain, but the lama is a mountaineer; and the different species are found along the ridges of the Andes, largest we believe in the equatorial parts, but more numerous and more active farther to the south, where the pastures are better. Instead of the two toes in the lama being united on the under part, and forming one entire padded foot as they do in the camel, they are well separated, and each is furnished with a complete pad, as may be seen in the following cut.



The foot is remarkably well adapted for holding on upon the rough surfaces of rocks and precipices; and thus though the lama is but a small animal, not larger or stronger than a common deer, it is very sure-footed on mountain paths; and before the introduction of the mule, which is now the beast of burden chiefly employed in those countries, it was much esteemed by the native Peruvians.

Although the characteristic foot of the ruminantia be in all cases a divided one, consisting of two principal hoofs upon which the animal treads in walking, without the small supplemental ones coming to the ground, except where that is soft, and the animal sinks deep, yet there is still a very remarkable adaptation in this simple foot to the places which the animal inhabits. The larger buffaloes which inhabit marshy places, and, generally speaking, the whole of the ox tribe, which prefer humid surfaces to dry and elevated ones, have the hoofs very broad, so as to present an extended base to the soft ground. This form of foot gradually changes as we proceed from humid pastures to those which are dry and elevated; and when at last we come to the goats and antelopes which inhabit the craggy steeps of lofty mountains, we find the hoofs very small, hard in their texture, and firm in their edges. In proportion too as the foot acquires this mountain character, there is a corresponding increase of elasticity, not in the leg merely but in the whole frame of the animal; so that while these ruminantia which inhabit the moist plains are slow and unwieldy in their motions, the mountaineers are among the most light and bounding of all the mammalia; and there are no animals, not possessed of hands, or prehensile feet of some kind or other, which can preserve their balance so well upon such narrow footing. Some of the rock goats and rock antelopes can stand firmly upon a pinnacle of rock hardly more extensive than the human hand, and not only so, but they can bound from this narrow footing with wonderful elasticity, and alight securely upon a fresh one equally narrow.

In mentioning this order of animals, we cannot pass over their extreme utility to man, and the numerous ways in which they are useful. The milk of the ruminant mammalia is much more abundant than that of any of the others, and it is superior in quality, being one of the most healthy substances that is known. The manufacture of this milk into cheese, or that of its cream into butter, employs a great number of people; while the commerce in these articles is an extensive branch of trade. The flesh of the ruminants is a staple article of food in all nations; and though there are some articles which the luxurious esteem more as rarities, there is no kind of animal food upon which a man can feed so constantly and preserve an equal state of health. The skins of these are so valuable as leather, that they form an indispensable article of human clothing, and in many of the arts; and the skins of the different genera, and those of the same genus, at different ages, and in the different sexes, admit of being dressed in a great variety of ways, so that each is applied to its own specific purpose. The wool and hair are also articles of great value; and no part of the dead animal is without its use.

But notwithstanding those numerous and important uses of the substance of the animals, they are nothing to the uses of the animals themselves in a live state. The great quantity of vegetable matter which cattle convert into manure for the fields, and the peculiar adaptation of this to the nourishing of corn and of the more kindly grasses, render these animals indispensable to the farmer; and we may say with truth, that there is not upon the face of the earth a single spot so fertile as that it could bear corn crops even ten years without the assistance of cattle. The beauty of the animals too is something; for if the greatest master of colours limns a landscape with the utmost effort of his art, and forgets cattle, it looks cold and desert; and one would prefer a single cow touched by the broad and brilliant pencil of Cuyp to all the still life in the world. In fact, those animals appear to have been the grand means whereby the human race were at first brought from their savage habits. The naked hunter of the woods, who is understood to have subsisted chiefly upon the flesh of animals, and to have been hardly less ferocious in his manners than the carnivorous mammalia, became in time a shepherd, feeding upon milk, and clothing himself with the skins, and ultimately with the fleeces of his flock, till their great value taught him to love the gentle creatures; and when this step was once taken, the milk of human kindness was poured around the human heart, the attachment of man to the animal kingdom was placed upon a finer and firmer basis than the mere desire of eating their flesh; and the moment that a gratification in supplement to that of the mere animal appetites was afforded, the first grand step in civilisation was taken; nor was it long ere

the descendants of the shepherds founded the city, reared the palace, established the law, cultivated science, improved art, and enjoyed happiness. This is part of what we owe to the ruminant mammalia; the whole tale of their value and advantages is too long to be told.

Marsupialia.—In stating our reasons for removing these animals from the end of the flesh-eating order, we took occasion to remark that they ought, in strict propriety of arrangement, to form a sub-class, or a separate class altogether from the regular mammalia, because the character by which they are all distinguished, and upon which they are named, does not belong to any of the rest. This character is the attachment of a *marsupium*, that is, a purse or pouch on the under part of the females, which pouch is supported by two peculiar bones called marsupial bones for the sake of distinction; and the degree of its development varies in the different genera, and also in the same female when in different states. In some it is always largely produced, and answers as a receptacle to the full-grown young; while in others it is so little produced at any time, that it never covers the teats of the animal. There are, indeed, cases in which the pouch is little more than a ridge or fold upon each side of the belly laterally; but the bone exists to some extent or other, even where the distinct pouch is wanting, and thus the whole of these singular animals are brought into one class; and there would be no objection to consider them as an order, only they do not strictly agree with the other orders of the mammalia, in any great particular either structural or physiological.

The bones which support the marsupium are attached to the pubis, and embedded among the abdominal muscles, so that the pouch is retained in its place with a degree of force proportionate to the strain which it has to bear. We may see in part the use of the singular structure of these females. Their habit requires that they shall be much in a slanting or upright position; and the strength of their muscles being, in the more characteristic species, concentrated upon the loins and haunches, uterine gestation, until the young were well advanced, would neither be convenient nor safe, accordingly there is a different arrangement of parts in them, and instead of there being but one opening to the uterus, as in the proper mammalia, there are two canals of comparatively small diameter, and curved in their direction. There are in the organs of the other sex peculiarities which answer to these; and though the formation is certainly singular as compared with that of the mammalia, the adaptation which it evinces is nowise inferior, only as the habits of the animals are not very well known, and as they were for a long time considered and classed with the others, and their more remarkable peculiarities passed with little notice, the proper study of them may be said to be little more than in its infancy.

There is no doubt, however, that the whole of the animals have a double gestation—a gestation in the pouch, and a gestation previous to that in the internal uterus. It has not been very satisfactorily made out whether the young, when in the uterus, have or have not a regular placenta; but the analogy is against their having one in any considerable state of development; and in those species which have been observed, the young, when they leave the uterus and be transferred to the pouch, are too rudimental for having an umbilical cord in any state of development, They are far more minute and formless than the young of any of the mammalia, not excepting those which come into the world blind and naked; and in some species at least (for the greater number have not been examined with sufficient care), they are without any produced members, or any decided marks of systematic action of any kind. The female transfers them to the pouch with her mouth, or applies them to the teats in those instances where these are not covered by the pouch. It is upon the nipple or teat, indeed, that the young one is suspended, and not by the mere pouch; and when very rudimental ones are removed from the teat, they cannot regain it without the mother's assistance, and thus they would perish in the pouch without being able to help themselves.

It is of course not known whether all the species are equally rudimental when placed in the pouch, or indeed, whether the same female places all her young ones in it at the same age. This is most probably the case; but the point is one upon which we cannot speak positively, and, indeed, the whole doctrine of the production of these animals, is one which must be worked out upon its own data, without any analogy drawn from the other mammalia. In those species which have been open to accurate observers, the whole period of gestation, at least up to the perfect formation of the young animal, though not of course to its growth, has been found nearly equally divided between the womb and the marsupium; only the young ones take shelter in the latter after they are capable of finding the greater part, if not the whole, of their own food. Where this is the case, the marsupium is of course considerably enlarged; but it is not in this that the principal office of this organ consists. In its internal covering, partially also in its teats, and perhaps wholly in these in some of the species, this part of the system is only temporary and developed when nature requires it, and disappears again when the necessity for it ceases.

The minute description of the curious economy of these animals is not very well adapted for popular illustration; and though it were so adapted, it is too scanty for admitting of being made satisfactory. We may remark, however, that by far the greater number of the marsupial animals are either leapers or climbers; and this peculiar arrangement of the organs of gestation is evidently intended to enable the loins and haunches to have more powerful action in this way than they would have if the animal were loaded with full grown young. The double internal uterus and the marsupium also enable these animals to bring forward a succession of young ones at the same time; and they may be observed in the pouch at evidently different ages in the different individuals which are there at the same time.

All those circumstances point strongly to the fact that these animals are subjected to considerable hardships and contingencies; and this agrees with the characters of those countries which the greater number of them inhabit. These are chiefly seasonal countries, in which there is much alternate parching and flooding—countries in short which are not well adapted for the common mammalia in a state of nature; and accordingly we find that in New Holland, which may be considered the head-quarters of marsupial animals, there are no native placental mammalia, and such mammalia are not very common in

the other localities of these animals. New Holland, New Guinea, some of the other islands of the archipelago, South America, and the warmer part of North America, in the case of a single species only, are the localities of these animals; and it is not a little remarkable that not one of them hasbeen hitherto found in Africa, though they occur on both sides of it.

As they have their portion of the earth set apart for them as it were, they are distributed into their own orders, which, however, have been usually taken into the system as genera, and perhaps it is not worth while to alter an arrangement which cannot be misunderstood, if we do not confound them with the other mammalia.

The singular part of the economy of these animals is, however, the pouch, and the double gestation. There has been much inaccurate writing on this subject, but the leading facts have been in a great measure cleared up. The Virginian opossum, which has been longest known, has been examined with a good deal of attention. From which it appears that the pouch begins to be visibly preparing for the young about the tenth day, and that in about five days more the young are placed in it. This is done always in a state of concealment, and consequently the exact method of it is not known, though there is no doubt the mouth is the instrument. When these young are deposited in the pouch they are very small, not exceeding a grain or two in weight. The mother, it is to be borne in mind, is about the same size as a common domestic cat. On the twenty-fifth day the motion of the young in the pouch is sufficiently great to be felt by the finger on the outside; and by eight or nine weeks the young ones are found hanging, some without and some within the pouch. While they continue suspended to the nipple it is about a quarter of an inch long; but they do not quit the teats till they are about the size of rats. After this the teats begin to shrivel up and soon disappear. About the eighth week the eyes are opened, at which time they begin to quit the teats, though they return to them for some short time.

The marsupial bones, which are found in the skeletons of no other animals, form a very peculiar character. They are inserted by a tendinous union, and not by joints near the middle of the pubis, and directed towards the sides; and it does not appear that there is any necessary correspondence between the development of the bones and that of the pouch in its soft parts. The males have them as well as the females and those which have the pouch but very little produced, have often the bones very decidedly so. Though the pouch and its economy be the most remarkable, they are not the ones upon which it is convenient to divide the animals, the proper mode of division being the teeth and feeding apparatus, as in the case of the mammalia properly so called. But whatever may happen to be the food or teeth of these animals, and whether the pouch is well developed or merely rudimental, there is a family likeness which runs through the whole. The animals never have the graceful form of the true mammalia; they have a very stupid look and expression in comparison to these, and they are sadly inferior to them in resources, though their dispositions are generally mischievous enough in proportion to their strength.

In the marsupial animals, and particularly in those of them which have the marsupial character most completely developed, there are certain conformations of the blood-vessels in the lower part of the body, in which they differ from the mammalia. These conformations tend to secure, in proportion to the blood of the whole animal, a greater supply of arterial blood to the lower extremities, and to those parts in which the peculiar characters of the animals are situated. The marsupium and its bones render the pelvis deeper than it is in any of the mammalia, and this enables the iliac branches to come off earlier and at smaller angles, by which means the blood circulates more freely and in larger quantity, and this supplies the waste of the more powerful action of the hind legs, and, generally speaking, also of the tail. Those peculiarities cannot be very clearly explained, however, without the assistance of figures, and not easily to ordinary readers with them.

The spine and skull do not differ greatly from those of the common mammalia in the arrangement of their principal parts, only in the more characteristic species, the skull is smaller in proportion, and the vertebral column is enlarged towards its sacral extremity. The fore legs are always furnished with complete clavicles, and thus they have always a cross motion, so that the animal can grasp with them or bring them to the mouth. In their development the organs of sense follow nearly the same law of adaptation to locality as is found in the mammalia; but the fore paw has in no case less than four fingers and a rudimental thumb. Some of them, however, have the fore feet adapted for digging in the ground; one or two have the toes of all the feet webbed, and several have the hind feet formed like those of the leaping animals. Some of them, as the koala, have the toes of each foot divided into two groups, an external one containing three, and an internal one containing four, which act against each other in grasping. In those which simply run upon the ground, and which are more or less of a carnivorous character, the feet approach more to those of the running carnivora, having five toes on the fore feet and four on the hind, all armed with claws which are sharp and crooked, but not retractile. The whole race are, with but few exceptions, solitary animals, living alone, and rarely found in more than a single pair, and that only occasionally. The kanguroos are almost the only ones which form an exception to this; and they make a slight, though a very slight, approach to the ruminant mammalia in their food, and the fact of their being of some use to man; but the approach is but a slight one, and their social principle is not sufficiently strong for admitting of their being tamed.

We shall now very shortly notice the several genera, or, perhaps, to speak more accurately, orders or sub-orders into which these animals are usually divided. The first are the opossums, which are wholly American animals, though some are furnished with a pouch and others not, and one at least is aquatic in its habits. These animals have their mouths formed very like those of the insectivorous mammalia. They have ten front teeth above and eight below, which last are very small; one canine tooth in each side of both jaws, which is strong and compressed; and seven cheek teeth in each side of both jaws, the ones next the canines very small, and the others with pointed tubercles like all insectivorous teeth. The head is long, the muzzle pointed, the gape wide, the ears rounded and nearly destitute of hair, and the tongue studded with hard points

They walk on the flat foot; have five toes on the feet, only the thumbs on the hind feet have no claws, and are opposable to the fingers. The tail is very long in all the opossums, hairy in part, and naked in the other parts. They are covered with pretty close fur; and like the insectivorous mammalia they have the stomach simple.

They are animals of a rank and offensive smell, residing in holes of trees during the day, and crawling about and climbing during the night, levying their contributions upon little birds and their eggs, as well as upon insects. The Virginian opossum is the largest, and it does not exceed the size of a cat. It is furnished with a pouch; and so are three or four other species inhabiting South America; some of which frequent the rocks by the sea side, and feed upon crustaceæ. Others of the same country, which are not much larger than common rats, are without the pouch; but its place is marked by deep folds along the side of the body. One species of Guyana, which is about the size of a pole cat, has the feet webbed, and its manners are understood to bear some resemblance to those of the otters.

Those which have been enumerated comprise the whole of the American species, so far as these have been discovered. They are, comparatively speaking, an obscure as well as an useless race of animals; though in a country where insects are so exceedingly numerous, every insectivorous animal is of some service.

The marsupial animals of New Holland are much more characteristic than the American ones; and there is a succession of them, answering in a great measure to three or four different orders of the common mammalia. The colonists in Australia have bestowed the names of common English animals upon the greater number of them; and this at first led to mistakes respecting their natural history; but those mistakes have been in a great measure rectified.

The genera of these Australian marsupial animals are, *Dasyurus*, which are carnivorous animals; *Parameles*, which have more the form of badgers, though not very like those animals; *Phalangista*, which are climbing and leaping animals; *Ptaurista*, which have the skin of the sides formed into a parachute; *Potorus*, which resemble rats; *Kangurus*, of the leading species of which we have already taken notice in speaking of leaping animals; *Phascolarctos*, which is a small animal, remarkably slow in its motions; and *Phascolomys*, which is also a very slow ground animal. It is necessary to bear in mind, however, that those phalangers (*Phalangista*), which have the tail naked or covered with scales, are natives of the islands to the north east of New Holland; while those which have the tails covered with hair are natives of New Holland itself. Some species of these have been set down as American, but it does not appear that there is any truth in their being natives of that country. To these must be added, though in separate sections, the two most singular animals of Australia, or indeed of any part of the world. These are, the ornithorhynchus, which is a swimming animal; and the echidna, which is a burrowing one. There is no doubt that these two follow the general law of the marsupial animals; though a regular pouch would not be consistent with an animal which crawls and dabbles in mud at the bottom of pools, or yet with one which burrows rapidly in the ground.

The fact of these two animals having only one posterior opening to the body, as is the case in birds, together with their jaws being drawn out into horny mandibles something like those of birds, and like them destitute of true teeth, were strong inducements to the naturalists by whom they were first observed and examined, and who had been in the habit of carrying one type through each class of the vertebrated animals, to look upon them as a kind of birds, or perhaps as partaking of the characters of bird and oviparous reptile, jumbled together with those of the mammalia. Such a melange of character is, however, inconsistent with all that we meet with in the other parts of nature; and though in the mammalia, whether common or marsupial, there are very remarkable differences of structure as suiting each to its proper locality and office, yet there is not the slightest tendency to blend the two characters of any two classes in one and the same individual. This fact might have been arrived at from what has all along been observed of species, and species which, in structure, in food, and in habits, approximate very nearly to each other. From the great proximity between some of these, we may conclude not with probability only, but with certainty as great as can be obtained upon such a subject, that they could be blended together far more readily than the characters of two classes; but we find that the line of distinction between species and species is so clearly drawn, and so impossible to be permanently broken, that not one new fertile species partaking of the characters of two separate ones, can be introduced by all the skill of the cultivator of animals, though he labours with the utmost assiduity for the express purpose, inasmuch as the animals of one generation which he procures by this means, possess qualities which, for certain purposes, are more estimable than those of the pure animal of either species.

If this holds true between species which are so nearly allied to each other, and in all probability are so nearly from the same original pastures as the horse and the ass, the argument thence arising ought surely to have been sufficient to show that there could be no such blending as that which was alleged in the case of those animals, and more especially in that of the ornithorhynchus, which was the earliest and the best known.

Other arguments, all tending to the same effect, might have presented themselves in formidable array; for if there are any animals which have less occasion than others for any of the attributes of birds, they are the very ones under consideration. Flying is the proper bird character; and flight might be much more useful to, and therefore might be expected to be sooner given to a mole or an otter than to either of those animals. Besides, when birds lose their proper function, the capacity of flying through the air, they lose in a great measure those parts of their bodies which are the proper organs of flight. If they are swift-footed animals, they have rudimental wings and downy feathers, which serve them as balancers; and if they are slow-footed, the bones of the wings are hardly, if at all, produced beyond the skin of the side. If the wings are to be used as swimming organs, as is the case with those aquatic birds which are incapable of flight, there is a peculiar modification to fit them for this office; but there is in no case the slightest tendency in the wing of a bird to take the shape of a toed and clawed foot, as we find both in the ornithorhynchus and the echidna.

The skeletons of both animals are strictly those of mammalia; and in the articulations of the legs, there

is no approximation to the articulation of the quadruped reptiles, which, whether they move fast or slow, always have the joints of the legs turned in a very peculiar manner, so as never to be mistaken for animals of any other class.

There is another circumstance which probably tended to mislead those naturalists who looked too exclusively to the facts immediately before them, and the analogies of the mammalia, without due attention to those of the marsupial ones. It was not then known that the mammæ or teats of these animals are deciduous, or that they shrivel, the apex dropping off and the glands being completely absorbed, when not required; and it is highly probable that no two young ones are ever nursed upon the same teat of a mother, that is to say, in successive generations, whether the one generation follow the other ere that other is yet completely formed, or whether years, or longer intervals of time, may come in between them. This being the case, it is evident that no conclusion could be drawn from the total absence of teats in the female ornithorhynchus, unless these animals should be found accompanied by young, and without this apparatus. The number of these animals are so few, and their habits and modes of life are so difficult to be observed, that though an individual now and then was occasionally found, the searchers for them did not meet with a gravid female, or a female accompanied by very young offspring. This, of course, left the case open to conjecture; and as ornithorhynchi have been seen about some of the pools of the Australian streams, and eggs found in the banks soon afterwards, without any animal being observed to which those eggs could belong, there was the evidence of juxta-position in favour of their being the eggs of the ornithorhynchus. This same juxta-position is a very treacherous argument in natural history; and if we obtain nothing from analogy to bear it out, and especially if we have anything from analogy positively bearing against it, we cannot use it with anything like safety; and this turned out to be very remarkably the case with the supposed eggs of the ornithorhynchus. More careful inquiry succeeded in obtaining the young with the mandibles so short as to form a mouth capable of sucking, though one of very singular shape; and though the evidence has not yet been carried that length, it is by no means impossible that, at an earlier stage the young ornithorhynchi may be so formed as to be able to adhere to the teats of the mother, in the same manner as the other marsupial animals. The following is a portion of the account transmitted to the Zoological Society of London, from the Honourable Lieutenant Maule, who, in common with very many officers both of the British army and the British navy, placed on foreign stations, is now cultivating natural history with equal assiduity and success. We quote from the proceedings of the Society's Committee of Science, to which committee the information was first communicated. "During the spring of 1831," writes Lieut. Maule, "being detached in the interior of New South Wales, I was at some pains to discover the truths of the generally accepted belief, namely, that the female *Platypus* lays eggs and suckles its young.

"By the care of a soldier of the 39th Regiment, who was stationed on a post at the Fish River, a mountain stream abounding with *Platypi*, several nests of this shy and extraordinary animal were discovered.

"The *Platypus* burrows in the banks of rivers, choosing generally a spot where the water is deep and sluggish, and the bank precipitous and covered with reeds, or overhung by trees. Considerably beneath the level of the stream's surface is the main entrance to a narrow passage which leads directly into the bank, bearing away from the river (at a right angle to it), and gradually rising above its highest water-mark. At the distance of some few yards from the river's edge, this passage branches into two others, which, describing each a circular course to the right and left, unite again in the nest itself, which is a roomy excavation, lined with leaves and moss, and situated seldom more than twelve yards from the water, or less than two feet beneath the surface of the earth. Several of these nests were, with considerable labour and difficulty, discovered. No eggs were found in a perfect state, but pieces of a substance resembling egg-shell were picked up out of the *debris* of the nest. In the insides of several female *Platypi* which were shot, eggs were found of the size of a large musket-ball and downwards, imperfectly formed however; i. e. without the hard outer shell, which prevented their preservation."

The eggs, without any shells which Lieut. Maule describes as having been met with in female ornithorhynchi were no doubt the young, in a state probably sufficiently far advanced for being ready for their external destination; but it does not appear that there is any thing which can decidedly connect the substance resembling egg-shell either with the mother or with the young.

It must be borne in mind that the question here is not whether the primary rudiment of the ornithorhynchus is or is not an egg; because the rudiment of every known animal is an egg; and the question is only as to the state of development in which this egg is when it leaves the body of the parent animal. In the true mammalia the maturing is internal; and though the young are in different degrees of perfection at their birth, according to the nature of the species, they are always sufficiently developed for being capable of sucking the mother by means of the mouth. In the marsupial animals it is probable that there are also differences of development in the young of different species, when they leave the internal uterus; but they leave that uterus without any distinct development of parts, and therefore without the capacity of performing any of what are called the voluntary functions of animals. They have no mouth formed, although they have a means of attachment to the nipple; and until they have a mouth, and can quit and regain the nipple at pleasure, it is highly probable that the nourishment they receive from that organ is not milk suited for the purpose of ordinary digestion, and requiring the action of the air in breathing before it is fit for the purposes of life: but that it is a fluid derived immediately from the unchanged arterial blood, and therefore requiring no more breathing or action of the air in the young which receives it, than the nourishment of the true mammalia requires while they are in the uterus. Indeed the arterial structure of the hinder parts of these animals is such, that the same supply of arterial blood may go either to the uterus or the teats, or that it may go in part to both at the same time.

We must therefore consider the marsupial teats as having somewhat of a placental character, as long as the young adhere to them, and are formless. It should

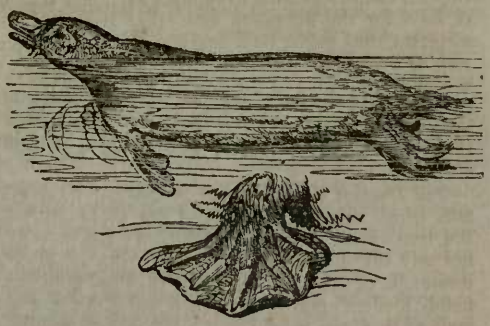
seem, however, that a change takes place in those organs, in the latter stage of the marsupial gestation; and that glands, capable of secreting milk, but differing from the permanent mammary glands of the true mammalia, are produced at the proper time for the purposes of the young.

That these glands are not conglomerate, like those of all the land mammalia, which bring forth their young alive, does not prove that they are not milk glands; for the mammary glands of the cetaceous mammalia are not conglomerate, but consist of little tubes which open at the one extremity, but are closed at the other; and in the cetacea the walls of these are capable of secreting a milk which is as rich as ordinary cream. It has been mentioned by several observers in Australia, that these glands do contain milk; and that they appear sufficiently developed, this milk is found in them, and can be extracted from them by pressure, only at those stages of the animal's economy, when the milk is necessary for the young.

Those observations have been made with such care and reported with such accuracy, they have been examined with so searching an analysis, and glands analogous in situation to these, in shrews and some other animals, have been shown to be developed at times and for purposes so different, that the fact of the ornithorhynchus suckling its young, for some time at least, may be said to be completely made out; and the establishment of this in the case of the ornithorhynchus is tantamount to the establishment of it in the case of the echidna.

There still remains, however, the question of the degree of development which the young have when they leave the internal uterus. If they are in the state of eggs, as we properly understand eggs in birds, and in those oviparous reptiles which produce perfect eggs, and do not hatch them internally, then there is no instance of the contents of such an egg, when perfect, being incompetent to bring the contained an mal to a state of maturity, if placed in the proper circumstances. It is true, that pigeons and some other birds feed their young partially upon a secretion of the stomach; and that almost all birds, except such as feed their young upon the most succulent and easily digested food, prepare the food in part by the lubricating and solvent juices, by means of which they prepare their own food for the stomach. This, however, is a very different operation from suckling, and it is performed by a different apparatus, namely, the common apparatus which the animal has for its own feeding; while the milk glands of the ornithorhynchus are prepared for an express purpose, and at an express time; and therefore, whether the young when brought from within are more or less developed, or required to depend a longer or shorter time on the mammary apparatus, we cannot, without violence to the general analogy of nature, and the introduction of organs for which there is no use, hesitate to admit that the ornithorhynchus and the other monotrematous animals follow the general law of the marsupial animals; and differ from the others in adaptation to that law only in so far as the fitting of them in the best manner for their very peculiar habits is concerned.

The following cut will furnish some idea of the figure of the ornithorhynchus when making its way through the water; and we have added the foot on a larger scale, in order to show the curious management of the web, by means of which this foot becomes alternately an efficient swimming and an equally efficient digging instrument. It will be observed that the web is capable of being stretched even beyond



the extremities of the claws; but it is also true that it can be retracted, or turned upward upon the upper side of the foot, so as to enable the animal to dig in the earth with great force and activity, for which purpose it is otherwise well adapted, in consequence of the shortness, the strength, and the articulation of its fore legs. In the quotation from Lieut. Maule, the situation and form of the nest are described, so that it is unnecessary to advert to these; and it should seem that the food, in great part at least, consists of worms, and shell-less aquatic mollusca. The echidna, on the other hand, being a land animal, and having the mandibles and tongue differently formed, is a feeder upon insects. Leaving, however, those curious animals, we shall now very briefly advert to the rest of the marsupial animals, in order that we may trace the particular divisions of the common mammalia to which they have the greatest resemblance. We have already offered some observations on the opossums, and shown the correspondence there is between them and the insectivorous division of the common mammalia; and the grand difference in their habit is that the opossums are more the inhabitants of trees, and the insectivorous mammalia are more the inhabitants of the ground. This throws them upon different latitudes of the earth for their pastures; the opossums being found in the American continent only; only one out of the warm latitudes, and that one not reaching the cold ones; while the insectivorous mammalia which possess the three kinds of teeth, and therefore range properly as carnassiers, are most abundant in the temperate or the cold latitudes; and their place in the warm latitudes is supplied by the ant-eaters and the analogous genera, assisted by insectivorous reptiles, chiefly saurians, whose structure and covering fit them for activity in warm countries only.

Simple as it may seem, there is a very beautiful adaptation to other parts of nature, in this geographical distribution of those two classes of animals Climbing insectivora would interfere with the summer pastures of the birds in the deciduous groves and forests of temperate countries, because the tree insects and their larvæ supply those birds with their proper food; and, on the other hand, animals constructed like these ground mammalia would not be well adapted for breaking open the strong castles of the tropical ground insects, and levying such contributions upon the inmates as to preserve the proper balance of the numbers. The soft-billed birds, and

this is the character of the greater number of our summer visitants, are just as badly fitted for breaking open those strong castles; and therefore, while the tropical countries contain the most abundant supplies of food for the anteaters and other strong clawed edentata, they would be a desert to those birds which visit us during the summer. It is thus necessary to the proper working of the general system of nature's economy, that our insectivorous mammalia should keep to the ground; and it is just as necessary that those of tropical countries should be capable of climbing.

The Dasyuri (which name is derived from their tails being hairy or woolly and not prehensile) are the true carnivora of New Holland; but they have not any thing like the strength or the courage of mammalia of the same size; and they are indiscriminately feeders upon insects, such warm-blooded animals as they can master, and carrion and all manner of animal garbage which they can pick up. Their leading characters are, eight incisors in the lower and six in the upper jaw, all small and regularly arranged; large canines in both jaws; six grinders on each side of both; the two anterior ones compressed, and with trenchant edges like the true carnivorous teeth of the mammalia, and the ones behind with insectivorous or sharp points besetting their surfaces. There is something in the structure of this mouth which renders it less carnivorous than the mouth of the mammalia with which the animal most nearly corresponds. In them the false molars come in between the canines and the great carnivorous teeth, and thus each of these can perform its work, separated to a distance from the other. The canine is by this means more completely a wounding or killing tooth, and the carnivorous more completely a cutting and tearing one; further, as the tearing tooth comes in close juxtaposition with the wounding one, those animals have what may be called a more dangerous mouth than the carnivora; and though they are not so capable of wounding, they mangle a good deal more. Another thing which lessens the power of these animals is the concentration of a great portion of their energy upon the large and powerful tail, and on the marsupium and its apparatus; and their speed is diminished by the possession of more perfect clavicles than are possessed by any of the carnivorous mammalia, and especially by those which are fleet footed.

Perhaps the most characteristic of them, though it differs so much from the rest as to be considered a different genus by some naturalists, is an animal about the size of a wolf, of a yellowish brown colour over the body generally, and streaked with cross bars of black across the back. This has been found only in Van Dieman's Land; and it has been termed *D. cynocephalus*, or the dog-headed dasyurus. The name, however, is not a very correct one, as the air and even the shape of its head are by no means like those of any species of dog, and the ears are short, erect, and rounded. Neither this nor any of the others is capable of climbing, and therefore they are reduced to seek their food upon the ground; and this one is known to prowl much about the wild shores of Van Diemen's Land, and pick up such animal refuse as is cast on the beach by the sea, or brought down by the floods during the rainy season. The other species, or perhaps the members of the other genus, have different characters. Their bodies and also their heads are longer in proportion; and their tails are covered with much longer hair. The largest of them has the coat very shaggy, something resembling that of a bear; others are smaller, less shaggy, and not so dark in the colour; and some of them are very small. These animals are much disliked by the colonists who reside in the neighbourhood of their haunts; and they are accused of committing considerable depredations on the flocks of the colonists; but it is probable that a good deal of the injury of which they stand accused is perpetrated by the bushmen, and the dingo, or half-savage dog, which is much more likely to do injury to flocks than those prowling, cowardly, and comparatively feeble animals.

The genus *Perameles* (so named from a certain fancied resemblance to badgers) are still to a considerable extent carnivorous. They are ground animals, and certainly answer in their manners to the badgers of other countries; for they are expert at digging in the ground. These animals, like all animals which are expert burrowers, have the muzzle long, the head slender, the ears so placed as to turn down upon the nape, the hair of the body short, and the tails much more slender than those of marsupial animals in general. Their hind feet are much longer than their fore ones; and they are formed something like the feet of the kanguroo, so that they can either spring from the toes or from the whole length of the tarsus. The external and internal toes on their fore feet are reduced to mere tubercles, so that their feet appear only to have three toes, which toes are, however, well adapted for digging, and furnished with strong claws. The thumb on the hind feet is very short in comparison with the others, and the two middle ones are generally united by membrane, so that they can offer a firmer point of support than could be given if the toes were entirely divided. The females are provided with a pouch (*pera*), so that perameles is merely a translation of "pouched badgers," the name given them by the settlers in Australia. As these animals are still more obscure in their modes of life than those to which we have already alluded, we are less acquainted with their feeding. It is probable, however, that the greater part of their subsistence consists of ground insects, and other small ground animals.

Those which we have now enumerated comprise all the marsupial animals which have any part of the mouth decidedly carnivorous, though it may be said that the insectivorous character predominates in the whole of them, being that of the greater number of their cheek teeth. We cannot therefore regard them as being set, like the true carnivorous mammalia, to watch over and regulate the numbers of an extensive and varied population of mammalia; this accords with the character of the country in which the vegetable feeding marsupial animals are not very numerous, and in which, until they were introduced, there were hardly any true mammalia.

Of the remaining division of marsupial animals, some bear a slight resemblance to squirrels, at least in some of their habits, and very partially in some parts of their structure; but the greater number may be said to have hardly any types among the true mammalia. Some of them live almost exclusively in trees, in the holes of which they form their nests or other abodes; and many of them are furnished with parachute membranes along the sides, by means of

which they leap about among the branches with great agility.

The genus *Phalangista* (the phalangers), as already hinted, are not confined to New Holland, but consist of two sections, one with the tail naked, but prehensile, and the other with the tail hairy, but prehensile as well as that of the other.

These animals, and indeed the whole of this division, are chiefly vegetable in their feeding, though there is perhaps none of the marsupial animals exclusively vegetable. These animals have, however, their intestines longer, and more furnished with cæcal appendages than those formerly noticed; and thus it follows that their general food is more difficult of digestion. They have the thumbs large and directed to the rear, something in the same manner as the hind toes of birds. This thumb is without any claw, and two of the toes of their feet are often united as far as the second phalange. It is this which caused them to get at first the name of phalangers; but it is not a very happy name, inasmuch as the last mentioned genus, though without thumbs, have the toes united in a similar manner; and the Malay name "pelandor," which resembles this one, and is sometimes mistaken for it, is one which we would translate rabbit, though it is said in many of the oriental islands to be applied to a small leaping animal having many of the characters of a kanguroo.

The character of these phalangers, and of another genus or subgenus closely allied to them, as dependent on the mouth, are: two very long and strong incisive teeth in the under jaw, acting against six smaller ones in the upper. This produces a slight resemblance to the rodentia; but the edges of the cutting teeth are of a more tearing and less gnawing structure than those of the rodentia. They differ from these animals also in having the upper jaw always furnished with long and pointed canines; but the canines in the under jaw are not longer than the false grinders.

The chief distinction between them, which is decidedly different from the allied genera, is the want of parachute membranes along the sides. Still they are expert climbers, and search the trees with great diligence and rapidity; and they are exceedingly dexterous in suspending themselves by the tails from the branches of trees. They have a rank and offensive odour; but, notwithstanding, they are eagerly sought after as food by the inhabitants of those countries in which they are found; and in New Holland they are eagerly hunted, both by the natives and the colonists. The trees of New Holland are remarkably well adapted to the habits of animals of this description. Very many of them are hollow; and as soon as the central wood of a tree begins to decay, the wood-consuming insects, known by the general name of white ants, come in countless myriads to clear it away. Such animals as those of which we are speaking come first to levy their contributions upon the insects, and then to take possession of the cavities, so that the hollows of the trees form ready-made burrows for these animals. The natives are, however, very expert at scaling the trees and drawing them out or dislodging them by means of smoke. The species which inhabit the Oriental Archipelago do not live so much in hollow trees as those of New Holland; because the trees there are not so subject to decay, and the animals are in consequence more among the branches.

These animals, from the possession of the pouch, have been called by the general name of opossums; but the individuals have been named after any animal which it struck the fancy of the namer that they nearly resembled. The largest of them is about the size of a full-grown cat, the others are smaller.

The allied genus *Petaurus* (the flying phalangers or those with the lateral membranes) differ from the others in these membranes, in the greater pointedness of the nose, in having the feet more capable of cross motion, and in the tail not being prehensile. They are very active animals among the trees, and can support themselves for some little time in the air by means of their parachutes, though they are of course quite incapable of gaining a fresh impulse from that element. The teeth of these animals are very insectivorous, their molars next the canines being very pointed, and the ones further back in the mouth terminate in four sharp points, so that no part of the mouth of the animal is adapted for bruising vegetable matter.

The most characteristic, or at all events the largest animal of this section or genus, is the great flying phalanger. The total length is about twenty inches. The head is small and very pointed at the muzzle; the ears are large, of an oval form, and covered with hair; and the tail, which is round at the basal parts, though flattened in the length, is very thickly and finely beset with hairs. The general colour of the body is of a greyish brown colour, paler on the sides of the lateral membrane; and the head is nearly the same colour, with bright yellowish brown hairs down the middle of the forehead. It inhabits the woods on the eastern coast of New Holland, especially the rich district between Port Jackson and Botany Bay.

Another species, the long-tailed flying phalanger, is about a fourth larger than a common rat, with the tail slender and half as long again as the body. It is greyish brown above, and whitish on the under part. The tail is black for the greater part of its length, but paler towards the body.

Another species, of a greyish brown colour, and with the toes furry, having a black tail with a white tip, also inhabits New Holland. The most remarkable of the whole, however, is the little flying phalanger, which is not more than two inches long in the body; and yet by the help of its parachute it can leap to a very great distance as compared with its size. The most remarkable character of this little animal is the tail, which is formed with hairs regularly disposed on each side, arranged like the webs of a quill; and there is no doubt that this form of the organ assists the animal greatly in performing its leaps.

There are some other species found in New Guinea and the adjacent isles; but it does not appear that any of those which are furnished with parachutes are found so far to the northward as the species which are without this appendage. They differ considerably in size and colour; but there is a strong likeness among the whole of them, and it does not appear that there is any very great difference in their manners. The genus *Petaurus* is known by the name of the kanguroo rat. The cutting teeth are the same in number as those of the last, with those of the under jaw very long. The canines are also wanting in the under jaw, but those in the upper are long and pointed. Immediately behind the canine they have a large molar with a trenchant edge, though the

other four have their crowns marked with four rather smooth tubercles. These circumstances indicate a certain degree of the carnivorous character, though not a very decided one; and their digestive organs, and also their cheek teeth, indicate a more vegetable habit than any of those which we have already described. In their forms they bear a considerable resemblance to the kanguroos; and the chief difference consists in their having canines in the upper jaw. The hind legs are very long as compared with the fore ones; the thumbs are entirely wanting, and the first and second toes are closely united up to the nails, which gives them the appearance of having three toes on the hind foot, with two nails on the inner one. They can walk, or rather leap, upon the two hind feet, and use their fore paws something in the manner of hands. The size of this animal is about the same as that of a young rabbit, and its colour resembles that of the common shrew. Illiger gave it the name of *Hypsiprymnus*, which means elevated on the hind legs, or at the crupper; and Shaw and some others classed it with the kanguroos, from which, however, it is evidently distinguished by the canines in the upper jaw, and the unequal length of the incisive teeth in the same. It is, however, what naturalists are in the habit of calling a link between the phalangers and the kanguroos, partaking much more of the general form of the latter, but agreeing with the former in the general structure of the teeth, with the exception of the particulars that have been noticed. There appear to be several species of this animal, or more strictly speaking varieties, inasmuch as almost their only differences are those of size and colour, which may be produced by mere difference of locality.

The kanguroos may be said to form the last genus of this part of the marsupial animals; and they are the most decidedly vegetable feeders of the whole. Their front teeth are the same as in the last mentioned, and their cheek teeth are the same in number, but they are entirely without canine teeth, and in their native locality they subsist entirely upon vegetable matter. Both they and the last mentioned species have the stomach divided in two separate sacs. Their general structure and manners have been noticed, accompanied by an illustrative figure in a former part of this article; and some account of the species and popular notice of their habits may be seen in the article KANGUROO; so that we need only mention further in this place that they are not confined to New Holland, but that some small ones at least occur in the Molucca Islands, where they are called rabbits by the Malays. *Macropus* (large foot) was the generic name given to these animals by Shaw, which Illiger proposed to alter for *Halmaturus* (leaping tail), which is the more correct name of the two; because, though some other leaping animals have the hind legs proportionally as long as the kanguroos, there are none which make so much use of the tail in leaping.

Only two genera of the marsupial animals of New Holland remain to be noticed; and each of these requires to be formed into a separate section. The first, the *Koala*, has six cutting teeth above and two below, as in several of the genera already mentioned; two false grinders above and none below; and four other grinders in each jaw, but with two tuberculous protuberances on the crown of each, and not in any respect the true grinding crowns of the vegetable feeding mammalia. The claws in this animal are sharp and rather crooked; and they spread out so as to act against each other in the same manner as the feet of squirrels. The animal climbs readily, but does not leap expertly. The young are brought forth in their early stage; but as carrying it in a pouch, or on the under side of the body, would not suit the climbing habit of the mother, it is carried on the upper part of the neck, to which it clings firmly, and the mother is enabled to climb without any danger of its falling off. Besides climbing, the animal burrows expertly, and its food is understood to be almost wholly vegetable, consisting of dried grass and withered stalks of plants. It is an exceedingly inoffensive animal. The generic name *Phascolarctos* means a bear furnished with a pouch; but there is very little of the character of the true bears either in the appearance or the habits of the animal.

The WOMBAT (*Phascolomys*—pouched rat) is the last which is yet known, and it is one of the most peculiar animals of the whole. It agrees in the general character with the rest of the marsupial animals; and therefore there is no question as to its belonging to this order or sub-class of the mammalia. It does not, however, agree in the usual characters of classification, as for instance in the teeth, or in the articulation of the jaws. The lower jaw is articulated with a mere opening and shutting motion in the manner of the carnivorous animals, and wants entirely the grinding action by a slight backwards and forwards motion, which characterises the rodentia. The teeth in the front of the mouth are two in each jaw, very stout, short, thick, and flat, the upper ones inclining towards each other at their extremities, and both rounded off so as to present oblique oval discs, with a rounded edge to the front. There are no false grinders or canines in either jaw; and the number of true grinders in each is five, with flattened oval crowns, but divided by a central furrow across the middle of each. Although, therefore, the mouth of this animal does not exactly resemble that of the typical rodent mammalia, which are not marsupial, yet they approach nearer to these than to those of any other animals. The wombat is plantigrade, with four toes on all the feet, only the thumbs on the hind ones are mere tubercles; and the claws are long and strong, and well adapted for burrowing. The ears are very small, and almost concealed among the rough fur of the animal; and the eyes are also very small; both circumstances indicating that the animals are habitual burrowers in the ground. They appear to be among the most passive of the mammalia. They can be tamed, or rather they will live with those who feed them; but they show nearly equal indifference to good and bad treatment; and though perfectly harmless, they seem incapable of being turned to any useful account, farther than that of being eaten, for which purpose it is said that their flesh is not badly adapted; and as their food is entirely vegetable, and their lives spent with exceedingly little labour, it is by no means improbable that this may be the case, though enough is not known of their habits for enabling us to judge whether their productiveness is such as would render them of much, or even of any, value in a state of domestication. With these animals we shall close our brief examination of the marsupialia; and we have made that enumeration rather less brief than it might have been, in order to save the space that would be occupied by a separate article MARSUPIALIA.

in its place in the alphabet; and we trust that what has been stated here will render a mere reference from that word to this article quite sufficient for all purposes to the common reader.

We could have wished to be able to state more clearly the relations of those marsupial animals, to the ordinary mammalia as well as to each other; but so many anomalies present themselves in both of these respects, that it is doubtful whether, in the present state of our information concerning them, an increase of words would produce any increase of knowledge.

Cetacea. This is the last order of mammalia in the view which we have taken of them; and indeed, in strict propriety, they belong to the true mammalia, and therefore should precede the marsupial animals; but it is sometimes convenient to sacrifice a little of the structural arrangement of animals, for the sake of that part of the arrangement which guides us to their localities; inasmuch as, without the study of the locality, as well as the organisation of the animal, we are furnished only with half the lesson of wisdom which the animal is calculated to afford. Indeed we cannot properly appreciate the structure, without taking the locality along with us; because the organs of motion, and the external parts generally, are adapted to the locality; and the internal parts are necessarily adapted to the external, in order that the animal may be one complete and symmetrical whole, and not an assemblage of parts incongruous to each other.

Now, all the mammalia of the orders which we have already noticed, whether placental or marsupial, are, to some extent or other, land animals; for even the amphibia, the seals and the morses, which are more completely formed for the water than any of the rest, can, and do, lie on the banks and rocks for hours at a time, enjoying themselves in the air and basking in the sun; and the others, whether placental or marsupial, which find the whole or the greater part of their food in the waters, are more decidedly land animals, and capable of ranging to some distance over the dry surface. The otter, for example, is rather a fleet walker; and the palmated opossum, though not quite so fleet, is still a tolerable walker. Even the ornithorhynchus, slow as it is, can get on faster than some of the toothless animals which live habitually upon the land; and thus, though they all differ by shades greater or less, there is none of the mammalia belonging to any of the preceding eight orders which has not some capacity of action, both on the land and in the water.

The cetacea, on the other hand, though true mammalia in the whole of their internal structure, and in all the essential points of their economy, considered without reference to the element in which they reside, and for which alone their external form and their organs of locomotion are adapted, are, in consequence of this adaptation, perfectly helpless on the land, or even when they ground on the shallows in such a manner as not to be able again to get afloat. Some of that section of them which are herbivorous, and, as such, approach a little nearer to land, or at all events to shore animals than the cetacea of the sea, can contrive to shuffle a little way up the shallow and back again, in the course of their feeding. But the characteristic cetacea, which are those of the sea, though they do not die for want of breathing, as a fish does which breathes through the medium of water, are yet so perfectly helpless when stranded by accident, that they very speedily perish for want of food, or in consequence of the injuries which they do themselves in their attempts to get off. This draws a perfect line of distinction in point of locality between them and every description of the land mammalia, and completely justifies the considering them as separate from all descriptions of the latter, whether they are, in the physiological character upon which the distinction is founded, equally true mammalia with the cetacea or not. The cetacea claim our separate attention upon other grounds: they are by far the largest and most powerful of all the mammalia; and their pasture is wider in proportion. Setting aside those which frequent the fresh waters, their pasture is in mere extent full two and a third times as great as that of the land mammalia: and when we consider that much of the land is unfit for the support, or even for the travelling, of any mammalia, we are constrained to admit that these animals have many times the range of any or all of those of the same class which inhabit the land only. We do not mean to say that their numbers are greater; because, they are all large animals; and we find, upon examining the land mammalia, that, unless in the case of genera specially adapted for confined and peculiar localities, their numbers increase nearly in the same proportion as their size diminishes.

In the article cetacea, in its alphabetical place in this work, we went into considerable details, both of the general structure and species of these animals; and in a preceding section of this article we had occasion again to revert to their organs of swimming, more especially to that most powerful organ of the whole, the tail of the black or Greenland whale. In consequence of this, it will be necessary only to give a few hints in this place, in order that our analytical list of the orders of the mammalia may be complete, and that for purposes of general comparison, and for inferring from this comparison the relative importance of the different mammalia, the reader may not have to refer from this general article to any particular ones, which reference might disturb his comparison.

Generally speaking, then, the cetacea are mammalia, without a single external vestige of hind feet or legs; and the whole of the posterior part of their body is concentrated into a thick and powerful but tapering tail, which ends in a great cartilaginous lobe, which is placed horizontally, or in a cross direction to that of the caudal fin of fishes; and though their neck consists of the same number of bones as that of the longest and most supple neck of the land mammalia, those bones are so exceedingly short, and so totally without motion upon each other, that there is no bending in any direction of the head in respect of the body, and no bending of the body in the part anterior of the fore-legs. The structure of those legs has been explained in a former section, when it was shown that externally they have the form of a sort of fins, though they still retain so much of the action of the anterior of land mammalia, as to be capable of clasping, and also of striking, and that with considerable force. Their brain, though small in respect of the head in many of the species, is still of considerable size, and the parts of it well developed; but the external organs of the two principal senses, those of seeing and hearing, are small, there being no external ears; and the eyes, though clear and expressive, being very minute

as compared with the size of the animals. From the position of the swimming fin, or lobe, on the extremity of the tail, that organ strikes the water upwards and downwards; and thus it is equally efficient for ascent and descent as for progressive motion. Cuvier was the first who collected the whole of the cetacea into one order according to their organisation, by separating the herbivorous ones from the morses, with which they had been previously confounded. The general structure of these, as adapting them to their element, is the same as that of the more characteristic ones, the difference consisting chiefly in the adaptation of their feeding organs to food of a different description, namely, food which requires to be ground, or rather bruised, by teeth, instead of being conveyed entire to the stomach, and wholly assimilated by the action of that organ in the viscera, as it is in all the rest of the cetacea. They thus may be formed into two families, and those very natural ones,—the herbivorous and the ordinary cetacea, as they are most characteristically named by the great naturalist who first established the order on its proper structural basis.

Herbivorous cetacea. All the teeth of these have flat crowns, which is the truly herbivorous character; and the swimming paws of some of them are furnished with little claws or nails, by means of which they can crawl or climb wholly or partly out of the water, so as to reach and feed upon the grass or other vegetation near the margin. The females have two pectoral mammæ; and both sexes have whiskers of produced hairs, which gives them, when half out of the water, a very slight resemblance to human bodies; and there is little doubt that this resemblance, in animals which are rarely seen, except in parts of the world very imperfectly—and we may add fabulously—known to the ancients, gave rise to all the ridiculous stories about sirens, and tritons, and mermaids, and old men of the sea; nor is it at all unlikely that the type of Father Neptune of the old mythology, and that of the Davy Jones of modern sailors, were borrowed from well-whiskered veteran animals of this family. Now, though they are large animals, they are exceedingly harmless; though those which live upon sea-weed may be more active, and come nearer the shores when a storm is about to loosen their food; for it is a very general instinct of animals, both of the sea and of the land, to feel the circumstances which bring them a supply of food, and to arrive at the place in order to receive it. We are far from saying that the animal has any knowledge of what is coming, in the sense in which we use knowledge as expressive of mental judgment founded upon reasoning from experience. So far from this, that we feel perfectly sure that no animal has any knowledge of the future, or even of the past, in the sense in which we use the word, and sometimes apply it incautiously to them.

It does not follow from this, however, that these and many other animals may not foretel to us the coming of storms, or other changes of the weather; for there are many such indications, in which no animal is concerned. When the light cirri play in more than ordinary numbers and activity in our summer sky, or when the moon shows a zone of gummy light in the winter, the chances are many to one that we shall have foul weather; and yet surely nobody will pretend to say that either the light clouds in the upper air, or the peculiar reflection or refraction of the moonlight which forms the lunar zone, can have any knowledge of the weather. The indication which they give, belongs, however, to the very same class as that given by animals, whether of the land or of the waters.

There is a considerable difference between the breathing of those herbivorous cetacea, and that of the true ones. The latter breathe through apertures in the top of the head; and thus they can breathe though the muzzle is entirely under water. In the herbivora the openings come through the bones of the head nearly in the same manner as in the others, though, as the fore part of the head does not require to be largely produced for the same purpose as in the others, they rise nearer the termination of the muzzle. They do not, however, open even there, but descend to nostrils placed in the front, so that cetacea of this kind cannot breathe without raising the muzzle, in part at least, out of the water; and thus they do not require the blowing apparatus of the other cetacea.

Their organs of digestion correspond with the herbivorous character of the teeth: they do not ruminate, but their stomach is formed into four sacs, two of which are continuous and two lateral; and the intestine is furnished with a large cæcal appendage. There are three distinct genera of those herbivorous cetacea. The first is the *manati*, which name has been corrupted to *lamantin*. Of this there are two species, one of the tropical rivers and estuaries of America, and the other of the rivers of the corresponding latitude in Africa, both of which rivers discharge their waters into the tropical Atlantic; and it is not understood that either of these species is found in any other part of the tropical waters. In the Amazon on the one hand, and the Senegal and the Gambia on the other, they are exceedingly numerous, more especially in the former, where, at the distance of more than fifteen hundred miles from the sea, they supply the people regularly with abundance of animal food of most excellent quality, resembling veal in appearance, but much more juicy. The animal is the *vacca marina*, or sea-cow of that part of the world, and approximates in value to the land cow.

The second species is the *Dugong* (*Halicore*, daughter of the sea), of the north eastern parts of the Indian Ocean and the oriental Archipelago. The mouth of this genus differs considerably from that of the former; for while the manati when full grown has only eight teeth with square flat crowns, the dugong has eight conical ones, united two and two, and the tusks are more persistent. This animal is not described as attaining so large a size as the former, which often exceeds twenty feet in length; but its flesh is not inferior in quality.

The only other genus is the *stellere*, which has been observed in the northern parts of the Pacific. It is different from the others, more exclusively marine; and it is understood to feed exclusively on sea-weed; and it has but one tooth in each side of both jaws, which tooth consists of a plate of some extent, furnished with ridges of enamel fitted for bruising. Its stomach is more simple than that of the other two genera; but its cæcum is very large. Less is known respecting it than respecting the others, because it more rarely makes its appearance on the shores; and its paws are not provided with those claws which enable the others to crawl up the banks, as the ordinary cetacea.

As these are better known, and have been alluded to already in the course of this article, we shall do

little more than enumerate the different families, of which Cuvier makes two, dolphins and whales. The dolphins comprise the dolphins properly so called, the porpoises, the narwhales, and a few others, all of which have the head small in proportion to the size of the body; and the whales contain the spermaceti whales, which have teeth at least in one jaw; and the whalebone whales, which are destitute of these instruments.

Such, in brief outline, are the mammalia, according to the arrangement of the most scientific naturalist of any age; and had we not already exceeded all ordinary bounds with the extent of this article, we should have felt desirous of adding two sections more. The first of these would have treated of the climatal distribution of the different orders, groups, and genera of the mammalia, both as affected by latitude, and by the physical character of the surface; and the second would have consisted of an attempt to trace something like a progressive history of the greater and more important divisions, including those which are extinct, and those which are entirely domesticated. The subjects of both these sections are, however, in great part anticipated, by remarks scattered through the different sections of this article; and therefore we shall not enter upon them, but shall conclude by pleading the great importance of the mammalia for the length at which we have noticed them, and earnestly recommending the farther and more minute study of them to every reader of the "British Cyclopædia of Natural History."

MAMMEA (Linnæus). A South American fruit-tree belonging to the natural order *Guttiferæ*. This is the *Mammee* or wild apricot of the West Indies and the American continent. The fruit is large, about the size of a cannon-ball, and covered by a double rind, the outer tough and leathery, the inner tender and membranous. The flesh, which is firm and of a bright yellow, has a singularly pleasant taste and fragrant scent; but the skin and seeds are very bitter and resinous. It is either eaten fresh or cut into slices with wine and sugar, or made into a preserve. In Martinique the flowers are distilled in spirit, to which they impart their flavour, and form a liqueur called eau-creole. The wood is good and used for many purposes.

MAN. See Bimana, and Mammalia, *Passim*.

MANAKIN (*Pipra*). A group of Dentirostral birds; and the last in Cuvier's arrangement, as possessing some characters in which they approach to the syndactylic birds, inasmuch as they have the two exterior toes united for about a third part of their length. The general characters of the groups are: the bill compressed, higher than broad, a notch toward the top of the upper mandible, and the nasal grooves large. Their tail and feet are short; in the general form of their bodies they bear some resemblance to the tits, but their manners are different. They are all natives of foreign countries, either of the oriental islands or of the tropical parts of America; and the beauty of the plumage in some, and the peculiarities of the habits in others, render them birds of considerable interest. The habits of the genera are, however, so different, that no one general description could be so framed as to include them all.

The three genera are: *Rupicola* (cock of the rock); *Calyptomenes*, which have no English name; and *Pipra* (the true manakins). We shall take these in their order:

Rupicola. Characters: the bill of mean length, stout, slightly arched in the culmen, a little hooked toward the tip and notched, rather broader than high at the base, but compressed toward the tip. Lower mandible straight, notched, sharp pointed; nostrils basal and lateral of an oval form, partly open, but entirely covered with the feathers of the crest, which can be elevated in the form of a semi-circle, not unlike the crest of the hoopoe. Feet stout, tarsus as long as the middle toe; the toes four, three to the front, the external and middle are united to the second articulation, and the inner united to the middle at the base; the hind toe very strong, and furnished with a stout claw; the first quill drawn out in a thread shape and short; the second and third also shorter than the fourth and fifth. The tail short, and squared over at the extremity.

Only one species of this genus is distinctly made out. It is a native of tropical America, a mountaineer, or more strictly speaking a rock bird, and very peculiar in the place which it chooses for its dwelling.

In consequence of the violent internal action by which the northern Andes, that is the Andes of Peru, and that spur which extends from them towards the Caraccas, appear to have been formed, and the violent currents of water to which they have been subjected by the bursting out of lakes, and the violence of the seasonal rains, their surface is more diversified than that of any other portion of the globe of nearly equal extent; the water has in many places cleft channels with perpendicular banks, hundreds of feet in depth, so that it requires the light of a vertical sun to reach the bottom. In some places the softer strata have been excavated away from under the harder ones, thus forming natural bridges of the most sublime character, the chasms, cauldrons, and even cascades below which are so deep, sinuous, and impervious to the light, that they are as dark as Erebus. In countless other places, where the water has not been able to effect a passage through, or where earthquakes, and other agencies may have been at work, there are caves in great numbers, and penetrating so far into the rocks, that they cannot be examined except by torch-light. Those caves are the proper abodes of the rock birds. They occur in great numbers, and are found in the caves at all times; though it is understood that they fly indiscriminately by day and by night. In some of their other habits, besides this habitual dwelling in caves, they bear some analogy to our rock doves, which are understood to be the common parents of all the races of domestic pigeons. They live in pairs, are much attached to each other, and the males more frequently leave the caverns than the females do. The eggs are two in number, of a white colour, and not unlike those of pigeons; the birds are also about the size of pigeons, but they are not nearly so powerful on the wing. Their habit does not require it; for in the vicinity of the dark and damp caves of a country of such powerful natural action as that which they inhabit, there is an abundant supply of insect food at all times, without the bird requiring to range to any great distance at any time. And if this food should fail, they have recourse to the small fruits, which grow plentifully upon the trees and bushes.

But though they have the resemblance to pigeons, which we have stated, they do not belong to the same order; for they are insectivorous in their leading character. They are exceedingly active birds,

and very much on the alert; and though the hunters of that country seek after them with great avidity, it is not easy to shoot them. Residing in the dark cave, even when that cave is not so pitchy dark as to require torch-light for exploring it, their eye sight is far more keen than that of the hunter, who enters from the clear and dazzling light of tropical sunshine; and thus, notwithstanding all the wariness with which he endeavours to surprise them, the thunder of their wings, as they escape by thousands, is often the only evidence he has of their presence. In this again they bear some resemblance to the rock pigeons. These prefer a dark or twilight cavern to a more exposed situation; and as the caverns which they haunt are chiefly those on the shores, in wild and lonely places, where they can be entered only from the sea, the sound of ten thousand wings passes over, and literally stuns any but the most experienced hunter in such places, before he has the slightest chance of getting a shot.

From the shortness and roundness of their wings, the birds in question are not air birds to any very great extent; and they often alight upon the ground, and probably subsist in great part upon ground insects and larvæ. They scrape the ground something after the manner of poultry, of which they possess some of the gestures; and these may have given rise to the inapplicable name of cocks of the rock. This name is inapplicable, inasmuch as they have not the voices, the general habits, or the fertility in a single brood of the gallinaceous birds. How often they may breed in the year is unknown; but the circumstance of never more than two eggs being found in a nest, while the birds themselves are so very numerous, would lead us to conclude that they breed frequently. In the countries where they inhabit, there are no circumstances in the seasons which prevent the birds of the rocks or the woods from breeding at one season more than at another, because food is nearly in equal plenty at every season. As many of the birds of such localities breed only single pairs at a time, and repeat them often, and yet are seen in greater numbers than birds which are more fertile in the single brood, there is some reason to believe that this is the most favourable mode of breeding; because although it extends more generally over the year, the food of a pair of young is, of course, obtainable with less exertion on the part of the parent birds than that of a greater number.

Though the nests of these rock birds are in the clefts and irregularities of the cave, they are formed of dry sticks, which the birds collect with considerable assiduity; but it is probable that the same nest serves for many broods, as it is not exposed to the weather; and as the birds are not of a ranging disposition; the nest is usually very large in proportion to the size of the birds, in order, no doubt, to preserve the eggs and young from the cold damp of the rock on which the nest is placed.

These are rather handsome birds. The general colour is bright orange brown, inclining to red. The crest is formed of a double row of very close feathers. Some white appears in the middle of the wing, and the quills and coverts are brown, bordered with yellow. The greater number of the feathers are square at the ends, as if a part were cut off. The bill and feet are yellow. The length is about eleven inches. The female is less than the male, of a uniform greenish brown colour, and with a smaller crest. The young are dull brown.

Another species or variety is mentioned, inhabiting the same countries, and having the same habits and the same size, but with the quills and feathers of the tail dark brown or nearly black. It does not appear, however, that there is any difference between the two upon which a characteristic distinction could be founded; and indeed it is more likely that the one with the black feathers is merely an accidental variety.

Calyptomenes. This genus, of which only one species is known, resembles the former in its general structure, and in part also in its habits; but it is very different in appearance, and inhabits a part of the world almost diametrically opposite, being found in Sumatra, Java, and the adjoining islands. It is a much smaller bird, being only six inches and a half in length, and thus being not larger than a blackbird. Its colour on the upper part is bright emerald green, very brilliant and shining. There is a black spot on the ear cover; and the coverts of the wings are black, with green tips, which form three beautiful bars across the closed wing. The primary quills are black, and the bill and feet brown. The female is grass green on the upper part, not so brilliant in the lustre as the emerald green of the male; and the under part is paler green, clouded with darker patches. She is without the crest on the head, and the black bars on the wing coverts; for only the tips of the quills and the inner webs are black. Both sexes are, however, very beautiful birds; but generally speaking they live in places which have been little visited by Europeans, and accordingly their manners are but little known.

Both these genera differ in their appearance, and also in their habits, from the true manakins, though there is as much similarity as induced the elder systematists, who did not attend very carefully to all the characters, to include them in the same genus. They are sufficiently allied, and sufficiently different from any other of the dentirostral birds, for being formed into a group; but there is no question about the division of this group into the three genera, of which we have now to consider the last.

Pipra (the true manakins). These are smaller birds than any of the others; but like them they are, generally speaking, remarkable for the beauty of their plumage. There are many species of them, but they are understood to be confined to the warmer parts of tropical America, and to the West India Islands. They differ so much from the others as to merit a separate generic description. Their characters are: The bill short, triangular at the base, where it is a little enlarged in breadth, convex in the upper mandible, which is notched, and pointed in the under one. The nostrils are placed at the sides of the base of the bill, covered in part by a membrane which is ornamented with little feathers: the feet are of mean length, but the middle toe is longer than the tarsus. The situation of the toes, and the union of the external and middle one, are similar to those of the two former genera. The wings and tail are short; and the third and fourth quills are the longest in the wings. They are beautiful little birds, which remain during the heat of the day in the depths of the close forests; and in consequence they are but little seen in proportion to their numbers. They inhabit peaceably; and do not range over the open plains, or approach the plantations to display their bright colours, and levy their contributions on the gardens, unless when the

habitation happens to be very near the wood, which is their strong hold, and even then they do it but rarely. When seen they are always admired, in consequence of the purity and brightness of their colours, the apparent gentleness of their manners, and even their voices, which, though they cannot be called musical, are rather pleasant in their chirping. The early part of the day, before the sun becomes powerful, is the time when they are abroad feeding. At that time they appear in little flocks; but during the rest of their time they live detached, even the males separating themselves from the females. They are difficult to rear in confinement, and seem to feel the want of that morning society, which is very constant, though it occupies but a small portion of any one particular day. They feed indifferently upon insects and berries, but appear to prefer the first. They fly with considerable rapidity, but their flight is low and short. Their nests are formed in thick bushes and trees of low growth, and their eggs, as is the case with all very small birds, are numerous; and this forms another remarkable distinction between them and the rock birds of the South American caves—the number of a brood in the green bird of the oriental Archipelago has not been so fully ascertained.

The species enumerated by different authors are very numerous, but several of them rest upon questionable authority, and are in all probability the same species in the plumage of different ages. We shall enumerate a few of those which appear to be best made out.

Caped manakin (*P. pileata*) is well-established species, and has been found in Brazil, in the humid forests; but it probably exists in many other parts of America. The other parts are bright chesnut; the top of the head, the nape, and the quills, pure black; the wing coverts have an ash-coloured spot on their extremities, and the quills have greenish margins. The cheeks and a streak over the eyes are bright red. The tail is slightly wedge-shaped, with six feathers in the middle, blackish and brown at the tips. The lateral feathers are brown, with yellow bases. The under parts are russet. The bill and the feet yellow, and the length four inches and a half. The feathers on the head admit of being raised into a sort of cape rather than crest; and the female possesses this as well as the male, but it and the upper parts are greenish. Her wings are ash-coloured with grey spots, and greenish margins to the quills. The nest and manners in the forests are imperfectly known.

Red-fronted Manakin (*P. rubifrons*) is a smaller species than the former, being only about three inches and a half in length. The front and rump are red, the upper parts black, with yellow borders to the quills; the two middle feathers of the tail longer than the others, and straight; the cheeks and chin greyish, and the feet brownish yellow; a specimen described by Shaw, as *P. militaris*, is considered as a variety of this one. This species is found in various parts of South America.

Goitred Manakin (*P. gutturosa*) is so named from the feathers on the sides of the neck, which are long, slender, and puffy, and have the appearance of an enlargement or goitre on each side of that organ. The upper part is black, and the under part white; the bill and feet yellow, and the length three inches and a half. The female is russet on the upper part and reddish white on the under. It is described as from the northern parts of South America.

White-throated Manakin (*P. gutturalis*). The whole plumage of this species is glossy black, with the exception of the throat, which is white down to the upper part of the breast; the lower mandible and the internal margin of some of the quills. The upper mandible is black, the feet red, and the length a little more than three inches. In the female, the upper parts are olive green, the under parts white; the quills and tail feathers are blackish brown, and there is a white spot over the eye. This species is also from the northern parts of South America.

Golden-breasted Manakin (*P. pectoralis*). Upper parts bluish black; and head, neck, and lower part of the breast, of the same colour; with a large gorget of brilliant golden yellow on the upper parts of the breast; the under parts reddish brown, the bill brownish, the feet ash colour, and the length three inches and a half. The colours of the female are not known.

Racquet-tailed Manakin (*P. longicauda*). This is one of the largest species, measuring five inches and a half. It is black on the upper parts, bright red on the head, passing into orange at the roots of the feathers; the quills and tail feathers margined with pale blue, the two middle feathers of the tail considerably longer than the rest, having their webs very short for some distance, and then expanding to a little oval disc on each; the chin and throat deep black, the remainder of the under part pale blue, the bill brown, and the feet reddish. The female is dull green on the upper part, mottled with green on the upper parts, and has the sides of the wings whitish.

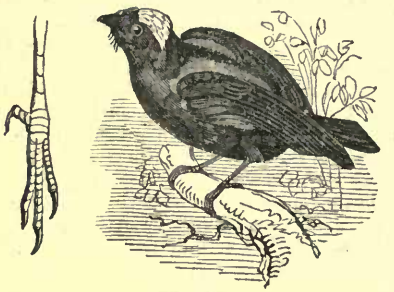
Blue-headed Manakin (*P. cyanocephala*). Olive green on the upper parts, with the head and nape pale blue, and the rump yellow; the quills and tail feathers black, bordered with green; the under parts bright yellow, mottled with green on the flanks; the bill and feet black; the length three inches and a quarter.

Red Manakin (*P. aurcola*). Black on the upper parts; brilliant red on the top of the head, the throat and the breast; forehead and sides of the neck orange yellow; quills, with the exception of the first on each wing, marked with a white spot in the middle; under wing coverts yellowish; belly mottled with black, red, and orange; bill and feet blackish; and length three inches and a quarter. The female is olive on the upper part, and greenish yellow on the under; and she has a ring of red round the top of the head, something in the form of a little coronet. The young are entirely olive, with the front, neck, throat, breast, and vent feathers spotted with red. They do not acquire the black till they are adult. This species has been observed in Guyana; and as the young and the female are very different from the male in their plumage, and have been observed with care, we are naturally led to suppose that many of the species which have been described from a solitary specimen, are the young of others, which assume very different aspects in their mature plumage. It is important to know that any genus of birds is subject to changes of this kind, because the changes always run more or less through every species of the genus; and this ought to teach systematists a little caution as to the number of species which they establish from colour alone. In its mature plumage, this is one of the most beautiful of these birds,—beautiful as most of them are.

Green Manakin (*P. stringillata*). This is a Brazilian species, three inches and a quarter in length, and the female is a very handsome little bird. The upper part is of a rich green colour, and the top of the head ornamented with a fine crest of the most brilliant red. The quills are brown, bordered with

white on their inner webs; the tail feathers are very short, and of a greenish ash colour; and the under parts are yellowish white, finely pencilled with brown lines; the bill is brown, and the feet yellow. The female is entirely green on the upper part, and without the crest; and brownish yellow on the under.

Blue-backed Manakin (*P. parceola*). This species is found both in the West India Islands, and the tropical parts of the American Continent; and, like the last, it is a very handsome bird. Its length is four inches and a half. The plumage on the upper part of a deep velvet black, with the back and the wing coverts sky blue, and the top of the head is covered with bright red feathers, forming an erectible crest. It is subject to some varieties in colour even in the mature bird; for specimens are met with having the crest orange, and others with all the upper parts green. The female is olive on the upper part, passing into yellow on the under, and has no crest. The young male is also without the crest, and all over of a greyish olive.



Manakin.

Besides the species which we have enumerated, there are perhaps a few others which are well established, though the greater number of those we have omitted seem to be doubtful. This seems to be especially the case with some species which have been described as natives of New Holland, and others as natives of Southern Africa. We do not question the existence of the birds thus described, in either the one country or the other; but we incline to the opinion that this genus belongs entirely to America. It is an obscure genus in its general habits, and it is one of which (from the causes that we have mentioned) the species cannot be settled without a good deal of difficulty. But the established species are so many, and the birds are so generally distributed in the close and damp forests, or, more strictly speaking, on the margins of the little openings with which these are interspersed, that we must reckon them among the most characteristic of the small birds of tropical America. They are strictly tropical, both in their plumage and in their geographical distribution; and the particular character of their plumage, though pure and brilliant in its colours, points them out as being—in part, at least—vegetable feeders, and as having no predatory habit about them, farther than capturing small insects. The omnivorous birds of those latitudes, and, generally speaking, all birds which are disposed to be pugnacious with their winged neighbours, have metallic glosses and reflections in some parts of their plumage, as if they were clad in armour for the purpose of fighting. This extends even to the humming birds, which, notwithstanding their diminutive size, are exceedingly bold and pugnacious in their dispositions, and drive their needle-like bills at the eyes of birds ten or even fifty times their own size. The dwellers in peace, again, which annoy no bird, have their plumage beautifully close and soft, but without any reflections, so that their colours appear the same in whatever direction the light falls upon them.

MANCHINEEL, is the *Hippomane mancinella* of Linnæus, a lofty West Indian tree, said to be poisonous to horses. The flowers are monœcious, and the tree ranks among the *Euphorbiaceæ*. The sap, which exudes when the boughs are cut or broken, is very acrid; it will blister and sphacelate the skin, and if inserted into wounds cause death.

MANDRAGORA (Tournefort). A genus of European herbaceous perennials, belonging to *Solaneæ*. This is the famous mandrake of the ancients; the root is carrot-shaped and fleshy, and often forked. Fanciful people have thought that when thus divided, it bears some resemblance to the legs of a man; and the crafty have not failed to assist the folly of superstition by artfully increasing the similitude, and attributing to the plant supernatural powers.

MANETTIA (Meetis). A genus of climbing plants, natives of the West Indies; the flowers are tetrandrious, and belong to the natural order *Rubiaceæ*. Generic character: calyx of from four to eight or ten segments; corolla tubular, throat contracted, limb four-parted and hairy within; stamens inserted on the throat, and included; style simple; stigma bifid; seed-vessel of two valves, seed roundish with membranaceous margins. These plants thrive in any light soil, and are easily propagated by cuttings.

MANGIFERA (Linnæus). An East India fruit-tree belonging to *Polygamea Monœcia* of sexual botany, and to the natural order *Terebinthaceæ*. Generic character: calyx of four parts; corolla of five lanceolate petals larger than the calyx; stamens one fertile, the others sterile; style filiform; stigmas headed; fruit a one-seeded drupe, flesh full of woody fibres near the nut. This is one of the best of tropical fruits, and is extensively cultivated both in the East and West Indies. By cultivation they are very much improved in quality; some of them being as free from stringiness as are our best clingstone peaches. They contain a rich yellow melting pulp, but though highly gratifying to the palate, they can hardly be compared to our best peaches. The trees have been long inmates of our stoves, and pretty good fruit have been matured both in France and England. And no doubt when the trees which we have now in cultivation attain a greater size and age, they will frequently bear fruit, especially if some pains be taken to assist impregnation.

MANGROVE, is the *Rhizophora mangle* of Linnæus. A curious Indian tree, growing on the banks of large rivers, or on the sea-coast, and even within the bounds of the ocean as far as low water mark. Their mode of rooting is peculiar: it consists, not like that of ordinary trees of divisions of the stem below the surface of the ground, but as it were of arches of roots above it, so that a more extended base is formed, and a firmer hold established in the loose and swampy soil. From the summit of these arched roots the trunk of the mangrove springs, and attains a considerable height. Another remarkable property of this tree is its habit of reproducing itself viviparously: that is, its seeds germinate and emit roots before they are shed from the capsules.

MANTICORA (Fabricius). The first genus of colcopterous insects in the system of Latreille, be-

onging to the family *Cicindelidæ*, or tiger beetles, and composed of a large species inhabiting South Africa (*M. maxillosa, tuberculata*, De Geer), having the tarsi cylindrical, and alike in both sexes, the abdomen very large and entirely embraced by the elytra, which are soldered together, the wings not being developed; the mentum is also furnished with a central tooth. The insect is entirely of a black colour, and is found in sandy situations.

MANTIS (Linnæus; or rather MANTIDÆ). A family of predaceous insects, belonging to the order *Orthoptera*, and section *Cursoria*, Latreille, distinguished by the five-jointed tarsi, the longitudinally folded under-wings; the extended prothorax, prominent head, and narrowed and elongated body; the palpi are short, and the fore legs raptorial.

The singular attitude assumed by these insects when about to seize their prey, which consists of other insects, has obtained for them the name of mantis, that is, soothsayer. Taking their station in a convenient situation, and remaining immoveably fixed with the long prothorax elevated in the air, their fore legs being prepared to seize their prey, the mantidæ pass many hours in this position, and the superstitious inhabitants of the countries where they are found, have fancifully considered that they indicated to the passers by the road which they ought to follow, and even that they were able in some mysterious manner to predict future events. The long fore arms of the insect elevated in the form of arms, at the same time with the head and thorax, have also caused these insects to be compared to persons in the act of prayer, whence they have obtained the vulgar name of *Prégadiou*, or *Prie Dieu*, in the southern parts of France and Italy, and the same idea has induced the application of such specific names as *Mantis religiosa, precaria, sancta, oratoria*, &c. The names of other species, *mendica, pauperata, superstitiosa*, have originated in the curious begging attitude of the insects; hence in some countries they are regarded as something sacred, and which the inhabitants consider it a duty not to harm *.

These are the only orthopterous insects which subsist upon other insects, and for this end their entire structure indicates strength and agility. The legs are long and slender, and support a long and slender body. The prothorax itself is disproportionably long in many species, but this gives a very great increase of motion to the head: the head itself is vertically attached by means of a short kind of slender neck, which permits great freedom in its rotatory motion. But the most curious part of the structure of this group of animals consists in the organisation of the fore legs, which are much stronger than the posterior legs, and are occasionally used in walking or running, but ordinarily their usage is the prehension of their food, and nothing can exhibit a more beautiful adaptation of structure to functions than is to be observed in the fore leg or hand of the mantis. The coxæ are very long, and, indeed, have by some writers been regarded as the real femora, but such is not the case; the trochanter is the minute following joint, and is succeeded by the femur, which has been sometimes considered as the tibia, and which is very robust, and armed on the inside with two rows of strong spines, between which the tibia is received when unemployed, this tibia is curved and also armed with spines along its whole inner length, and is terminated by a strong hook which folds upon the femur. At the basal part of the hook the true tarsus is attached, consisting of five slender joints, and which in no way assist in securing the prey. When, therefore, a mantis is about to seize a fly or any other insect, feeble it is true, but very active, it elevates the fore part of the body, resting upon its four hind legs, the middle pair being advanced forwards, the anterior femur is brought into contact with the coxa, and the tibia rests upon the femur; no sooner is the luckless insect sufficiently near, than the fore leg is extended to its full length, and the insect immediately seized by the tibia, which is immediately folded upon the femur, the prey being completely secured by the numerous teeth which arm both the femur and tibia, and is then leisurely devoured; should the fly escape, the mantis follows it in the most cautious manner, moving almost imperceptibly along, until it is again within reach, watching it with the same eagerness as a cat does a mouse.

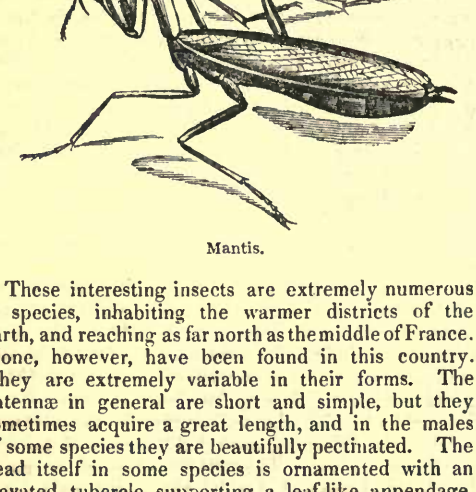
Rösel has given an interesting account of the history of one of these insects in the fourth volume of his Insecten Belustigung, from which it appears that they are very voracious; he kept some a long time, feeding each with four or five flies per day, the females requiring as many as six, being larger. When, however, two were placed in a box together, their carnivorous instinct impelled them to violent combats, cutting at each other with their fore legs, and not ceasing until one had decapitated the other. Even when very young, they attack each other, and the male occasionally falls a victim to his unwilling partner; even after coupling the former pays the forfeit of his life, being killed and devoured by his bride: and it is even stated in the seventy-fifth volume of the Journal de Physique de Rozier, that an instance had been observed, in which the female had first cut off the head of her mate, coupling had afterwards taken place, and the male was subsequently devoured by the female. The Chinese, aware of this fighting propensity, keep these insects in little bamboo cages, and match them together in combat, as is done in this country with fighting cocks.

After impregnation, the female takes her station on the twig of a plant, and remains there several hours, without any other motion than a very slow progression, during which the eggs are deposited, and are covered with a soft and whitish substance, forming a large mass, which may be easily mistaken for a fruit, and of which the form varies in the different species, the substance soon hardening, and gaining a yellowish colour. The eggs are arranged in regular series, out of one end of which the young make their escape at the expiration of nine months after the deposition of the eggs, which takes place in September, the young not being produced until the following June. The young larvæ have all the appearance of their parents, but are destitute of wings and wing covers. Rösel, indeed, having opened an egg previous to the bursting forth of the larvæ, mistook for a pupa the little creature therein contained, although at the same time he was acquainted with the state which was really analogous to the pupa, and in which the wings and wing covers are very short and rudi-

* "So divine a creature is this esteemed," says old Mouffet, that if a childe aske the way to such a place, she will stretch out one of her feet and show him the right way, and seldom or never misse. As she resembleth those diviners in the elevation of her hands, so also in likenesse of motion: for they do not sport themselves as others do, nor leap nor play, but walking softly she returns her modestly, and showes forth a kind of nature gravity."

mental, as in the grasshoppers. The larvæ change their skins several times, but arrive at the imago state in about three months.

The *Mantidæ* are found in situations exposed to the hottest sun, appearing most active in the greatest heat. In the South of France they are much more inactive towards November, and may then easily be caught. At all times, however, it is difficult to escape being wounded by the acute spines of their fore legs, which readily pierce the skin. In some species, indeed, the fore legs are nearly destitute of these spines, and of a short size; they must, therefore, be less carnivorous than the others, conducting naturally to the following family, *Phasmidæ*, in which the fore legs are of the ordinary structure. Some species, forming the genus *Eremiaphila*, first discovered by Savigny, and more recently by M. Lefebvre, in the desert plains of Egypt, where insects are rarely to be met with, are nevertheless powerfully armed. And hence it has been conjectured that these insects must possess the power of sustaining a long fast. Their movements, moreover, are very slow; but they differ from the other *Mantidæ* in the colour of the body, which resembles that of sand, upon which they are found. Hence, perhaps, we may attribute to them the possession of a deceptive art in procuring food, of which we have given other instances in our general article, INSECT.



Mantis.

These interesting insects are extremely numerous in species, inhabiting the warmer districts of the earth, and reaching as far north as the middle of France. None, however, have been found in this country. They are extremely variable in their forms. The antennæ in general are short and simple, but they sometimes acquire a great length, and in the males of some species they are beautifully pectinated. The head itself in some species is ornamented with an elevated tubercle, supporting a leaf-like appendage. The ocelli are three in number; the eyes large, globular, and lateral; the prothorax is sometimes furnished with flattened wing-like appendages at the sides, varying in size, and sometimes giving this part of the body a remarkable appearance. The four hind legs are generally single, but in others the femora are furnished near the tips with leaf-like appendages. The wing covers are also very variable in form, and the abdomen is furnished at the extremity with two conical articulated filaments, as in the *Blattidæ*. The males do not appear to be provided with the two short threads between the preceding, which are found in the male *Blattæ*, but this sex may be easily distinguished by the number of abdominal segments, of which there are eight in the males, and only six in the females, on the ventral part; whereas there appear to be nine dorsal segments in both sexes. The females are also easily distinguished by the large size of the terminal segment of the body, which is preceded by equal sized segments; whereas the terminal segment in the male is very small, the preceding being very short. Latreille united all these insects into a single genus *Mantis*. M. Serville, however, in his classification of the *Orthoptera*, published in the Annales des Sciences Naturelles, proposed numerous genera founded upon various structural peculiarities, which it is unnecessary to dilate upon in a work like the present, having already noticed the most material modifications to which these insects are subject. M. Lefebvre has also added some other genera in his memoir upon the *Eremiaphila*, published in the "Annales" of the Entomological Society of France.

MAPLE is the *acer* of botanists, so called from the sharpness of their juices. There are many species either shrubs or trees; four of them are British, common in hedges. This genus gives a title to one of the natural orders, namely *Acerineæ*.

MARANTA (Linnæus). A genus of reed-like plants found in the warm parts of America, belonging to the natural order *Canneæ*. They are nearly allied to ginger, but the pungent aromatic principle is wanting. The tubers contain much fecula, which is collected and prepared as food; and, from its former use as a cataplasm for arrow-wounds, it is commonly known under the name of arrow-root. This farinaceous substance is procured from many different species, but chiefly from *M. arundinacea*, in the West and from *M. allouya* and *ramosissima*, in the East Indies. In our stoves they grow well in light, rich soil, and are increased by dividing the roots.

MARCGRAVIACEÆ. A small natural order of plants, containing four genera and six species. The genera are *Antholoma*, *Marcgravia*, *Norantea*, and *Ruyschia*. They are all very curious half-climbing shrubs, or small trees, with pitcher or hood-shaped bractæ, something resembling the vessels formed by the metamorphosed leaves and leaf-stalks of *Cephalotus* and *Nepenthes*. Of the properties of these plants there is at present nothing known, and even their station in the system is debatable. There are two suborders, namely, *Marcgravieæ* and *Noranteæ*. In the former, the corolla is calyptriform; while in the latter the five petals are free.

MARMOT (*Arctomys*, literally "bear rat," or rat having the body formed something like that of a bear). Under the article ARCTOMYS, in its place in the alphabet, there will be found a few remarks on the general characters and habits of this genus of rodentia, and a reference to the present article for the species, the chief of which we shall now enumerate as briefly as possible; but, it may not be amiss to mention the generic characters in brief, because the genus consists of two sections; or rather, it is a family or group, consisting of two genera, which differ considerably in their structure. The characters are two very strong incisive teeth in each jaw rounded on their anterior surfaces; no canines in either jaw; five cheek teeth on each side of the upper, and four on each side of the under, with their crowns furnished with ridges, and also with tubercu-

lous points; the body thick and heavy; the head and eyes of large dimensions, but the ears small; the feet very strong, with five toes on the hind ones, and four, together with a rudimental thumb, on the fore. The claws upon all very stout and compressed, but better adapted for digging than for prehension, though all the animals have clavicles, and can bring the fore feet to the mouth. The two sub-divisions, or sub-genera, which have been established by M. F. Cuvier, are chiefly founded upon the absence or the presence of cheek pouches: but, in the greater number at least, there is another important character which accompanies this; those which are without cheek pouches are social, living in considerable numbers, often several families in the same burrow; and those which have cheek pouches are solitary, living singly or, at most, in pairs. The old generic name, *Arctomys*, has been restricted to the social species without cheek pouches, of which the Marmot of the Alps is the type; and the solitary division, with cheek pouches, of which the Souslik, or Siberian Marmot, is the type, has received the name of *Spermophilus*. We shall take the enumeration of the species under these names, for the sake both of perspicuity and brevity, though there are some of the imperfectly known species which it is difficult to arrange.

Arctomys. The chief distinction of these having been mentioned just above, there is no necessity for repeating it.

The *Marmot of the Alps* (*A. marmota*) inhabits, as its name implies, the Alps, and some of the other lofty mountains of Europe; but it is not found even in the most mountainous parts of the British Islands. It is an animal rather more than a foot long from the nose to the root of the tail; its colour is subject to some variation; but the prevailing colour on the upper part is dark grey, with the tip of the tail black. The feet whitish, the part surrounding the muzzle whitish grey, and the under part of the body bright brownish red. Its large head, its clumsy body, and its short thick legs, give it what one would be apt to consider an expression of stupidity; but in the case of no animal is the external appearance more at variance with the facts. In a state of nature it conducts the making of its burrow with greater neatness, and keeps it in better order than any of the burrowing rodentia, and its domestic economy is scarcely inferior to that of the beaver itself. In fact, though the hut of the beaver is a structure reared, and the burrow of the marmot is excavated, there is an ingenuity in the one burrow which is not found in the other. It always consists of two galleries, the one of which contains the dwelling and the entrance to the dwelling; and the other, which meets this, but has a greater inclination and opens further down the slope, and at a lateral distance, is a sewer or drain, by means of which the inhabited portion is always kept dry and comfortable. The nest consists of a great quantity of dried grass and moss, and is made sufficiently large for holding a considerable number of the animals, which keep one another warm during the inclement season, which is often very severe in the elevated places which these animals inhabit. All the society which inhabit the same burrow work in concert, both in preparing it and stocking it with those provisions which are necessary before they pass into a dormant state for the winter, and after they awake in the spring, and before the fields are fit for their support. It is very generally said, that in carrying home their stores, one of the society allows the others, and even invites them, to use his body as a sort of sledge. He turns on his back, and is loaded with as much of the dry grass, or moss, or other necessary of a marmot's life, as he can hold together with his paws. When he is thus loaded his comrades seize him by the tail and pull him along with his load, he contriving to keep steadily on his back all the time. As those which act horses to this singular sledge get tired, they are relieved by others; and if "sledge" himself gets exhausted, another is loaded, and so on until the load is safely conveyed to the burrow. There are many other little particulars in their domestic management, contributing to comfort or to cleanliness, the detail of which would render this article too long.

The marmot of the Alps is easily tamed; and in a domestic state it is a very docile, gentle, and intelligent creature, and may be taught many little tricks, all of which are amusing, and none of them offensive. It is not so productive as some of the other rodentia, there being only one litter in the year, each litter consisting in general of about five; but the animals are subject to fewer casualties than one would suppose, in the cold places which they inhabit, and where the keen eyes of eagles and vultures and other powerful birds of prey may be supposed to be frequently upon them. They are very vigilant creatures, however; and it is understood that when they are engaged in their labours, they always have a sentinel posted on some rock or other eminence, who keeps careful watch, gives notice of danger before it is near, and has himself some little place into which he can retire and remain till the danger is over.

The *Polish Marmot, or Bobac* (*A. bobac*) is nearly of the same size with the former, but is a little different in the colour. The general colour is yellowish grey, mottled with brownish black, with the under part of the body yellowish russet, and the throat and tail reddish. A portion round the eyes is brown; and that round the muzzle is silver grey. Its native localities are further to the north than those of the marmot of the Alps; for it is found from Poland to Kamtschatka. It does not inhabit such elevated places, however, as the Alpine marmot; and therefore, though it is found in higher latitudes, it does not follow that it is in a colder climate. It is also careful in selecting the exposure of the situation in which it forms its burrow, and also in the kind of soil in which it is made. It always builds or burrows in a bank sloping to the south, and in dry soil. The burrow is deep, and lodges a colony of from twenty to thirty individuals. The quantity of dried grass introduced into these social burrows is very great; and they are equally industrious in their labours.

The *Maryland Marmot* (*A. monax*) is an American species, belonging to the same division as the two European ones which have been mentioned, and nearly of the same size. It does not inhabit the very cold places of America, but rather the central and southern parts of the United States, and perhaps places further to the south; for Catesby styles it "the Bahama rabbit." In the United States it is called the ground hog, and various other local names, none of which are very applicable. Its colour is rusty brown, rather darker on the flanks than on the middle of the back; a portion round the muzzle is bluish grey, and the tail is black.

The *Quebec Marmot* (*A. empetra*) is not the Canada marmot of Buffon, though it is that of some of the

later and more accurate French naturalists. Buffon's Canada marmot is the Carolina one last mentioned, which, instead of being found in Canada, does not reach the northern, or even beyond the central part of the United States. This is of a blackish brown, mottled with white in some places. The top of the head is a uniform brown, passing into reddish brown on the nape. The cheeks and chin are whitish grey; the breast and paws bright red; and the tail, which is short but covered with abundance of hair, is black. It inhabits very cold countries, being found in great numbers in the environs of Hudson's Bay, where, of course, it passes a considerable portion of the year in a dormant state. Though it is the American species which has been longest known, there have been some mistakes besides that of Buffon, to which we have alluded. The marmots, and the smaller ground mammalia of North America generally, to whatever order they belong, form a department of the history of mammalia upon which information is still very much wanted. The country is so very wide, so well adapted for animals of this description, and many parts of it are so difficult to be explored during the summer, in consequence of floods and quagmires, that there may be many animals of this description, especially hybernating ones, of which we may be still ignorant.

The *Missouri Marmot* (*A. Missouriensis*) inhabits the dry plains on the western side of the great central valley of North America, extending southwards toward Louisiana, in many places of which it is exceedingly abundant. Its general colour is reddish brown, with a large head flattened on the under part, the eyes very large, with the irides of a dull brown colour; but the ears so short, that they appear as if they had been shortened by art. The cheeks and a portion over the eyes are furnished with long hairs; and the whiskers of moderate length and of a black colour. All the feet have five toes, furnished with long black claws; and the feet themselves are covered with very short fur. These animals are so abundant in some parts of the valley, that their burrows extend over a surface several miles in circumference. Their cry, which is loud and peculiar, has procured them the local name of 'prairie dogs'; the last part of which name is, of course, absurd; but they are strictly enough prairie animals, being found only in the dry plains to which this name is given, and never upon the humid savannahs, which would not of course suit their burrowing habits.

The *Short-tailed Marmot* (*A. brachyura*) has the social habits of the last mentioned one, and inhabits nearly the same places, only it appears to extend westward as far as the prairies on the banks of the Columbia river, and perhaps as far southward as Upper California and the Texas, if not further. It is generally speaking of a brown colour, mottled with reddish grey on the upper part, with a tail only one seventh part of the whole length. Reddish brown on the upper part, iron grey on the under, and marked with white along the sides intermediate between those colours.

The *Red Marmot* (*A. rufa*) is a species but imperfectly known, and understood to have its habitat in the dry bushy plains by the banks of the Columbia, and other places further to the west. It is described as having the fur all over of a reddish brown, with the ears very small, and covered with reddish brown fur.

Another species, the *Barking marmot*, (*A. latrans*) has been described as living in a social state in the same localities which are assigned to the Missouri marmot. Its colours are nearly the same with the latter, and its feet have the same structure, namely, five perfect toes upon each. The probability therefore is, that it is identically the same animal described from a specimen accidentally a little redder on the back than they are generally seen. This probability amounts almost, if not altogether, to a certainty, when we bear in mind that the sound of the Missouri marmot is considered in the places where it inhabits as so much resembling barking, that the animal is called the prairie dog.

The species of the social marmots of America require to be examined with a good deal of care. Many of them have been founded upon single specimens, some of them obtained from the Indians, and perhaps have been judged of without the requisite degree of attention to their structure. Now social animals require fully more care in this way than solitary ones. Living in the society of each other is the intermediate step between living solitary in wild nature and being domesticated; and therefore we might be prepared to expect among these social animals, a little of that breaking down of the uniform colour which is so common among domesticated ones. Besides this, the social ones are generally far more numerous than the solitary; and we may conclude that the probability of breaking down into differences of colour shall increase with an increase of numbers, though not necessarily at the same rate. We want information indeed respecting many of the animals of the Rocky Mountains; and it is not impossible that, in a country so extended, and so varied both in its surface and its climate, many may be discovered in future, of which we at present know nothing. It is true that the great Bonassus, which was several years ago exhibited in Britain, as an undescribed marvel from that part of America, was an unprincipled hoax, for the purpose of raising money by its exhibition; but it by no means follows that respectable naturalists, or respectable travellers of any class, could be guilty of anything of this description.

SPERMOPHILUS. We have already mentioned the leading characters, both of structure and habit, which distinguish this genus of the group from the true marmots, namely, the possession of cheek pouches, and being solitary, not social. There are, however, a few other characters, which are worthy of notice, as pointing out more clearly the proper place of this genus in the order of rodent animals, which is that of a connecting link between that of the true marmots and the ground squirrels. The most remarkable of these are the feet and legs more lengthened, the feet longer, and all free, with a single tubercle at the base of each, not covered with hair. The most remarkable difference, however, is in the bones of the head, the oval pupils of the eyes, and the perfectly free toes.

The *Siberian Marmot*, the *Souslik*, or *Zizel*, (*S. sitillus*,) is the typical genus. It is of a yellowish brown colour on the upper part, varied, and spotted with transverse markings of white, and has the under part entirely white. The cheek pouches are large for the size of the animal. It is by much the most handsome of all the marmot group or family; and when it was considered as a regular member of that group, it was considered as the variegated marmot. There are

however, one or two coloured varieties, one spotted, another waved, (which is the one to which the name zizel is more immediately applied,) and a third one is of a uniform yellowish brown. This species is understood to be considerably more carnivorous than the true marmots; for, along with its hoards of seeds and small fruits, the bodies of little quadrupeds are met with. The name Siberian marmot is not very correctly applied to it, inasmuch as it occurs in longitude from Bohemia and some other parts of Germany, eastward to the shores of the Pacific, and southward to Persia and India.

Parry's Marmot (*S. Parryi*) is an American species, belonging to the same genus, and is found in the extreme north of the American continent, having been noticed by Hearne on his journey, and it was considered by him as a ground squirrel. Richardson observed it again on Franklin's expedition, and assigned it its true place in the system. It has the fore paws with five toes on each, the external ears exceedingly small, and the tail long, and black at the extremity. The upper part of its body is mottled with black and white, and the under part is rusty red. It is furnished with cheek pouches; but though we may conclude from its structure that its habits do not differ greatly from the species last described, it has not been observed with sufficient minuteness for enabling us to state positively anything respecting its habits.

Franklin's Marmot, (*S. Franklinii.*) This species is known in its native country by the name of the grey marmot of America. The hair on the upper part of the body is short, and barbed or annulated with a number of colours, consisting of blackish, sandy white, black and white, yellow and blackish, blended together on different parts of the hairs. The hairs on the under part are blackish at the roots, and sandy white at the points; and those on the tail are annulated in a similar manner. These different colours of the single hairs of the covering give the animal a greyish appearance, with the exception of the long hairs above and below the eyes, and the moustachios, which are black.

Richardson's Marmot (*S. Richardsonii*) is another native of the far northern parts of America, which is locally known by the name of the tawny marmot. The top of the head is covered with short hairs, which are black at the base and brighter coloured at the points. The muzzle and cheeks are brownish, and the brown hairs mixed partially with the blackish ones on the top of the head. The throat is sandy white. The upper part of the body is covered with soft fur, blackish at the base and yellow at the points, which gives it the tawny appearance from which it obtains its local name; but the middle of the back is of nearly the same colour as the top of the head. The flanks are greyish brown; and all the under part reddish brown. The tail is covered thinly with long hairs, which are annulated with different colours. The external ears are oval and short. The inner toe on the fore foot is very small, and has a short blunt claw; the toes on the other feet, both before and behind, are well developed, with horn-coloured claws, very sharp and crooked. It is presumed that this species partakes a good deal of the carnivorous character; but both its manners and its habitation are very imperfectly known.

The *Powdered Marmot* (*S. pruinosa*) is another North American species, about the size of a rabbit. The point of the nose is black; the ears short and oval; the covering on the upper part formed of hairs annulated with three different colours—ash-coloured at the roots, black in the middle of the length, and white at their extremities, which gives the animal the appearance of being dark grey, powdered over with whitish. The tail is a mixture of black and red, and the cheeks are whitish.

These species are probably not the only ones in the extreme north of America; and as the species of the eastern continent is known to break into differently coloured varieties in places which differ in their physical characters, it is by no means improbable that the American ones may do the same; and that some of those which have been described and named as different species, may be only accidental varieties of the same.

All the animals of this genus are more nocturnal in their habits than the true marmots; and from this, and their living solitary and in wild places, their manners are not so easily studied; neither is it easy to come to a just conclusion as to what is a species and what is not. Social animals can always be studied with comparative ease; because their social habits make them less afraid of man than the solitary ones are; and there is the advantage of seeing numbers of them together, which is always a certain means of establishing species, and ascertaining habits in a more satisfactory manner, than when only one species can be seen at a time. Altogether the marmot group, both in the true marmots and in the allied genus of which we have now given an outline, are interesting animals, from their peculiar habits, and also from the place which they occupy in the classification.

MARSDENIA (R. Brown). A genus of very fragrant under-shrubs, natives of Syria and New South Wales. They belong to the fifth class of Linnæan botany, and to the natural order *Asclepiadeæ*. They are easily managed greenhouse plants.

MARSH CINQUEFOIL is the *Comarum palustre* of Linnæus, a common British bog plant belonging to *Rosaceæ*.

MARSH MALLOW is the *Althæa officinalis* of Linnæus, a British plant formerly famous for its medicinal qualities. It belongs to *Malvaceæ*, and is most frequently met with on salt marshes.

MARSH MARIGOLD is the *Caltha palustris* of Linnæus, a very conspicuous British plant frequently seen in damp meadows. It belongs to *Ranunculaceæ*. A double variety of it is cultivated in flower-gardens.

MARSUPIALIA. Mammalia which have a double gestation, and, generally speaking, an abdominal marsupium or pouch for receiving the young. See Mammalia.

MARTEN (*Mustela*). An extensive genus of digitigrade mammalia, first established by Linnæus, but considered as a sort of sub-tribe or section by Cuvier, and by him arranged into four genera. An account of the last of these in Cuvier's order, the otter, will be found under the title Lutra in its place in the alphabet; and therefore the details of this article will be restricted to the other three. There is some advantage in thus separating the otters from the rest; because though in their general structure they agree with the others, and are equally carnivorous, yet they have webbed feet adapted for swimming and feed upon fish, while the rest of the section, in all the three genera, feed chiefly, and many of them

exclusively, on warm-blooded animals; and their cheek teeth are of a more bruising and tearing character than those of the otters.

Martens of every genus have six incisive teeth, two canine, and two carnivorous, and two tuberculous teeth in each jaw; but the number of their false molars is subject to some variations, which are attended with differences in the general character and habits of the animals, and for this reason they are worthy of attention. Many species have six above and eight below, and others have only six both ways, so that the total number of teeth varies from thirty-eight to thirty-four. These variations in the number are not, however, of very primary importance, because it is the form of the teeth which is our best guide to the food and feeding of any of them, and the number is rather a secondary matter. The additional four teeth which occur in many of these animals are never so fully developed as the rest, and they are sometimes little more than rudimental. Their establishment in the jaw is less firm, as they have only one fang or root, while all the others have two or more: they are also less efficient in their crowns, which consist of a single smooth and blunt point. The other false molars, which are more firmly established in the jaw, are narrow from the outside to the inside, broad from the front to the rear, and very sharp in the points. The carnivorous teeth which come behind these very much resemble those of the cats, which are the most carnivorous of all animals; and thus the martens have a very strong carnivorous character in this particular tooth. The upper one has an internal tubercle which is very distinct; and the lower one has a heel or projection on the back part, which decreases its cutting and tearing character. The tuberculous teeth in the lower jaw are small, rounded, and have their crowns formed into three points. The upper ones are much larger, especially from the front to the rear; and they have a furrow in the length of their crowns, irregular in its depth, and well calculated for acting against the irregularities of the lower teeth in bruising flesh in its recent and tough state. The whole mouth indeed is of a highly carnivorous character.

The legs of the whole are short, and the foot always consists of five toes, which are united by membrane for a great part of the length. The inner toe is the shortest of the whole in all the family, and the middle and fourth ones are usually the longest. The remaining two, though shorter than these, are both of equal length. The balls of the toes are furnished with naked tubercles of an oval form, and there is another in the middle of that part of the foot which comes to the ground in walking, and this middle one has three lobes directed toward the toes. The foot is thus both a firm one and one not liable to be injured, though planted with force upon hard and rough surfaces; and thus the animals can bound and leap after their prey with great agility, in which they are further assisted by the length and elasticity of the spine. The claws of all, with the exception of the *zorilla*, or polecat of the Cape, afterwards to be noticed, are crooked as well as very sharp in the points, though they are in no species decidedly retractile like those of the cats. Most of the species can, however, climb walls and trees, and get over lofty obstacles and through small openings, with very great facility.

The body is, in all the species, long and slender, and, though elastic and capable of being made very stiff by muscular exertion, it can also move more lithely than that of most other mammalia. The covering is soft and fine in all the species; and it consists of two kinds of fur, the one longer, silky, and glistening, the other short and woolly, and remarkably close. In most of the species the skin is very firm, and both kinds of fur stick firmly to it; and if we except that of some animals which live habitually in the water, the skin and fur of the marten tribe are less liable to be injured by the weather than those of any other small animals.

On this account the skins of many of them are sought after with great avidity as furs, on account of their warmth, their beauty, and their durability jointly; and though the skins of various other animals are used as furs, those of the marten tribe are most valued, and they themselves considered the fur animals by way of eminence. In one or other of the species they occur in almost every part of the world, with the exception of Australia and some of the remote islands; but the regions of the north, close by the shores of the polar ocean, are especially their head quarters; and it is there that the finest furs are obtained, and they are obtained in immense numbers both in the Eastern continent and in America.

None of the martens pass the winter, or any part of it, in a state of lethargy, even in the coldest places which they inhabit. They are animals of too much energy for this; for, though many of the hybernating mammalia can make considerable exertions during the season of warmth and activity, there is always a trace of something sluggish about them. The martens, on the other hand, are so full of energy and life, and so strong in proportion to their weight, that it is exceedingly difficult to fatigue them; and, what is not universal among animals, they are as tenacious of life as they are energetic in the exercise of it.

Protected as they are by their double covering of fur, they are nearly indifferent both to changes of temperature and changes of the weather. They do not pant in the summer's heat, neither do they shiver in the winter's cold. Rain, or immersion in water if that be necessary, does not readily wet their living fur, and snow makes comparatively little impression upon them. The long silky portion of their fur throws off rain or snow like a nicely adapted thatch; while the woolly part among the roots is so fine in the staple, that it is perhaps one of the best non-conductors of heat in nature, and the very best among the mammalia.

Any one who reflects upon the great advantage which his own body receives from as near a uniformity of temperature as he can command from artificial clothing, must readily convince himself of the great saving of the energy of an animal which must be effected by this means. There is nothing which so soon wears out the system by natural decay, and nothing which so frequently exposes it to disease as alternate heating and cooling; and if we compare one of those fur animals clothed in its non-conductor, with a tropical animal in its thinly-scattered covering of coarse hair, which admits a full play of the temperature against the skin, we shall readily see that those animals can bear, without the slightest inconvenience, extremes of heat and cold, which would very speedily destroy the tropical animal, by actually wearing it out beyond all possibility of exertion.

There is therefore not a more beautiful instance of adaptation of animal and country to each other, than

that of the marten tribe to the extreme north of the continents. Owing to geographical causes which it would be foreign to our purpose to explain, the summer there is, taking the whole twenty-four hours, and referring to places where it rains but seldom at that season, warmer than any spot under the equator; while in the winter the cold is so intense that mercury remains solid for weeks or even for months.

The high average temperature of the summer in those polar latitudes arises from the perpetual presence of the sun, which, after a time, brings the dry surface of the earth to a degree of heat unknown in the temperate or even in the tropical latitudes. In the latter, the direct action of the sun is no doubt greater, but it lasts on the average only twelve hours out of the twenty-four; and during the remaining twelve, the earth is greatly cooled by the radiation of heat from it through a cloudless sky, and the evaporation of the heavy dew which is constantly forming on the surface, and as constantly dissolving or evaporating by the heat which radiates from beneath. The tropical animal has therefore a refreshing pause of nearly half the four-and-twenty hours from the ardour of the climate; and beasts of prey, which are from the nature of their food the most laborious of all animals in a state of nature, are adapted to this state of things. They retire to their dens before the heat of the day comes on, remain there till the evening, and begin to stir themselves only after the shades of night have gathered around. They are, almost without exception, very noisy animals, and nature has so adapted them and their prey to each other that their voices strike terror, and cause the prey to discover itself by its efforts to escape. The martens and other predatory animals of the cold countries need no such repose, and require no such noise. They beat about; and though they too, in seasons when there is night, prey more by night than by day, yet they do not loiter a part of their time like the others, but are always on the alert, and always ready for action; and one knows not which most to admire, the excellence of their defence against the great variations of season to which they are exposed, or the economy of animal action which is produced by this species of defence.

But though these animals, fitted for making their way through very small openings, and treading very softly from the lightness of their bodies and the peculiarities of their motions, can come upon their prey silently and without the sound and fury which accompany the spring of a lion or a tiger, are yet furnished with means by which their coming is known; and thus where the animals on which they prey have free scope for making their escape, the number which they can capture at a time is limited to one. When a polecat for instance invades the farm-yard or the hen-roost, where the birds are confined, it kills one after another; but in free nature, if it succeeds in seizing one, all the rest are gone, the offensive odour of the animal giving them sufficient intimation of its presence. All the rest have not the same offensive smell; but few of them have an agreeable one; and in some it is so superlatively disgusting that no living creature can remain and breathe within a considerable distance of them. This odour is secreted by small glands on the posterior part of the body; and there is no doubt that it serves the double purpose of protecting from them the animals on which they prey, and protecting them from more powerful animals. The odour of our common polecat is offensive enough, but it is nothing to that of the South American animals of the family, which smell so intolerably that one dares not approach them. It cannot be supposed that this, which, though it wounds not, may truly be called an "offensive" weapon, has been given to these animals for the mere purpose of warning of their danger the weaker ones upon which they feed. In South America, when the chinche is in quest of its prey, the jaguar and the puma are also prowling about, and if it smelled even tolerably they would have no objection to make a meal of it. The odour which it gives out is, however, a sufficient defence against any animal whatever; and thus it is left to pursue its own prey undisturbed by its more powerful neighbours. It is evident indeed that the chief use of the offensive odour of these animals, in their economy, is protection against those carnivora which are more powerful than themselves; and in proportion as their habits lead them to come more in contact with these, we always find them the more abundantly furnished with this means of repelling. The polecat, for instance, which comes on the cultivated grounds, and is exposed to danger from domestic dogs, is far more offensive in its odour than the marten which keeps in the loneliness of the forest, where there are few mammalia more powerful than itself.

It is upon the rodentia chiefly, and upon birds, that the animals of this group levy their contributions; and accordingly we find that where the one are found in greatest numbers the others are found in greatest numbers also. In such a country as Britain, where squirrels and other rodentia inhabiting trees are rare, and not natives, but are introduced animals in the few places where they do occur, the staple food of the marten tribe consists of those members of the rat family which abound in the woods, though to these they often add birds. The polecats and weasels, which frequent the champaign countries rather than the forests, do occasionally capture a hare, and still more frequently a rabbit; but still the smaller rodentia are their principal food, and we have evidence of this in one weasel being more serviceable in a farm-yard for mousing than half a dozen cats. But though the members of the family or section which are found native in such countries as Britain are very interesting animals, and in their way highly useful to man, they form but a slight feature in the natural history of the country. It seems almost a contradiction, and even an absurdity in language, but notwithstanding it is true, that the natural history of Britain, or of any country so much cultivated as Britain, can hardly be called a *natural* history. It is an *artificial* history, although the subjects of it may be growth and life; and man, by extending his dominion completely over the greater part of the surface, has come instead of those predatory mammalia, and predatory animals of other classes, which but for man would have been the regulators of life. The bones of the hyæna are buried deep in the soil; the wolf has been extinct even in the wildest parts of the country for nearly a century and a half; the wild cat is confined within far narrower limits than it once occupied; sportsmen are in many parts of the country obliged to preserve foxes in order that they may hunt them; and martens are rare, and confined to very peculiar localities.

We can therefore draw no inference as to the state of wild nature, or the use of any kind of animal, from what we see around us at home; further than

this, that the predatory animal which has remained among the cultivated fields or near the farm-house, however offensive it may be, or however much persecuted, is not without its use there. As cultivation extends, and farinaceous seeds are grown in greater abundance, so the members of the rat family, whether of the house or of the field, which feed chiefly upon such substances, multiply in proportion. In the field man is defenceless against them: they are small, and are in concealment during the day, and therefore he can no more get rid of them by any device of his own, than a cultivator of fruits could get rid of caterpillars without the labours of the summer birds.

Those small rodentia to which we have alluded as feeding chiefly upon farinaceous seeds, multiply with extreme rapidity; and were it not for the weasels and polecats, the depredations which they would commit would be beyond anything which, in the present state of the country, we could readily suppose. It is true that the owl and the kite, and even the crow, come in for a share of the merit of this protection, nor must we forget the wild cat which lingers in some of the cultivated districts, and always most abundantly in those where slovenly kept hedges, and ill-dressed ditches, and idle commons overrun with breaks, afford cover for the small field rodentia. But still the weasel can follow them and find them in situations where they are perfectly safe from all the rest; and therefore it would cost a farmer more arithmetic than the majority of farmers are masters of, to sum up how much corn the weasel and the polecat save him in the course of the year.

But if such be the case in our own country, which is in a great measure taken from under the ordinary laws of nature, and brought under the regulation and controul of human art, how great must be the necessity for the animals of this family, and how much their value, in those extensive regions of the world which are still completely under the laws of wild nature! It is not in the tropical parts of the world that animals such as the members of the marten family are especially required; for there the grand spoilers of vegetation are of insect race; for from the perennial summer of tropical climates, insects of all kinds, or at least of some kind or other, are in activity there throughout the year. The animals therefore which play the same part in such climates, are insectivorous—the ant-eaters, and the various races of ant-eating lizards, the whole tribe of the edentata in short, with the exception of the few herbivorous ones, whether they carry on their operations above ground or below.

But in polar countries the case is very different. There the winter sets in early, and before its approach the parent insects all vanish, while the embryo generations for the succeeding year are quiescent in their places of concealment, and not accessible to any preying animal, at least to any of the mammalia. In those countries, however, the exuberant vegetation of the ardent summer (for summer is ardent when it comes) requires some controlling power, and this controlling power is given to a vast number of rodent animals—squirrels, rats, and mice in countless multitudes. Some of these hybernate during the severity of the winter months, and others do not; but even those which hybernate are abroad for some time after the leaf has fallen in the autumn, and again in the spring before there is a single leaf to spare; whilst such as do not hybernate, are active in feeding throughout the winter. When there are no leaves, such animals, as a matter of necessity, have recourse to buds and bark, the destruction of which is far more injurious to vegetation than the consumption of leaves during the season of growth; and as nature is never without a counterbalancing power, something is required to regulate their numbers.

It must not be supposed that there is anything imperfect in this, for herein lies the very perfection and beauty in the system of nature. If each race could maintain itself without any other race, then the whole would necessarily be reduced to a state of perfect inaction, and the world would be no living world. But the whole are so adapted to each other as that the portion which what we call the spoiler consumes, is really as necessary to the preservation of the race of the consumed party as it is individually to the consumer; and the powers of life are so vigorous in every race, that what is necessary for the other race can well be spared.

The rodent animals in the forests of cold and tropical countries, are subject to many contingencies from the severity of the winter, besides the direct and extensive consumption of them by the animals whose use in nature we are endeavouring to point out; and as they also have their use in restraining the exuberant vegetation of the summer (which, if allowed to go on, would run everything up to stem and leaf without flower or seed), and also in consuming the surplus seeds (which in most plants are at least a hundred fold what is necessary for the succession)—as there are these necessities for the rodent animals, in order to preserve a temperate and healthy state of vegetation, and as the rodent animals are subject to the contingencies and direct spoliations which we have mentioned, the uniform law of the system requires that they should be endowed with a fecundity equal to or greater than those means which tend to thin their numbers. We know that this is the case with all the tribes of ground rodentia which are found in our own country; and we all may have read, if so inclined, of the perfect floods which are sometimes poured from the wild forests upon the cultivated parts of northern and polar countries; as, for instance, of the invasion of lemmings which sometimes takes place in Norway, and by which the surface vegetation is as completely destroyed as it is by the locusts in climates nearer the sun.

This great power of production is necessarily attended with a corresponding strength in the controlling power; and accordingly we find that in Siberia, in the northern parts of America, and, in short, round the whole polar zone, the rodent animals, and the marten tribe which prey upon them, exist in multitudes which no man can number; multitudes which, though hundreds of thousands of both kinds of animals are every winter killed by the hunters for the sake of their skins, do not appear perceptibly diminished. In this way employment is given to a vast number of people in latitudes where, and at a season when, other occupation for man in the same localities there would be none; and thus we find that in the natural economy of the polar regions, and in the severity of the polar winter, there is provision made for calling forth the skill and industry of human beings, and crowning them with an ample reward.

Nor are the trophies of the thousands of slain which are the produce of this labour without their

use in the grand commerce and accommodation of the world. It may be said that the furs of Siberia and Canada are "luxuries." But we ask, what is meant by a luxury, if the thing alluded to contributes to human enjoyment, and the possessor can afford it? If these two conditions are involved in it, everything is a necessary of life, and sable and ermine are just as much so to one who can afford them, as rags are to a beggar, or as the wool on its own back is to a sheep. It is often thought, and not unfrequently said, that the possession of such misnamed luxuries as those to which we are alluding, produces envy and discontent in all who cannot afford them, and tempts many to endeavour to obtain them by improper means. This, however, is the vice of the parties, and not the fault of the things complained of. There is an honest way of getting at them, and that is "to win them," and there is or ought to be the greater struggle for improvement, in proportion as there is more to be won. The fable, and though it is a fable it has a moral, says that the mighty Macedonian sat him down and cried when the world was won; but it will be remembered that he was bold, and venturous, and cheerful, during the winning of it. The moral of this fable is, that while there is anything to be won we ought never to abate our cheerfulness, or slacken the hand of our industry; and really, in the natural view of the case, the man who has least has the vantage ground in this respect.

We have thus endeavoured to show not only that the martens have a use and an important use in nature, proportionate to their numbers and to their general distribution over the earth; but that they are valuable to man in many respects. Some races which will not quit, but rather which come and multiply, in proportion as man cultivates, are useful in the direct preservation of his property from enemies against which he himself has no defence. Others again find employment and furnish wealth, and the wealth so furnished, if contemplated in the proper spirit, ought, as all wealth ought, to be converted into a stimulus to intelligence and industry in those who possess it not.

This is the most important light in which we can view any production of nature, and consequently it is the light in which we ought to view it, and if we do not view it in this light we deceive and degrade ourselves. The express declaration of One whose word admits of no question is, that the dominion of the whole is given to man for his use:—"Replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the face of the earth." This grant is universal—free to all, according as their capacity may enable them to avail themselves of it; and in virtue of this it follows that whenever anything in nature is endowed with great activity and power, this activity and power can be made greatly useful to man, and man stands convicted of "burying his talent in the earth," if he does not avail himself of them to the full extent.

We have shown that the martens are remarkable for their energy and activity, and having done so we shall now proceed to a brief notice of the three genera, which it is our more immediate business to explain.

The three sections of these animals as established by Cuvier are *Putorius*, the polecat; *Mustela*; and *Mephitis*, the offensive-smelling animals of South America, which have no common English name.

Putorius.—The animals of this genus, though by no means the most handsome, are the most sanguinary of the whole. Their carnivorous tooth in the lower jaw has no tubercle in the inner side; their tuberculous teeth in the upper jaw are broader than long, and they have two false molars above and three below. Externally their muzzle is shorter and thicker than that of the martens, properly so called, and this shortness and thickness of the muzzle in a carnivorous animal, always indicates an accession of carnivorous character. They do not bear so striking a contrast to the martens in this respect as the cats bear to the dog, and there is not so much difference in their characters, but still there is enough for entitling them to be considered as a separate genus. The species are numerous, and distributed over many parts of the world; and the individuals in most of the species are abundant.

Common Polecat (*P. communis*).—The polecat is one of the most common of the genus, and also one of the most powerful and the most mischievous, while its fur is of very little value, and its flesh so rank as to be rejected even by hungry dogs. Generally speaking, it is about a foot and a half long, and the tail is about half a foot more. Its general colour is brown, passing into yellowish on the flanks, and with some white spots on the head. It is a very active and nimble animal, and remarkable for its boldness. Its body is long but its legs are short, and therefore while it is running its belly appears to touch the ground. It can leap to a great height and distance for its size; and when it leaps for the purpose of seizing its prey, it hits a mortal part with the certainty and the force of a javelin well directed, so that when a rabbit, or even a hare is killed by a polecat, only one feeble shriek is uttered by the victim. It climbs walls with great facility, and no animal is better adapted for getting over rough ground, through brakes, or through crevices in walls and holes in fences, which one would scarcely deem large enough for admitting a rat. It can also upon emergency climb trees; and, indeed, there is no animal which can so readily find access to all sorts of places. In case of necessity it can subsist upon rats and mice; but in general it prefers game of a higher description, and is not very particular as to the kind. It is very destructive of hares, and still more so of rabbits, which, as they are social and hares are solitary, are its favourite prey. Those who have rabbit-warrens endeavour to destroy polecats by every scheme they can invent, indeed it is understood that a single polecat would in time desolate a warren, because if it finds plenty of prey it merely sucks the blood, and eats the brain of one victim and then passes on to another; and in this way it will destroy a great number in the course of one day. It is very apt to infest the neighbourhood of houses, where it prowls nightly for such prey as it can find access to. In the poultry-yard, or in the pigeon-house, it is equally destructive as it is in the rabbit-warren; and, if it can find no other prey, and these are accessible, it will contrive to plunder bee-hives of their honey. In places where there are many rabbits and poultry, and also slovenly hedges and brakes to afford it cover, it is a perfect pest to the farmers. It is very daring, and will not hesitate to take up its abode in barns, hay-lofts, and other places, the possession of which it defends as resolutely as if they were its own property. In the summer season it often frequents brakes and copses

though not the central parts of extensive forests. In such situations it digs a burrow, not very deep but extending five or six feet under ground, and usually terminating under a bush, or close by the tangled root of a tree. It is no easy matter to dislodge it unless by smoke; for its burrow is too small for admitting a terrier dog, and its odour, especially when excited, is offensive even to a proverb—more so, indeed, than that of any other animal in Britain. Anger, or perhaps rather fury, is the only passion which it displays upon such occasions, for it does not appear that fear enters into its composition. When attacked by a dog the polecat turns, and defends itself with great spirit. If the dog is not staunch, so as to go in upon it at once, but stands barking as curs do when they hesitate, the polecat springs at him, fastens so exactly and so severely on his nose, that he is apt to run yelping away from his comparatively small enemy.

The common polecat is found in all the West of Europe, and also in the North of Africa, and it is perhaps most abundant in the middle latitudes of its range. It does not belong to those animals which frequent in such numbers the countries of the extreme north; and the thinness and poorness of its fur point it out as a native of more southerly and congenial climates. Even with us it is not found in the wild uplands any more than in the extensive forests. It is naturally a low-country animal, and peopling and cultivating have no tendency to diminish its numbers. On the other hand, they are rather the means of increase; for rabbits and partridges, both of which are favourite prey for the polecat, increase rather than diminish as the fields are more cultivated. It breeds in the spring, and the litter usually consists of three or four. The mother does not continue to suckle them for any great length of time, but supplies them with eggs and the blood of animals. When she carries the latter to her nest, it is said that she contrives to compress the wound by which she kills them, so as to keep in the blood, in order that it may be sucked by her young ones, whereas, when polecats kill for their own eating, they suck the blood instantly. None of the tribe are good milk nurses to their offspring, their apparatus for this purpose being by no means perfect. Unless when required for the young ones, the mammæ are nearly obliterated, and even then they are but little produced. The mammæ are ventral, and vary in number; some species have only four, and others as many as eight.

This paucity of nursing in animals which are exceedingly bloodthirsty, as compared with those which have less of that character, or none of it, is a point worthy of attention in animal physiology; and though it has not been systematically noticed, it will be found to be by no means one of the worst keys to the disposition of the animal. The mammæ of the female cat, for instance, though no animal shows more attachment to its young, are but little developed in comparison to those of the female dog; these again are less developed than in the female hog, and so are they less developed than the mammæ of the ruminants, especially the cow, which may be considered as the most domestic, and the most immediately connected with man of all animals. It would be easy to fill up the chain through the whole range of the mammalia, and it would invariably be found that the bloodthirsty disposition is inversely as the development of the mammary apparatus. The instances which we have given, which are leading ones, serve, however, to establish the fact. Nor are we without experimental evidence as to the other portion; for (as we have formerly had occasion to remark in the article Lutra) if the young of a carnivorous animal continue to be fed for a long time on milk, or milk and farinaceous matter united, their dispositions are softened, so that they become tame and gentle. If, on the other hand, animal food, and especially raw flesh, is given to them early in life, they become ferocious, and never can be tamed into perfect obedience, or any docility, except such as is flogged into them with the whip. The breeders of dogs are perfectly aware of this circumstance; so that, out of the very same litter, and of two pups, the one of which can hardly be discovered from the other, they can so deal with the one in its feeding as to make it ferocious, and so with the other as to make it perfectly gentle. Even in the human subject there are proofs of this; for people who live upon vegetables and milk are, with equal usage, much more gentle in their dispositions than those who live upon animal food; and when pugilistic combats were, to the shame of human nature, encouraged by many of the misnamed great of England, as manly sports, that passive sort of brutal courage, known by the slang name of "bottom," was cherished in the ruffians by feeding them upon beef almost in a raw state. It is most encouraging to the philosophic student of nature to find, that that which has been proved to him by his own observation, without any reference to natural history, corresponds exactly with that which runs through the system of nature.

The *Polish Polecat*, (*P. Sarmatica.*) This species has sometimes been confounded with the common; and, from the peculiarity of its colours, it has sometimes been considered as a cross between the common polecat and the *ferret*. Such, however, is not the case; for the animal is abundant in a state of nature, and that in places where neither of the others is to be met with. It is rather more tropical in its locality than the polecat, being found chiefly in the South of Russia, in Asia Minor, and generally in the countries around the Black Sea and the Caspian. The upper part of the body is bright brownish yellow, beautifully mottled over with small brown and white spots. The under part, the legs, and the point of the tail, are rich brown. The head also is brown; but it is marked with a white line, which proceeds from under the one ear over the eye across the front, and onward to the other eye, and under the other ear, something in the shape of a horse-shoe. The ears, the point of the muzzle, and the chin, are white. In its markings it is a very handsome animal; and on account of these, its skin is in considerable estimation with the dealers in *peltry*; but it is a poor fur, short, thin, and by no means durable, though those who are fond of show are apt to be taken in by its colours. By some naturalists this species has been classed with the true martens; but any one who smells it can tell at once that it is a polecat.

The *Ferret* (*P. furo*) is, generally speaking, of a yellowish colour, with the eyes of a red or rosy tint, on which account some have supposed that it is an albino variety of that animal. This is, of course, an incorrect statement; for we have no instance of an albino variety being continued by propagation in any race of animals; and besides, it differs from the polecat, not merely in external appearance, but actu-

lly in the skeleton, which, being the least changeble part of an animal, is the best on which to ound distinctions. It has a rib more than the polecat, and an additional bone in the sternum. It is lso a smaller and more delicate animal, and suffers nuch more from exposure to cold. The polecat, lthough its fur is by no means a polar one, can rough it" very well, even in the severest storms vhich visit our lowlands in winter; whereas the ferret as to be kept in the house, and in a box lined with ool, long before the thermometer sinks to the freezng point. Nor are we without the evidence of istory as to the southern origin of the ferret. Strabo nforms us that in early times a great portion of Spain as literally eaten up on the surface, and drilled into oles like a honeycomb, by rabbits, just as many parts f the Pampas in South America are at present by he viscachio. Countries, when thus taken possesion of by those burrowing rodents in such multitudes, re quite unprofitable to man; and scarcely any uman means, indeed none which would be repaid y the advantage gained, can rid them of these pests. To bring Spain within the class of useful countries, he ferret was imported from Africa; and it has ever ince been more or less preserved in Europe, not omesticated, (for, to soften its disposition would be o destroy its usefulness,) but a subject of the care of hose who employ it. To those who feed it, and are therwise kind to it, it is not gratuitously savage, at east in any very high degree; but very little tamering with it angers it, and makes it bite. When ngry, its odour, which is far from pleasant at any ime, becomes even less so, and establishes its conexion with the polecat genus. It is considerably maller than the polecat, being four inches shorter n the body and an inch shorter in the tail; and it is xceedingly slender. It is very bold, however, and s disposition to kill rabbits is most inveterate. It s chiefly used for rabbit hunting, not for killing hem; for if it were allowed to do that, it would soon despatch a whole warren, and leave the owner to dig ut the dead bodies at his leisure. It is used to unearth" them, or drive them out of their holes, and t is carefully muzzled to prevent it from biting. The abbits are not, of course, aware of the perfect harmessness of the muzzled ferret, and so they scamper ut, and are caught, generally by terriers, which vatch at the mouths of the holes, and at another time n a net, if the object is to keep the rabbits alive. It s also the very prince of rat-catchers; and as it is ot muzzled for this sort of occupation, it slaughters way in a dashing style, and might be very useful n places infested with rats, were it not for the attenion and trouble which it requires. In corn stores nd mills it might be advantageously kept; and if snug berth could always be provided for it, it vould be very valuable at sea. The ferret, as is he case with most animals when transported to a limate colder than their natural one, spends a great leal of its time in sleep; but the moment that it wakens, it is in a state for action; and slender s it seems, it is capable of undergoing a great deal f fatigue. The period of gestation is six weeks; nd two litters, varying from about five to nine, are roduced in the year; so that it is a very prolific nimal. The female is apt sometimes to devour her wn offspring when they are newly dropped; but when she does this, she is very soon ready to prepare or another litter. Altogether the ferret is a most interesting little animal; and it is not the less so for having been in Europe for at least two thousand years, without becoming so far accommodated to the climate as to pass into the wild state. This is another curious point in the physiology of animals, and one which well deserves attention. Man can inhabit from the equator to very high latitudes; the dog can accompany him in all, and most of the other domestic animals, in the greater part, accommodating themselves to the difference of climate in the course of time; but the more carnivorous animals are, as it were, tied to their localities, and no time will inure them to a climate very different from that of which they are natives.

The *Siberian Polecat*, (*P. Sibirica.*) This species is about the size of the ferret. Its general colour is bright golden yellow, but often with white on the point of the muzzle and below the lower jaw, and brown on the nose and the eyes. It is subject to varieties, however; and it is understood that a few individuals of these varieties are found as far to the westward as France. In its native country, where it is abundant, it resides chiefly in the forest during the summer; but, when the cold weather sets in, it approaches houses, and is very apt to play the same part in farm-yards and pigeon-houses as the polecat and the weasel. It is probable that this species might be rendered very useful in the destruction of rats, as it is more hardy than the ferret. Its fur is much longer than that of any of those which we have yet described, clearly indicating a more northerly origin.

The *Weasel* (*P. vulgaris*) is the most diminutive of its tribe. Its height from the ground, when the back is not arched, does not exceed two inches and a half; and the length of its body is less than eight inches. The tail is shorter than in most of the genus, being about two inches and a half, and terminating in a point. The colour varies a little in the individuals, and still more with climate; but, generally speaking, the upper parts and the legs are pale brown, the throat and belly white; and there are two spots of brown behind each corner of the mouth. The eyes are small and round, and of a clear black colour; and the ears are rather large, and have a fold near the margin, which makes them appear as though they were double. The weasel is very generally distributed over the cold and temperate parts of the world, and it is a very bold and energetic little animal. The flexibility of the weasel, and the agility with which it moves about, give it a wonderful command of all sorts of places. There is a proverb which says, "He builds closely with dry stones who can build out the weasel;" and the saying is true, for the animal has been known to worm its body through a hole less than three quarters of an inch in diameter. It is also a most expert climber, and can ascend a wall or a tree with all the dexterity and expedition of a cat; and as its feet are shorter, and its body longer in proportion than that animal, it can twine round and round so as to elude capture. On the ground it is not a very swift animal; less so, indeed, than most of its congeners; and thus, in an open place, it is soon run down. If, however, there are trees, or walls, or brakes near it, it is in vain to hunt the weasel by the help of any known animal; and, small as it is, no dogs, except the most determined terriers, are fond of having anything to do with it. It springs at their nose or cheek, and there it hangs, inflicting a bite

equally painful and powerful, (for its canines are rough,) and it is so light, that the animal on which it fastens is unable to shake it off. The Scotch name "Whitret," which is given to this animal, is, in the old language of the country, (not the Gaelic,) remarkably expressive of its action and manners; for it implies that it is seen one moment and lost the next. As is the case with the whole tribe, and with predatory animals generally, the weasel remains in a state of repose during the day. This is not always the case, however, for the writer of this article has seen a weasel fairly run down a leveret along a furrow of ploughed land, and seize it by the side of the neck, and instantly finish it, at noon day, and under a bright sun. The weasel is indeed remarkably scientific in the killing of its prey, and fixes on the place where its bite is most speedily mortal, and the blood of the animal most easily obtained, as correctly as if it had studied anatomy sufficiently to entitle it to a diploma; it is doubtful indeed, whether, many of those who have got possession of such a document, could kill a hare or a rabbit, and extract its blood, with the same neatness and expedition as a weasel. The weasel is particularly fond of warm blood; but it is somewhat of an epicure in the matter of flesh. It likes that "high;" and when one smells the store which it generally has in its larder, in favourable situations, one is forcibly put in mind of the distich of the satirist—

> "O blast it, south winds, till a scent prevail,
> Rank as the ripeness of a rabbit's tail."

This taste is not, however, peculiar to the weasel, or to the group of carnivora to which it belongs; for all carnivorous animals give the preference to flesh with the odour of putridity about it, rather than flesh which is fresh and recent. Here again there arises a curious little point, not uninstructive to the human race. The man of wholesome and simple appetite, who lives in great part upon vegetable matter and the product of the living beast without the destruction of its life, and who eats flesh but rarely and as a dainty, likes to have it as fresh and recent as ever he can get it; but, with a thoroughly carnivorous man, the case is different; he must hang up his mutton a fortnight and his venison six weeks, and can in no case relish grouse unless he can eat it with maggot sauce of its own growth. We must not be astonished at this coincidence between man and the other animals in the matter of food. It is the merely animal man that feeds, not the intellectual man; and in proportion as man approximates any animal in the nature of his food, he must approximate that animal in his *gusto*.

We have remarked that the weasel, when on the hunt, or when by any means excited, is an exceedingly energetic and powerful animal for its size; and it is worthy of remark, that its muscles, or working structures, enjoy as complete a relaxation in the time of its repose. During the greater part of the day, unless under peculiar circumstances, such as those to which allusion has been made, the weasel gives itself up to rest and sleep; and it is impossible to imagine a creature giving more perfect and more equal rest to all the working structures of its frame, than the weasel does upon such occasions. It has the utmost degree of relaxation, not only in the muscles of the limbs, but in the muscles connected with the spine, which are, indeed, as much called into action as the others, if not more so, during the leaps which the animal has to take. If one takes proper judgment of where the centre of gravity is situated, and so puts his stick under a sleeping weasel, and raises it gently from the ground, it comes head and heels together as easily, and with apparently as little pain to itself, as if one were lifting in the same manner a bit of ribbon or an old stocking. So also, if found sleeping, it may be taken up by the head, the heels, or the tail, and swung pendulumwise for at least a dozen times before it begins to awake. In fact, though it is a snappish little animal when awake, there is none in the whole catalogue of the mammalia with which one may take greater liberties when asleep.

Weasels have, we believe, only one litter in the year, which circumstance sets them down as being properly natives of temperate countries, and not of tropical ones; for the ferret, which, though not originally from a region absolutely tropical in respect of latitude, though from one which is certainly tropical in point of climate, has two broods in the year. The female is not, even as brood for brood, so productive as the female ferret, for her litter rarely, if ever, exceeds four or five. She prepares for them a comfortable bed of dry stalks and leaves and soft moss; and we are not aware of any recorded instance of her devouring her offspring, as the ferret sometimes does. The period of her gestation is nearly the same as in that species, and the young ones are blind when they are dropped, as is the case with almost all carnivorous animals. She is an attentive mother, however; and though she has the same deficiency in suckling as the rest of the tribe, she brings them fresh eggs and warm animals quite full of blood in a fluid state. Those stimulating viands whet their young instincts, and cause them to grow apace, so that in a short time they are able to join in the nocturnal forage, and kill their own prey.

The weasel is not so destructive about farm-yards as the polecat; it is a much prettier animal; and though the odour of it is no desirable perfume, it does not offend the nostril to such an extent as that of the other does. For these reasons, the weasel is by no means so much persecuted as the polecat; and in country places it is generally rather a favourite than otherwise. Nor is it undeserving of this favour; for it is a most excellent mouser, and perhaps destroys more of the murine tribe than any other of our wild animals, excepting perhaps the owl. The fur of the weasel is much more close and delicate than that of the polecat, and on these accounts it is held in higher estimation. It also improves in quality in proportion as the animal inhabits a more northerly climate; and the weasel skins of Siberia fetch a price in the Chinese market (the grand mart for furs) equal to some two or three times their weight in silver. Altogether, indeed, the weasel is a very interesting little animal, and may be considered, in our view of the matter, one of nature's *chefs d'œuvre*, because it contains a maximum of power in a minimum of matter.

The *Ermine* (*P. erminia*). The ermine is, in respect of its fur, the most celebrated not only of the polecat genus, but perhaps of the whole marten tribe—the term ermine being applied as symbolical of the robe of a judge, or anything else which is understood to be of unstained or incorruptible purity. It is only in winter, however, that the fur of the ermine is of that snowy whiteness which makes it so much admired, for in summer it is yellowish. It is

ather larger than the weasel, being about nine inches nd a half long in the head and body, and three and half in the tail. Its form is much the same as that f the weasel, and its manners and modes of action re similar, but in a state of nature it does not fre- uent the same kind of localities. In summer it is, enerally speaking, of a yellowish brown on the upper art, and a clear sulphur yellow on the under, with he chin white, and the tail brown, except the extre- nity, which is black. This is really its gay or nuptial lothing, though it is not the one held in most esti- nation by those who seek animals for their skins, and ot for their manners. There is another reason for his: the skins of animals are not so firm in the sum- ner, neither is the fine under covering of the fur nimals so abundant and close at that season as it is n the winter. A summer fur is in fact a thing of mall value compared with a winter one in respect oth of durability and of warmth; and therefore the uperior quality of the ermine's fur goes along with hat peculiarity of its colour which is so much admired. The winter colour is, as we have said, the most snowy hite; and we are not aware that the fur or hair of ny other animal can in this respect come up to it. There is one part, however, which does not change, amely, the tip of the tail, for that remains throughout he year of the most intense black; and when the ur of the ermine is used for ornamental purposes, his black is spotted in little tags over the white, and oth colours profit by the contrast.

In all animals, whether mammalia or birds, which ut on white for their winter clothing, there is always ome part which remains unchangeable, as a sort f hostage that the animal shall return to its summer olour when the season comes round. In the variable are which occurs in some of the lofty mountain tops n the northern part of Britain, the general colour in winter changes from pale dappled fawn to pure hite, but the tips of the ears remain black all the ear round. The ptarmigan, which inhabits similar situations, undergoes a change from mottled grey to ure white; but the shafts of the principal quills, and n many cases the webs, retain the black colour which they have in the summer.

The ermine haunts copses, hedges, and meadows, and it is particularly fond of the banks of streams when they are margined with bushes. It is as pre- datory in its habits as the weasel, or even the pole- cat, but it very rarely invades the poultry-yard, or even resorts to the habitation of man. The ermine, as well as the weasel, has been tamed, and made to show some attachment to those who were kind to it; and this we might be prepared to expect, because all the marten family, from the nature of their food, and the means by which they have to obtain it, must be animals of considerable intelligence and resource. From what has been already remarked, however, the taming of them must be begun at a very early age, and before they have tasted blood, otherwise it can never be perfectly accomplished. The inducements to tame such animals are not, however, very great, because the only uses to which they can be applied are unearthing rabbits and killing rats and mice.

The *Mink* (*P. Lutreola*). This is an animal of the North-east of Europe, and probably of the countries beyond, and in some of its characters and its habits it makes a slight approach to the otters. Its feet are partially webbed, and it frequents the margins of the waters, feeding chiefly upon frogs and crabs. In its structure it approaches more nearly to the polecats than to any other genus of the martens; but it differs from them in habit, as above mentioned, and also in its odour, which is that of musk, and not so strong as to be rank and offensive. The fur of the mink is not so much prized for its colour as that of the ermine, but it is of better quality, being more close and warm, and also more firm and durable. The colour is maroon, approaching to black, with the last part of the tail black and the chin white. There is very little reflection of light from the fur, but it is exceedingly soft and beautiful, and fetches a high price in the market. The mink, from its aquatic habits, does not come near the habitations of men, and thus does not incur their displeasure for any depredation which it commits on their property. This, however, does not ensure it a safe dwelling by the banks of those lonely rivers which are its favourite haunts; for, though its conduct does not awaken the revenge of mankind, its covering stimulates their cupidity. From the nature of its haunts, and from its being hunted in the winter, less is known of the domestic manners of the mink than of most others of the genus; but it resembles the rest so much in its organisation, that in all probability its whole charac- ter, with the exception of haunt and food, is nearly the same.

The *Vison* (*P. Vison*) is an American species, very much resembling the mink both in its appearance and its habits. Like that animal, it has the feet partially webbed, but it wants the white on the chin, though it has sometimes the white line on the throat. Its size is nearly the same as that of the mink of North- eastern Europe, and its fur is of equal, if not superior quality. It is found both in the United States and in Canada, only much more abundantly in the latter country. Like the European mink, it inhabits the margins of the waters, and feeds upon reptiles and fishes. Indeed, both species are to be considered as a sort of intermediate link between the polecats pro- perly so called, and the otters, being more aquatic than the one, and less so than the other.

The species which we have enumerated are the principal ones of the polecat genus which inhabit the temperate and cold regions of the world. A few others are indeed mentioned by different authors, but it does not appear that there are any grounds upon which these can be well established as species. Most of them resemble either the ermine or the mink, and both of these are subject to variations of colour, the only circumstance upon which the sup- posed species are founded. In the ermine, especially in its winter dress, and that is the dress in which it is most valuable, and in consequence most sought after, we might be prepared to expect those variations in colour. All animals which change from any other colour to white during the winter, do so as an adapta- tion to the cold, and consequently the extent of the change must be in proportion to the degree of cold to which they are subjected. Those with which we are most familiar are the alpine hare and the ptarmigan, already alluded to; and it is matter of observation that they do not change so completely to white in mild places, or in mild winters, as they do when the place or the season is more severe. It is quite natural to suppose that the ermine, which is a seasonal animal in its colours as well as they are, should be affected in a similar manner by difference of climate or difference of season, and that ermines

which are caught in warm places or mild winters should retain a portion of their summer colour. The change, too, is gradual, not instantaneous, and the white comes on in patches, so that an ermine caught early in the season is almost sure to be mottled; and, were it possible or desirable to catch an ermine every three or four days, from the beginning to the end of the change in the colour of its fur, there is little doubt that a lover of varieties would be gratified by as many varieties of ermines as there were catchings, though the greater number of them might be of the very same litter. It is thus of the utmost importance to attend to the colours which polar animals undergo in the course of the very variable seasons to which they are subjected, before coming to any conclusion as to what is a species or a variety, and what is not. As the mink inhabits lower down than the ermine, and, generally speaking, not quite so far to the north, it is not subject to seasonal variations of colour. It does appear, however, to be subject to very considerable variations in the white upon the chin, the throat, or both: sometimes it is on the one, sometimes on the other, sometimes on both, and sometimes wanting altogether; so that, in fact, it ought to be discharged from among the descriptive characters of the animal.

The warm regions of the world have their polecats as well as the colder ones, though they are not nearly so numerous in the former, and their skins there are of little or no value as articles of commerce. On this account they have been much less studied, and the studying of them has been comparatively recent, so that there may probably exist in the richer parts of the tropical countries many more species than we are yet acquainted with. The oriental isles are the places where they are most likely to abound, as these are the most fertile spots on the face of the globe; accordingly, there have been two species noticed in the island of Java.

Javanese Polecat (*P. Javanica*). This species is between six and seven inches long, and remarkably thin in the body. Its general colour is nearly the same as the summer dress of the ermine; but the cheeks are white, and there is a white spot on the front of each eye. The point of the tail is furnished with a brush of long hair, and the feet are abundantly covered with fur, which last circumstance forms a very marked distinction between it and the next species.

Naked-footed Polecat of Java (*P. nudipes*). This species is frequently called the Java ferret. It is rather less than the polecat of Europe, but larger than the ferret. The general colour of its fur is a very brilliant golden red, and the head and tip of the tail are white. Its most distinguishing character is the perfect nakedness of the soles of the feet. It has been rarely seen by Europeans, and nothing is known of the manners or the habits either of it or the preceding species, further than what may be inferred from their similarity to the rest of the genus.

African Polecat (*P. Africana*). This species is about ten or eleven inches from the point of the muzzle to the root of the tail, and the tail is about six inches more. Its general colour is russet brown on the upper side, and yellowish white on the under, with a band of russet along the middle of the under part. It is understood that the known specimens come from the western part of central Africa; but the precise locality is not known, neither are the habits. It bears, however, so close a resemblance to the rest of the genus, as to leave little doubt respecting its character.

Madagascar Polecat (*P. striata*). This species is about the same size as the European polecat; but it is very differently coloured and marked. The upper part is of a rich deep brown, with five longitudinal lines of white, one along the ridge of the back, and two on each side. These converge toward the tail, which is entirely white; and the under part of the body is also white, but with a shade of grey.

The *Cape Polecat* (*P. Zorilla*). This species is not very accurately named; for though it is found in Southern Africa, it is not confined to that part of the continent. It has been met with near the Senegal and the Gambia; and there is little doubt but that it is generally distributed over all the country to the south of the Great Desert wherever the soil answers to its habits. There have been some mistakes about this animal; for it has been described as an American, and as belonging to the mephitic animals of the southern part of that region of the world. These opinions are erroneous, however; for the zorilla is an African and a true polecat, and there is no true polecat in South America, at least so far as is hitherto known; though it is probable that some may exist in the rich wooded districts of the tropical parts. The name, at all events, is South American, and was, we believe, originally applied to one of the mephitic animals of that country; and we rather think that Buffon is chargeable with the misapplication of it to this animal. *Zorilla* means little fox, and was given to the fœtid animals of South America, on account of the intolerable odour which they emit. It is rather a large animal, as compared with some of the race, though inferior in size to the polecat of Europe. The length of the head and body is rather more than a foot, and that of the tail about eight inches. Its general colour is black, spotted with white on the head, and streaked with longitudinal white lines on the back. Those spots and lines have always very nearly the same position, but they differ greatly in size, so much so, that at a little distance some specimens appear entirely black, and others almost white. This differs from the rest of the genus, in having the claws better adapted for burrowing in the ground than for climbing, which would seem to indicate a difference of habit from the rest; but what that difference is, is unknown, and in every other respect this animal resembles the rest of the genus.

The enumeration which we have now given comprehends all the species of polecats which are well established; but it is highly probable that, in foreign countries, there are many more, inasmuch as these are nocturnal animals in their habits, and so conduct themselves that they are not easily observed. We must bear in mind too, that, of the wild forests in the tropical countries, not one mile in a thousand has yet been explored by Europeans.—We now proceed to the next genus.

Mustela. The animals of this genus, though they have much general resemblance to the polecats, yet differ from them in so many particulars as to warrant the generic separation of the two. The martens have not the offensive odour of the polecats, but on the contrary the smell of some of them makes a slight approach towards fragrance. They are also much more pleasant to look at. They are more elegant in their shape; and there is something in the expression of a marten which tells at once that, though it is as brave as

a polecat, or even more brave, it is not so cruel. And when we come to examine the teeth, we find that they justify the impression which is made by the appearance of the animal; and perhaps if a little more attention were paid to the connexion between the expression of animals, and the structure of those organs which determine the nature of their food and their mode of procuring it, natural history would profit not a little by the result. The martens have one false molar more than the polecats, in each side of the jaw, both above and below, and they have a little tubercle or heel on the inside of the carnivorous tooth, which diminishes its carnivorous character, and makes it in a slight degree a bruising tooth, not a tearing one. It may seem that these are slight differences; but it is by attention to such slight differences that we are enabled to become thoroughly acquainted with the nature and characters of animals.

In addition to those distinctions which we have mentioned between the true martens and the polecats, there are some other polecats. The martens keep to the woods and wilds, spend their lives peaceably there, and never invade the pigeon-house or poultry-yard; and as Nature has destined them for a somewhat severer life than the polecats, she has clothed them in a superior manner, and also given them superior powers of locomotion. It is delightful to contemplate how beautifully Nature does these things. If the average temperature which one animal has to bear is but a few degrees colder than that which another has, a difference is made in the clothing of the former, so as to put them on a perfect equality in point of endurance. Also, if one animal has on the average to travel a mile more a day for its food, muscular power in proportion to its weight is given it to the exact point of compensation. Now, who, we ask, but a Being infinitely wise, knowing all knowledge, and seeing everything to the end even before the beginning, could have planned and executed those wonderful adaptations, or rather, according to our view of the matter, could have endowed them with powers?

The *Common Marten* (*M. martes*) is about eighteen inches long in the body; and the tail, which is much covered with hair, especially about the point, is about ten inches long. It is thus longer than the polecat, and far more handsome in its form. Its nose is softened down, its head slender, its ears broad, rounded, and open, its eyes lively and sparkling but not ferocious, and its whole aspect, to use a homely expression, "just an animal that one would like." Its odour, too, instead of being disagreeable, is a positive perfume; and its fur is as rich as its form is handsome. On the back, the sides, and the tail, the woolly fur is very thick and soft, and the long fur smooth and shining. The hairs are annulated, the roots being ash colour, the middle length chestnut, and the points black. These give a varying and not easily described colour to the whole. The head is reddish brown; the legs and upper part of the feet chocolate brown, and the plant of the foot is thickly covered with woolly fur, like that on the body, so that the marten treads softly. The feet are well developed; the toes have considerable freedom of action; and the claws are strong, sharp, and crooked, well adapted for climbing, but not retractile, and therefore not used for clutching prey. There is some difference of colour in the under part, but it certainly does not amount to a specific difference, or perhaps even constitute a permanent variety. The under part in all is of the same general colour as the upper part, only paler; but the breast in some is pure white, and in others whitish yellow; and this constitutes the distinction to which we have alluded. In other respects there is not a shade of difference between the one and the other; and it is worthy of remark, that the yellow on the breast occurs more frequently in the warmer latitudes inhabited by the martens, and the white more frequently in the colder latitudes.

Common Marten.

The general residence of the common marten is in woods and copses; and the nest is formed in a hollow tree, a chink of a rock, or a hole in a wall, if the place is sufficiently sequestered. It is well formed of dry grass and moss; and it is understood that the female breeds in spring, and again in autumn, the litter varying from three to seven. If taken sufficiently young, and before it has tasted blood, the marten can be tamed with the greatest ease, and it is an exceedingly good-humoured and playful creature. There seems, however, to be an instinctive love of freedom and the wild wood inherent in the very nature of the creature; for, though it is ever so playful, and ever so good-natured, it lets slip no opportunity of regaining its liberty and joining its wild companions. The marten has thus another noble trait in its character—it can be tamed, but it will not be enslaved.

There is another strong instinct which the marten evinces, even when tamed—it has an implacable hostility to cats, and lets slip no opportunity of springing upon them and inflicting a mortal wound. In the forests, diminutive as it is in comparison, it battles stoutly with the wild cat; and we shall venture to quote from "The British Naturalist" an account of one of these battles, as from an eye-witness. "In the year 1805, a gentleman, on whose veracity we can depend, witnessed one of those combats in the Morven district of Argyleshire. In crossing the mountains from Loch Sunart southward, he passed along the bank of a very deep-wooded dell, the hollow of which, though it occasionally showed green patches through trees and coppice, was one hundred and fifty or two hundred feet from the top. The dell is of difficult access, and contains nothing that would compensate the labour, and thus it is abandoned to wild animals, and, among others, to the marten, which, though the skin fetches a high price, is not so much hunted there as in more open places; because, though they might succeed in shooting it from the heights above, they could not be sure of removing the body. Thus it is left to contend with the mountain cat for the sovereignty of this particular dell, and both are safe, except when they approach the farm-

house at the bottom of the hill. The contest then lasted for more than half an hour, and both combatants were too intent on each other's destruction to shun or fear observation. At last, however, the marten succeeded in falling upon the right side of the cat's neck, and jerking his long body over her, so as to be out of the reach of her claws; when, after a good deal of squeaking and struggling, by which the enemy could not be shaken off, the martial achievements of puss were ended in the field of glory."

The conduct of this warfare is not unworthy of attention, and therefore we should quote a few lines descriptive of it from the same work.—"The onset is one of some skill on both sides. The aim of the cat is to pounce with her paws upon the head of the marten in such a way as that the claws may destroy or wound its eyes, while her teeth are imbedded in its neck; and if she can accomplish that, the fate of the marten is decided. That, however, if done at all, must be done in a moment, and if it be lost, there is no repairing the mistake. The spring of the wild cat is larger than that of her opponent, and the cat takes up her position so that she shall, if possible, alight upon his head with her full spring and impetus. To distract her attention, he keeps moving his head from side to side, and if he succeeds in this object, he rushes to close quarters by a side-movement. If the spring of the cat takes proper effect, there is a struggle, but not of long duration; and it is the same with the opposite result, if the cat miss and the marten fasten, during the short pause of exhaustion after the spring. Here we may notice another curious feature in the economy of the feline race. It has been remarked of even the most powerful of them, that if they miss their object when they spring, they sneak cowardly away, and do not return to the attack for some time, if indeed they return at all. Now the fact is, that it is not cowardice, but exhaustion. The gnashing with the teeth and the talons seems to be the reaction by which the motion of the spring is balanced, and the tone of the animal kept up; and if it fail in that, it takes a while to recover the use of its springing muscles. Probably the violence both of the spring and the exhaustion are connected in some way or other with the electric state of the body, but that is a point not easily to be settled. Should both miss, the contest is renewed, and seldom, in the observed cases (which are not indeed very numerous), given up until the one be killed; and in the protracted contest the marten is always the victor, as the cat is first exhausted by the greater weight of her body and the violence of her leaps."

Interesting as the martens are, and common as they are in most parts of Europe, their natural history is by no means clear and satisfactory. As to their manners, indeed, and their anatomical structure, which is of course the foundation of those manners, there can be neither mistake nor difficulty; for they are so perfectly alike in these respects, that it is of no consequence upon which of them, if indeed there are really more than one, the description is founded. The usual distinctions are, the common or pine marten, which is found only in close forests, and nestles in the holes of trees; and the beech marten, which is found in more cultivated places, and nearer the habitations of man, which it sometimes plunders in a similar manner to the polecats.

It should seem, however, that these names are not only local, but that they are interchanged with each other in the different localities in which they predominate, the one in one locality, and the other in another. Thus, the common marten of the warmer parts of Europe, and, generally speaking, of England, if we except some of the wooded mountains toward the north, is really the beech marten, which is the only marten of these localities. On the other hand, if we go to the forests on the Scotch hills, or to those of the North of Europe, or of Asia, we find that the pine marten is not only the common marten, but almost the only species that is met with. When found in the forest, the marten is of rather larger growth than when found in open and lowland places; which shows that those wild localities agree best with its nature. As is the case with all animals that inhabit more upland, and are of course exposed to a lower temperature, the fur of the marten, when inhabiting the wild woods, is closer and firmer than when it inhabits warm situations. It seems, indeed, that these animals are affected in their size and colour by even moderate differences of climate. The martens of Siberia differ a good deal from those of Europe, and we might be prepared to expect this, from the great difference between the summer and winter in Siberia. But then, the Siberian ones differ from each other as much as either of them differs from the European; and when we turn our attention to the same species in the North of America, where it is particularly abundant, we find similar differences occurring.

It has sometimes been supposed that the different tint of the pale colour on the throat and breast of the marten constituted a different variety, if not a different species. This, however, is exceedingly doubtful; for there are in all countries which martens inhabit some with the breast inclining more to white, and others with it inclining more to yellow. This difference, too, is always accompanied with a different shade in the darker part of the fur. If the throat and breast have a pretty deep yellowish tinge, the fur on the upper part is always of a deeper and richer brown colour. This, we believe, happens most frequently among those which do not quit the forests, but live in the shades of trees; and perhaps we might expect it, from the more uniform temperature of the day and the night in such places. The shade, and the constant evaporation which is going on in a forest during the day, both tend to keep it cool, and the evaporation keeps the air immediately over a forest and between the trees more saturated with moisture, and therefore nearer the dew point than the air is over a plain. By this means the nocturnal evaporation of a forest is less in proportion to the diurnal than that of an open plain, and consequently the night is warmer. Indeed, as the marten remains quiescent for at least great part of the day, except when hunger forces it out, and as even then it preys chiefly or exclusively in the shade of the branches and leaves, the marten enjoys a pretty uniform temperature during the twenty-four hours. We have often had occasion to remark, that there is nothing which tends more to the general health of an animal, and the preventing of wear and tear in its system, than a uniform temperature; and this, as we have now explained how it is brought about in the forest, seems to be the principal reason why in the marten there is, both in its appearance and its fur, a superior animal to the marten of the open plains; and this, when duly considered, appears sufficiently to account for all the differences

nat are observable between one marten and another, t least in so far as the two observed varieties of Europe, and those which answer to them in other arts of the world, are concerned.

The great esteem in which the furs of this tribe of nimals have been so long held, and the severe labour hich must be undergone in order to procure their kins, have tended not a little to confuse the natural istory of them. The quality and colour of the ir are, of course, the properties upon which its arket value depends; and they consequently oc-upy the foremost place in the thoughts both of the unter and the dealer. With the exception of the rmine, the skins of all the rest are not only esteemed ore beautiful in proportion as they are darker, but ey are actually better in quality. For this reason classification, according to colour, of the skins of he very same animal is not only natural, but almost ecessary. On the other hand, the labour that must e undergone, in finding such small animals in the ilds, and the fact of the whole race being solitary nimals, of which one only can be captured at a time, enders the real hunting one of the least profitable ccupations in which human beings can engage; at he same time that it is one of the most severe, both n bodily labour and exposure to the weather. For hese reasons the hunting of the fur animals can be ractised only by persons of the very humblest class, ho are incapable of doing anything better. Such ersons cannot be expected to have any knowledge f the principles of natural history, or any desire to romote the practice of it; and we require no other roof of this, than the fact that, with the exception f one or two spirited agents in the wilds of Canada, hose occupation was much more that of purchasers f furs than original procurers of them, the hunters of ir animals, and the dealers in their skins, have added othing whatever to natural history. We have a emarkable instance of this in the case of the chin-hilla of the western slopes of the southern Andes. The skins of these animals had been in common use y thousands for many years before any person in Europe knew from what part of the world they came.

In Siberia there is the same distinction made be-ween the marten of the wild woods and the marten f cultivated places, as there is in Europe. That hich has the latter habit often levies contributions n poultry and pheasants, and slaughters away, so hat it kills a great number in a night. It is said lso sometimes to nestle in obscure corners about arns and other outhouses, and in fact to have a ood deal of the habits of the weasel. Its fur is much ess esteemed than that of the marten of the woods, nd therefore it is much less frequently sought after. ome of the American martens differ considerably rom those of Europe, at least in their colouring; and his will render a slight notice of one or two of them ecessary.

The *Canada Marten*, or *Pekan*, (*M. Canadensis*,) is bout the size of the martens of Europe, or perhaps a ittle larger. It has the feet, the tail, the muzzle, and he under part of the body deep reddish brown; the ars whitish, and the rest of the body greyish brown, aried with black. It is understood to be subject to ome seasonal variety of colour, and individuals also iffer greatly, some being almost black on the upper art. It occurs in considerable numbers in the coun-ry after which it is named; but its habits do not iffer materially from those of the others.

The *Huron Marten* is another coloured variety, differing considerably from the former. It is all over of a bright pale brown, but with the paws and extre-mity of the tail often darker than the rest. Hardly any positive description of its colour can be given, however, because it is subject to much variation. This variety, (if indeed it is a variety, and not a mere change of colour, produced by a different climate,) appears to stand to the other Canada one in nearly the same relation as the marten of the forest stands to the marten of the fields in the eastern continent. We are, however, so ignorant of the summer appear-ance of the American fur animals, from the inaccessi-bility of their country, except when it is frozen, as to be unable to come to any positive conclusion with regard to what is a species permanent for generations in its character, and what is a variety incidental only to the individual.

It is when these animals are in their winter attire that they are sought after; and though they are active at this time, it is by no means their character-istic season, for the summer covering is to be regarded as that most connected with the physiology of the animal; and unless this is as well known as the other, we can come to no very safe conclusion of such a nature as to satisfy the naturalist, how well soever those winter distinctions may answer for com-mercial purposes.

The *Sable* (*M. zibellina*). This is by far the most highly esteemed of the whole genus of the true martens, as it ranks higher among them than the ermine does among polecats. In form and size it does not differ greatly from the martens, and there is also a slight resemblance in the character of the fur, though that of the marten is very inferior in all those qualities which are valued in furs. Though the fact is sometimes stated otherwise, the teeth of the sable are of exactly the same character as those of the martens, which indicates the same kind of living, and the capacity of partially subsisting upon vegetable matter when animal food is not to be had. But there is one character of the sable which points it out as belonging to a different locality, and that is, the feet being completely covered with fur down to the claws. Thus the sable is a more north-erly animal than any of the martens, and an animal much more of the wilds. Accordingly it is never met with in warm places, but only in the extremest wilds of Siberia, beyond the positive forests, and on the margins of the polar ice.

The skin of the sable is exceedingly valuable; and though the animal is a very small one, a single skin fetches a large price. The animal is accordingly sought after with the greatest assiduity, and it may be said, that the desire of procuring sable skins has con-duced more than anything else to the discovery of the extreme north and north-east of Asia. It is during winter that this hunting is carried on, and it is described as being more severe than the hunt-ing of the fur animals in America, because of the vast accumulations of broken ice, covered with snow, which skirt the shores of the sea, and contain between them the most dangerous pitfalls, concealed by snow. In America, the margin of the polar sea is no doubt as wild in itself as it is in Asia; but the American hunting ground does not come up into so high lati-tudes as the sable ground in Siberia; and thus, though the American hunter has long roads and severe cold, he is not beset by so many dangers.

We need hardly mention that the fur of the sable is a rich brown, marked with some white spots on the chin and sides of the head. The part where these spots are is not as much valued as the rest; and the furriers work it up separately, and give it the name of "sable gill."

Like the ermine among the polecats, which is the most immediate associate in locality with the sable, among that genus of the tribe, the sable is subject to an annual change of colour. In summer it is black, and the change that it undergoes, naturally follows the general law of being more perfect in proportion as the cold is more severe. The cold of the sable's country, however, is sufficient every winter for accomplishing anything that cold can accomplish, whether it reside in the places which we have mentioned close by the polar sea, or on the cold heights of the mountains further south; and therefore the sable skins obtained during the winter are more uniform in colour than those of animals which inhabit less rigorous places.

In many places of Siberia the hunting of the sable is a duty imposed by the Russian government upon the exiles from that country; and to them, when they first enter upon it, it is the most dreadful to which human beings can be subjected. They are unacquainted with the country; and instead of knowing where to discover and how to procure the animals, of which they are compelled to find a specified number, they can hardly make their own way across rocks and chasms, fallen trees, and countless other irregularities, all hidden under the snow; and thus many of them perish in that dreadful wilderness.

The sable, as we might expect, partakes of the characters of a tree animal and a ground animal jointly. It can climb; and it is understood to climb for those wild berries which remain upon the branches in winter, as well as for birds and their eggs and young during the summer. It also hunts prey upon the ground; and though it is of course not capable of running down a hare in fair chase, it is very capable of despatching one if it come upon it by surprise. It is also sure to follow the more powerful predatory animals, the polar bear, the wolf, and the glutton, in order to obtain a share of their prey. In its disposition it is not a ferocious animal, but can be tamed, and will show some affection in a domestic state. In this state it subsists indiscriminately upon animal and vegetable matter, and is said not to be so prone to make its escape to the wilds as the marten.

We have now enumerated the principal species and the leading varieties of the polecats and the true martens, as they are found in the eastern continent and in North America. Had we attended to the differences of colour as they are noticed in museum specimens, which are often selected for their curiosity and not for their correctness, we should have had a much larger list; and there are some small weasel-looking animals of South America which have not been very accurately described, that appear to belong to a different family, though they have sometimes been included in this one. These, according to the best accounts, are plantigrade animals, and therefore they have neither the swift motions nor the energy of the present family. We have already assigned some reasons why the true polecats and martens should be in a great measure confined to the cold and temperate regions of the world, and that, in such a country as South America especially, the smaller predatory mammalia should be chiefly of an insectivorous disposition; and this last appears to be the predominating character of those South American animals to which we have alluded as being sometimes included in the present genus.

Mephitis.—The mephitic animals, at least those of South America, which are the best known, form a single genus, not very numerous in species, nor greatly so in individuals. The name by which they are known is highly correct and descriptive; for it is impossible to imagine anything more offensive than the odour which these animals give out when they are alarmed or irritated. They differ more from the polecats and the martens in the general appearance of their bodies than these animals do from each other. In number their teeth are the same as those of the polecats; but they have the tuberculous tooth in the upper jaw large, and two tubercles on the inside of the carnivorous tooth in the lower jaw, which reduce its sanguinary character below even that of the martens, which have less bloodthirsty habits than the polecats. In their forms these mephitic animals bear some resemblance to the badgers, sufficient to lead us to conclude that there would be some similarity in their habits and also in their food.

The general characters of these animals, besides that of the teeth as given above, are, the body very low, the head long and pointed, the ears small, the legs short, the claws on the fore feet large and strong, and well adapted for burrowing in the ground. They have not that arching and flexibility of the spine which characterises the two genera of which we have spoken; and their bodies are not adapted for making way through such small apertures in proportion to the relative sizes of the animals. They accordingly inhabit the ground, live in burrows, and when undisturbed, they are, like the badgers, very peaceful animals in their habits. Their markings also bear some resemblance to those of the badgers, consisting chiefly of longitudinal lines of white upon a dark ground. One, at least, is met with in the southern parts of the United States, and described by Catesby in his History of Carolina. It does not appear that this one is at all different from the one which occurs in South America to the eastward of the Andes, further than having the white lines more produced in some specimens than in others. This species is

The *Chinche* of Buffon and other authors; but it has also other names, and indeed there has been some confusion among all the rank-smelling animals of South America, from the fact of the Spanish indiscriminately giving them the name of *zorilla*, or little fox. The length of this species is about a foot and a half, exclusive of the tail, which is about half as much more, and very thickly covered with hair. The muzzle is very pointed, the eyes, like those of all digging animals, small, the fore part of the body altogether small, and the air of the animal dull and stupid. The colours are generally black and white; but their distribution and proportion to each other upon the body vary so much that they cannot be depended upon as portions of the descriptive character. It should seem also that these differences of colour are attended with difference of size; but what the particular circumstances of climate are have not been made out. They are, however, the reverse of the martens in their geographical distribution, and therefore we may conclude that climate has the very opposite effect upon them, and that in a place where

ıe marten family would thrive the best, these ani- als must be in the worst condition. This species is escribed as inhabiting the margins of the woods ıther than the depths of the tangled forests; and it ands charged with attacking farm-yards and de- roying poultry. We should feel inclined to doubt is part of its character, though it is highly probable ıat it may destroy eggs and also the callow young ' birds. When the animal is not alarmed, the odour ' it, though offensive certainly, is not intolerable; ıd it appears that the animal uses its battery for the ıme purpose that a vessel uses her stern-chase guns, ımely, to retard the progress of an enemy, and thus crease the chance of escape. The offensive odour confined exclusively to the apparatus by means of hich it is produced and emitted; and when this ›paratus is removed, it is said that the Indians, and ·en the Guachos, do not hesitate to eat the flesh of is animal, nor eat it without a high relish, though ›t equal to the flesh of an armadillo roasted in its own ell. When the animal is pursued and annoyed, the ıttery is discharged, not in mere gas, but in a liquid, hich, however, instantly evaporates, and is so buoyant ıd dispersive, and at the same time so powerful, that will taint the air for a mile or even several miles und. Nearer at hand it is perfectly intolerable, ıd the staunchest dog is instantly arrested by it. 'e do not give implicit credit to all the stories which e told of it, although we believe it would be very fficult to exaggerate its offensive qualities. As a spe- men of what is said, we quote the following short pas- ge from Kalmen. "In the year 1749," says he, "one these animals came near the farm where I lived. It as in winter time, during the night, and the dogs at were on the watch pursued it for some time, ıtil it discharged against them. Although I was in y bed a good way off, I thought I should be suffo- ıted; and the cows and oxen, by their lowings, ›owed how much they were affected by the stench. bout the end of the same year another of these ıimals crept into our cellar, but did not exhale the nallest scent, because it was not disturbed. A olish woman, however, who perceived it at night y the shining of its eyes, killed it, and at that moment ; stench began to spread. The whole cellar was lled with it to such a degree, that the woman kept er bed for several days after, and all the bread, eat, and other provisions that were kept there, ere so affected, that they were obliged to be thrown ıt of doors."

D'Azzara gives a similar account of the extreme ffensiveness of the discharge given out by the me- hitic animal of Chili, which is an animal resembling ıe former in many respects, though differing from it in hers. We have not thought it necessary to give ıy one of the many names which this Chilian animal ·ceives; because there is not any one of them ex- ressive of its character, and in its manners it is not ·ry different from the chinche. Like the other, it is ·ry subject to variation of colour, and the colours of ıe male and female are rarely the same, so that a escription founded upon colour would describe erely the individual and not the species, and thus ; in effect no description at all. According to 'Azzara, the Chilian animal lives in the open country ıther than in the forests; and we might expect this, r the general character of at least a great part of hili is more that of open country than of forest. It ırrows in the ground; and though the naturalist to whom probably we are indebted for our best inform- ation respecting it describes it chiefly as feeding upon eggs, insects, and such birds as it may occasion- ally capture, yet we strongly suspect, that from the vegetable character of the teeth, and its excellent provision for burrowing, it adds both earth-worms and bulbous roots to the food which he mentions. It is represented as having an easy and gliding motion, but not a rapid one; so that, though it can gallop when danger puts it to its speed, its motion is not faster than a man can follow it. It is not known to attack any of the mammalia, and it is altogether very mild and inoffensive in its manners. The Indians seek after it with some eagerness, and relish its flesh. When they pursue it they teaze it with a long cane, in order to make it discharge the contents of its offensive apparatus. When they once succeed in this, the animal is taken with the greatest ease and with- out offending any one; and they have the art of extracting this apparatus, which of course destroys the power of ever after emitting the odour, and the animal may then be kept in the house in a completely domestic state.

The secretion which these animals emit, and which is so volatile in its nature and so offensive in its smell, has not, we believe, been subjected to anything like an accurate chemical analysis, and thus its com- position is not known. Indeed, the analysis of this substance would defy the nose of almost any chemist, how well inured soever to the unsavoury smells of a common laboratory. It is generally supposed, how- ever, to have phosphorus in its composition, or, at all events, to have phosphorescent properties, so that, when the animal discharges it in the dark, it comes off like a jet of light, and thus it is literally a species of firing. When it takes effect upon the skin in sub- stance, it appears to be caustic and painful in its opera- tion, as well as offensive to the smell. Old dogs, who have experience in the pursuit of this animal, are not fond of going in upon it behind at any time, and will not venture until it has made its discharge; but young dogs readily run in upon it, and as its march is very slow, they soon near it; when they do so, however, they are certain of receiving the offensive discharge right on the nose, and this throws them into a state of the greatest apparent agony. They turn away from the animal with great fear, scrape the earth with their paws, and bury and rub their noses in it with piteous whinings, and tear them with their claws till they are all lacerated and bleeding. They do not desist from those demonstrations of suffering until they are completely exhausted, and fall panting to the earth through fatigue; and if one of them has suffered in this manner, nothing can induce him again to follow an animal of the same species.

If this matter is projected upon the clothes of a human being, those clothes are useless ever after, because no means have been discovered by which the offensive smell can be removed, at least in any rea- sonable portion of time. Hamilton Smith, whom Cuvier very justly characterises as "*très savant naturaliste*," mentions that Mr. Skidder, of New York, had a suit of clothes stained by this matter, which were washed with the greatest care, and afterwards suspended over the top of the house, not less than fifty feet from the foundation, and yet the rank odour was strongly smelt a long way off in the streets. Smith further mentions, that when one day travelling by coach in some part of the

United States, the coach came up upon a chinche (or skunk, as it is called in North America), which was endeavouring to creep through a fence. It was unable to accomplish this before the coach came close upon it, and so it discharged its artillery against the driver. This artillery did not take effect on him, but on a buxom American lass, who, occupying part of the driver's seat, was between him and the animal, and so completely did it pollute her clothes, that they never could be used afterwards. Whether Smith and his fellow-travellers were gallant enough to sympathise with this Transatlantic beauty while under the effects of this "untoward" accident, and remain in the same vehicle with her, is not recorded; but if they did, it was of course done at no common olfactory sacrifice.

It is not a little remarkable, that the whole of this tribe of animals are furnished with offensive odours in proportion either to their sanguinary habits, or to their inability to defend themselves by the ordinary means of cleanly warfare among beasts. The inability of defence appears to be the property with which this offensive odour is most largely associated; and in the true martens, which are the most lively and energetic animals of the whole, though the least disposed to interfere with any other mammalia, the odour, so far from being offensive, is agreeable; and in the viverridæ, which, in their general characters, stand somewhere between the dogs and the hyenas, the odorous secretion has a strong musky smell, and is by many highly prized, and purchased at a considerable price as a perfume.

There is one animal which, in its teeth and in its feet, bears a great resemblance to these mephitic animals, but it is totally different in the snout, the tail, and the general shape and covering of the body, so that it forms, at all events, a separate genus, and ought perhaps to be regarded as belonging to a tribe quite distinct from that of the martens in any of the three genera. We shall therefore describe it as such, and without positively referring it to the family.

The Telagon (*Midaus meliceps*). This is an animal of the Oriental islands, and was made known to Europeans by the researches instituted by Raffles in Java, which revealed so many of the natural wonders and peculiarities of these most singular and productive countries. The first and best account we have of it is in Dr. Horsfield's Zoological Researches in Java, and therefore our notice may be most conveniently, as well as usefully, given in his words. It will be observed, that he calls it by a name somewhat different from that given to it by Cuvier, which we have adopted, but it is the same animal. "The Teledu," says Dr. Horsfield, "has a peculiar external character and physiognomy. Although it generally agrees in size with the polecats of Europe and America, the circumstances which influence its appearance are entirely different. The heavy form of the body, as well as the head, gradually narrowed to an obtuse point, call to mind the figure of a hog. The shortness and strength of the neck, and the manner of walking, by placing the entire sole of the foot on the ground, contribute further to give the animal a sluggish appearance. The eyes are placed high in the head, and in their size and disposition have considerable resemblance to those of the hog; the eyelids are rigid, and well provided with eyebrows, consisting of minute bristles; the irides are of a dark colour, and the pupil is circular; the ears are nearly concealed by the hairy covering of the body; but these organs are provided externally with an oblong concha, which surrounds the posterior part, and, passing the lower extremity of the meatus auditorius, forms a small curve inwards. No whiskers are perceptible, but a few straggling hairs arise from the upper lip. The covering of the teledu is adapted to the cold region which it inhabits. The fur is composed of long delicate hairs, silky at the base, which are closely arranged, and afford a warm coat to the body. On the sides of the neck the hairs are lengthened, and have a curved direction upward and backward; on the top of the head, meeting from before and behind, they form a small transverse crest, and on the abdomen they are thinly disposed, and afford, in some parts, a view of the naked skin. The colour of the hair is blackish brown, more or less intense on every part of the body, except the crown of the head, a streak along the back and the extremity of the tail; these parts are white, with a slight tint of yellow; the mark on the head has a rhomboidal form, obtuse and rounded anteriorly, and gradually attenuated as it passes to the shoulders, where it unites with the streak on the back; in some individuals this streak is interrupted. On the abdomen the brown is of a lighter hue, inclining to greyish or rufous. The covering is subject to several variations; the tail is scarcely half an inch long, but the hairs covering it project above an inch from the body; the limbs are short and stout, and the feet agree in structure with those of the allied genera, being formed for the plantigrade manner of walking; the claws are united at the base by a thick membrane, which envelops this part as a sheath; those of the fore feet are nearly double the size of those of the hind feet. In place of the pouches and reservoirs of fetid fluids, with which several genera of this family are provided, the mydaus has two glands of an oblong form, about one inch long and half an inch wide, near the extremity of the rectum; they are placed opposite to each other, and are individually furnished with an excretory duct nearly half an inch long, which communicates with the intestine. In the middle of each duct is a very minute aperture, surrounded by a muscular ring, somewhat swelled, which enables the animal at pleasure to discharge or retain the fetid fluid secreted by the glands. The ducts enter the rectum about half an inch within the external aperture. The internal surface of these glands is covered with numerous wrinkles disposed transversely; the fluid secreted by them is perfectly analogous, in its odour, to that secreted by several species of *Mephitis striata* of Fischer. Having experienced that of the latter, which is known in most parts of North America by the name of skunk, I readily recognised it in Java."

The distinctions between this animal and the mephitic animals of America are very striking. Its muzzle is lengthened like that of the badger, and the extremity is truncated and somewhat enlarged, so as to bear a slight resemblance to the snout of the hog. This elongation of the jaws, without any increase of the number of the teeth, or any enlargement of their size, gives a ragged appearance to the mouth of the animal, and indicates a corresponding feebleness in its bite. The shortness of the tail is another remarkable distinction, and so is the character of the external covering. On the American animals the hair, especially toward the hinder parts, is long and soft, and that on the tails of the whole is very much

duced. The hair of this one, on the other hand, hort all over the body and tail, and it is hard and f. In the others the neck and anterior extremities rather more slender than the posterior parts of animal, whereas in this one the neck is very k and stout, and the fore legs are longer, as well stronger, than the hind ones. The whole appear-e, indeed, indicates a difference of habit in the mal, varying as much from the mephitic animals America as these vary from the polecats and rtens. For these reasons it cannot naturally be ssed in the same group or family either with the or the other, but must stand apart as an individual cies in the system, having no generic and few ily resemblances to any of the other mammalia.

The geography of the animal, as ably explained by . Horsfield, is as peculiar as itself. In the low and ile parts of Java there is not a vestige of it, and has not a name in the language of those people o inhabit the parts of the island that may be strictly led tropical. It is a mountaineer, and, though in-iting almost immediately under the equator, it abits a temperate climate. It is never found cept at an elevation of more than seven thousand t above the level of the sea, and at this great ele-ion it does not inhabit one continuous tract, but a nber of detached places. The profile of Java, like t of many of the other volcanic islands in that part the world, is very peculiar when viewed in its gth. It does not present one great central ele-ion, to which all the hills and slopes are subor-ate, as is the case with islands which bear evi-ice of being raised from the bottom of the sea *masse*. It presents a succession of conical peaks, ich rise high above the intermediate parts at the atest elevations of these ; and thus, if a traveller ses along the middle line of the island, he finds an ernation of climates and productions which contrasts y strongly with each other. Those elevations are native place of the telagon, although it is not ally abundant on them all. On the steep conical ks, which rise from the warm plains by continuous livities, it is comparatively rare ; but where the und at an elevation equal to, or greater than that ich has been mentioned, expands into breadth, it very abundant. Thus it is really an animal of the ins, although of those plains only which are on the untain tops. There are many such plains in Java, l they bear nearly the same relation to the fertile pestilent valleys on the shores, which the table d of Mexico does to the low and pestilent country the west side of the Gulf.

With European settlers, and also with the Chinese, se are the favourite places of Java, for permanent idence, even by those whose business is on the -coast. They are very healthy and very pleasant, l they admit of the cultivation of wheat and other ropean grain, and also of many fruits and culinary getables, while they are totally unfit for the growth rice, the staple and almost the only grain of the districts. These circumstances give Java, not-hstanding the extreme insalubrity of its shores, siderable advantages over India, and indeed over st of the warm countries in the East, inasmuch as ongenial climate may be found for the inhabitants lmost every latitude on the face of the earth ; and European chooses his residence high enough, he y enjoy a temperate climate, and one which is ny and salubrious all the year round. The telagon, as we have said, is very numerous in those plains, and it is often particularly annoying to the cultivators, from the facility which it has in rooting up the ground, and the offensive odour which it gives out when annoyed. The name telagon was given to it in consequence of the angle at which the nose is truncated off, which is nearly the same as that in the hog, and of itself would indicate not merely an animal which burrows in the ground for its dwelling, but one which turns up the earth in search of its food. In the plantations of the cultivators it destroys the roots of the young plants, and thus produces much greater waste than a larger animal feeding only upon full-grown vegetables. So great are the depredations which it commits, that in some districts the inhabitants live in considerable dread of its visitations. It inhabits the rich black soil only, and lives under ground during the day, but comes abroad in the night, and leaves very decided marks of the laborious working of so comparatively small an animal. Its lodging is generally concealed under the roots of a tree. It is of a circular form, several feet in diameter, and worked firm and regular on the inner surface. The entrance is by a subterraneous passage two or three yards in length ; and the animal is at some pains in concealing the opening to this by leaves, grass, and other vegetable matters. These animals are not social, but they live in pairs, and we believe the pairing is permanent, continuing intermediate between the broods. The litter is not understood to consist of more than two or three ; but it is not correctly ascertained how many litters are produced in the year, or whether there are more than one.

Besides the roots of plants, these animals eat a vast number of earth-worms, which are both abundant and of large size in the rich upland plains of Java ; and it is highly probable that its chief use in wild nature is to regulate the numbers of those worms, because it is found only in grounds where they are abundant. It is not very probable that it feeds on birds, and its mouth is not well adapted for contending with any of the mammalia. The fore teeth in the lower jaw stand out nearly as a continuation of the jaw itself, and thus are incapable of biting anything which is hard or tough ; and the canines are also small and feeble. In every part of its character, therefore, this is a most singular animal, and an animal adapted to a singular locality.

We shall close our account with another very short extract from Dr. Horsfield, descriptive of its manners, not as tamed, but as kept by him in temporary captivity. "The mydaus," says he, "is not ferocious in its manners, and taken young, like the badger, it might easily be tamed. An individual, which I kept some time in confinement, afforded me an opportunity of observing its disposition ; it soon became gentle, and reconciled to its situation, and did not at any time emit the offensive fluid ; I carried it with me from Mountain Prahee to Bladeran, a village on the declivity of that mountain, where the temperature was more moderate. While a drawing was made, the animal was tied to a small stake ; it moved about quietly, burrowing the ground with its snout and feet, as if in search of food, without taking notice of the bystanders, or making violent efforts to disengage itself ; on earth-worms (*lumbrici*) being brought, it ate voraciously ; holding one extremity of a worm with its claws, its teeth were employed in tearing the other ; having consumed about ten or twelve, it be-

came drowsy, and, making a small groove in the earth, in which it placed its snout, it composed itself deliberately, and was soon asleep."

With this quotation we shall close our notice of the telagon, and also of the very interesting family of animals to which it belongs. Next to the cat and dog tribes, the martens are the most interesting of all the mammalia, on account of the exertion which they require to make use of in finding their food, and of the development of the sentient or animal part of their structure which this requires. In some respects they are superior to either of those families which we have named; for they have more courage and more strength in proportion to their size, and they are furnished with clothing which protects them better against the vicissitudes of the seasons, and especially against the rigour of winter in those climates where the winter is more than usually severe.

MARVEL OF PERU is the *Mirabilis dichotoma* of Linnæus, a tuberous-rooted South American ornamental plant, introduced to our gardens nearly two hundred years ago. It belongs to the natural order *Nyctagineæ*.

MASON BEES, MASON WASPS, &c. These terms are applied to those solitary species of bees and wasps which construct their nests of bits of earth and sand. Of these, the genera *Anthophora* amongst the bees, and *Odynerus* amongst the wasps, are the most remarkable. We have, however, given an account of the proceedings of these insects in other parts of our work.

MASTICH TREE is the *Pistacia Lentiscus* of Linnæus, a tree indigenous to the South of Europe and opposite coast of Barbary. This tree yields the true mastic of commerce, its sap being obtained by wounding the bark.

MATHIOLA (R. Brown). A genus of beautiful flowering annual, biennial, and perennial herbs and undershrubs, natives of different parts of the world. They belong to *Cruciferæ*, and are known by the name of stock, or gillyflower, needing no description.

MAURANDYA (Jacquin). A genus of Mexican climbers, bearing didynamous flowers, and belonging to *Scrophularineæ*. They are greenhouse plants, thrive in any light rich soil, and are readily increased by seeds or cuttings of the young shoots planted under a striking-glass. The hardiest and most showy is the *M. Barclayana*.

MAURITIA (Linnæus, fil.) A genus of palms indigenous to South America. They are of lofty growth, and when kept in our stoves require a rich sandy loam, and plenty of water when growing freely.

MAXILLARIA (Flora Peruviana). A genus of South American orchideous plants, some of them bearing splendid flowers. They are managed like their congeners the epidendrons and oncidiums, and kept in a warm damp stove.

MAY APPLE is the *Podophyllum peltatum* of Linnæus: the duck's-foot of North America. In our gardens it is cultivated in a rich soil, and increased by dividing the roots or by seeds.

MAY FLY. The name given to a species of neuropterous insects of not very definite signification; being by some authors given as identical with the *Ephemera vulgata*, by others as a species of *Phryganea*, and by others as the *Sialis nigra*, which, appearing in the month of May, and serving as a bait for fish, seems more particularly entitled to the term.

MEADOW GRASS is the *Poa pratensis* of Linnæus, one of the most common of our agricultura grasses, and found in every pasture and meadow i the kingdom.

MEADOW RUE is the *Thalictrum flavum* o Linnæus, a British plant, and sometimes met with i gardens.

MEADOW SAFFRON is the *Colchicum By zantinum* of Linnæus, a celebrated medicinal plant The *C. autumnale* is a British plant, and is sometime cultivated by farmers.

MEADOW SAXIFRAGE is the *Scseli* o Linnæus; a genus of annual, biennial, and perennia herbs, mostly natives of Europe—uncultivated.

MEADOW SWEET is the *Spiræa ulmaria* o Linnæus, a common British plant, often met with o the banks of rivulets.

MEAL WORM. The scaly cylindrical larva o the coleopterous insect *Tenebrio Molitor* (see TENE BRIONIDÆ) is thus named, from taking up its resi dence in flour, meal, cakes, sea-biscuit, &c., in whic it does great damage, by eating or gnawing it i pieces. It is upwards of an inch long, and furnishe with short but powerful jaws, and remains two year in the larva state, previous to becoming a pupa. I is especially destructive in barrels of biscuits on boar of ships.

MEDICAGO (Linnæus). An extraordinary genu of annual and perennial herbs, mostly natives o Europe. The flowers are diadelphous, and belong t the natural order *Leguminosæ*. The hop-trefoil an lucern, both agricultural plants, belong to this genus.

MEDLAR is the *Mespilus germanica* of Lin næus, a well-known inferior fruit-tree, frequently cul tivated in gardens, and also found wild in many place in England and on the continent. They are com monly grafted or budded on the common hawthorn and thrive well in any soil or situation.

MEDUSA is the *Euphorbia Caput Medusæ* o Linnæus, a grotesque growing species of spurge in digenous in Africa. It is a greenhouse undershru and succulent.

MEGACHILE (Latreille). A genus of long tongued bees, (family *Apidæ*, sub-family *Dasygastre* or woolly-bellied,) having the abdomen of an ova form, densely clothed on the under surface with hairs which form in the females a pollen brush, and flat tened above. The maxillary palpi are composed o only two joints. The abdomen, moreover, is capabl of being turned upwards, so as to enable the bees t make use of their sting above the surface of the body These insects are generally called leaf-cutter bees and the instinctive agility with which they contriv to clip off circular pieces from the leaves of rose-tree and other shrubs with their jaws is most extraordi nary: these pieces of leaves are employed in th construction of their nests; and it is curious to per ceive one of these bees flying off with a piece of leaf as large as, or larger than, its own body. Thei nests are formed in the crevices of walls, or in bur rows in rotten wood; and the cells are lined at th bottoms and sides with the pieces of leaves, whic are cut exactly to fit each other; a supply of polle paste is then introduced into the cell, together wit an egg, and the whole is closed by several layers o circular bits of leaf, the uppermost of which forms th floor of the next superincumbent cell, which is sim larly constructed; and so on, cell after cell is adde until the burrow is completely filled. The manne in which the bee contrives to cut off a bit of the le

serves particular notice. Reaumur, to whom we so much indebted for our knowledge of the pro-edings of insects, thus describes it:—When the nale bee has chosen a leaf, she alights upon it, netimes taking her station on its upper surface, netimes underneath it, and at others upon its edge, that the margin passes between her legs. Her t attack, which is generally made the moment she ghts, is usually near the footstalk, her head being ned towards the apex. Now and then, however, places herself near the apex, facing the footstalk. soon as she has made a beginning, she continues ting with her jaws, (which are admirably formed the purpose,) and without intermission, till she has shed her work. As she proceeds, she keeps the rgin of the detached part between her legs, those ne side being above and the other below it, so t the section keeps giving way to her, and does interrupt her progress. She makes her incision a curve line, approaching the rachis first; but, en she has reached a certain point, she keeps eding from it towards the margin, still cutting in urve. When she has nearly detached the portion has been employed upon from the leaf, she ances herself upon her wings, lest its weight uld carry her to the ground, and the very moment arts from the parent stock she flies off with it in mph, the detached portion remaining bent between legs, and being perpendicular to her body.

There are seven or eight British species belonging his genus, of which the *Apis centuncularis* of Lin-is may be regarded as the type; they are generally ut equal in size to the working hive-bee, which y much resemble in their outward appearance. Of se species the habits of all have not been observed, is it known that all are leaf-cutter bees, although n the structure of the mouth it is most probable. t there are several other bees nearly allied to these, differing in certain structural peculiarities, and onging to the genus *Osmia*, which are also leaf-ters, or upholsterers, as they have been called, l including a species respecting which a good deal liscussion took place, first observed by Reaumur, l which employs the leaves of the scarlet poppy the linings of its cells. Some species of *Mega-'e* have also been called carpenter bees, from king their nests in rotten wood; whilst one of the gest species, *Megachile muraria*, a native of France, rmany, &c., is a mason bee, forming its nest with y fine earth, which it kneads into a kind of mortar, l which is placed against the sides of walls exposed he sun, and which contains twelve or fifteen cells.

MEGASTACHYA (Beaunois). A genus of an-l and perennial grasses, mostly tropical, but much re curious than useful.

MELALEUCA (Linnæus). A genus of green-se trees and shrubs, chiefly natives of New Hol-l. The flowers are polyandrous and handsome, l the plants associate with *Myrtaceæ*. They are cessfully grown in sandy loam and moor earth, and propagated by cuttings in the usual way.

MELAMPYRUM (Linnæus). A genus of Bri-annual weeds, commonly called cow-wheat. ey belong to *Scrophularinæ*.

MELANDRYIDÆ (Leach; Serropalpides, reille). A family of coleopterous insects, belong-to the section *Heteromera*, and sub-section *Sten-ra*, Latreille, having the maxillary palpi large, deflexed, and strongly serrated; the antennæ are inserted in a notch on the inside of the eyes, and are short and filiform; the body is generally oblong or narrowed, and subcylindric, the mandibles notched at the tip, and the tarsal claws simple; the head is deflexed and small, the thorax trapezoid, the posterior legs simple, and the mouth not rostrated; by which characters they are distinguished from the *Cistelidæ*, *Helopidæ*, *Œdemeridæ*, and other heteromerous *Stenelytra*. The penultimate joint of the tarsi is generally bilobed; in some, however, it is entire, and in these the hind legs are saltatorial; the anterior tarsi are short and dilated. These insects are of a small, or but moderate size, and are found either beneath or upon the bark of trees; they are generally of obscure colour, more or less varied with fulvous. The genera which Stephens introduces into this family are *Lagria*, *Melandrya*, *Hollomenus*, *Scraptia*, *Phloiotrya*, *Dircæa*, *Hypulus*, *Abdera*, and *Orchesia*, the first of which forms, according to Latreille, a distinct sub-family. In the genus *Melandrya* the maxillary palpi are serrated, the tips of the second and third joints being internally produced into a point; the thorax is abruptly depressed at the sides near the posterior angles, with the posterior margin sinuated. The scutellum is of the ordinary size. There are two British species, *Mel. caraboides*, being the type, of a blue black colour, and not of uncommon occurrence. It is very active, and flies well.

MELANIA (Lamarck; Helix Amarula, Linnæus). This genus of shells was blended by Linnæus with the *Helices*, and some authors have supposed it to possess some affinity to the *Lymnæa*; but except their both being fluviatile molluscs, and the form of the spire in the *Melania* an oblong oval, with the spire produced or turreted, they are in other respects very dissimilar. The *Melania* is closed by a horny operculum; they are rather thick, the exterior wrinkled, and the margin of the spiral whorls often surmounted with spines or knobs; the columella arched and smooth; the lower part of the aperture entire, constantly wider than the upper; they are also covered with a brown or black epidermis. Their habitat is India, Africa, and the two Americas. Many species are found in a fossil state. They belong to the third family *Ellipsostomata*, of the second order *Asiphonobranchiata*.

MELANOPSIS (Lamarck). These molluscs are fluviatile, and are very nearly allied to the *Melaniæ*, from which, however, they may easily be distinguished, by their columella being callous at the upper part, and their base truncated, as in the *Achatina*. They approximate the *Pirena*, from which they principally differ in having only one sinus, or a widened opening at the base of the shell. They are turreted, the aperture entire, oval, and oblong; the columella callous at the upper end and truncated at the base; the right side with a sinus; they possess a horny subspiral operculum. Ten fossil species are described. This genus belongs to the second family *Entomostomata*, first order *Siphonobranchiata*, second class *Paracephalophora*.

MELANTHACEÆ. A natural order of plants, comprising above twenty-two genera, and at least one hundred and twelve species. They are mostly bulbous or tuberous rooted plants, and occur in all the four quarters of the globe. They range next to *Tulipaceæ*, but they are inferior to them in the grandeur of their

flowers. A dangerous and poisonous acrid juice is detectable in many of them, particularly *Colchicum* and *Veratrum*. The roots of the former are the basis of the *eau medicinale*, and are now used in cases of gout with much success. The root of the *Veratrum* is believed to have been the hellebore of the ancients, an active drug, but requires to be administered in small doses. The other genera in this order are:—*Bulbocodium*, *Merendera*, *Uvularia*, *Disporum*, *Schelhammera*, *Burckhardtia*, *Anguillaria*, *Ornithoglossum*, *Androcymbium*, *Melanthium*, *Wurmbea*, *Tofieldia*, *Xerophyllum*, *Helonias*, *Nolina*, *Leimanthium*, *Chamælirium*, *Peliosanthes*, *Lichtensteinia*, and *Zigadenus*.

MELASIS (Olivier). An interesting genus of coleopterous insects, belonging to the section *Pentamera* and family *Buprestidæ*, but receding from the typical character of the family, having the antennæ strongly pectinated in the males and serrated in the females; the tarsi are subcylindrical, the body cylindric, the palpi terminated by a large globular joint, and the posterior angles of the thorax acute, in several of which respects this genus seems to form the connecting link between the two great families *Buprestidæ* and *Elateridæ*. There is but a single British species, *Mel. buprestoides*, Olivier, of a brown colour, not shining, and with reddish antennæ and legs. Found but rarely in the New Forest, &c.

MELASPHŒRULA (Ker). A genus of bulbous herbs from the Cape of Good Hope, belonging to *Triandria Monogynia*, and to the natural order *Irideæ*. Generic character: spatha two-valved, herbaceous, spreading; corolla of six petals, spreading, pointed; stamens ascending; stigma recurved; capsule turbinate; seeds small and globular. These plants succeed with the same management as *Ixias* and other Cape bulbs.

MELASTOMACEÆ. This order contains twelve genera and above seventy-six species of plants. They are in general handsome shrubs or trees, and leaves with several costæ, that is, with the midrib subdivided, and running longitudinally along the disc of the leaves. To be grown well, they require much heat and much space, in order that the foliage and flowers may assume their proper magnitude. The fruit is generally a fleshy insipid juicy berry, for the most part eatable, and of so deep a black as to dye the teeth and mouths of the eaters; hence the name *Melastoma*, or black-tooth. The juice is sometimes, as in *M. Tococa*, of so intense a black as to be used instead of ink. The leaves, and indeed all parts of the *M. parviflorum* and *M. longifolium*, afford a black dye, and, as well as those of the *M. malabathrica*, are used for dyeing cottons. The leaves of the *M. theæzans* are used at Popayan instead of tea, and are said to form a beverage preferable to that afforded by the Chinese tea-plant. This shrub is hardy, and might be cultivated in many parts of Europe.

The macaco-wood of commerce is the wood of *Tococa Guianensis*, the fruit of which is considered an agreeable food by man, and very much relished by monkeys. The fruit of *Blakea triplinervis* is yellow, and by most persons thought not only eatable, but pleasant.

Most of the *Melastomaceæ* thrive in moor-earth, and are propagated readily by cuttings. They must not be over-watered in winter.

MELEAGRA (De Montfort). A genus of molluscs now forming a subdivision of the genus *Turbo*.

MELEAGRINA (Lamarck; MYTALUS MARGARITIFERUS, Linnæus). A very great affinity doubtless exists between this mollusc and the genus *Avicula*, with which De Blainville has reunited it; but we trace distinctions sufficiently marked to induce us to preserve it as a separate genus, though contrary to the opinion of that eminent naturalist. The shell is always equivalve, always without the elongated transverse base, without the cardinal tooth, and the form of the shell constantly orbicular, sometimes attaining eight inches in diameter. In addition to these striking differences, the sloping sides of the opening, admitting the passage of a byssus, is very perceptible on both valves, which never occurs in the *Avicula*, where a notch answers the same purpose. The exterior of the valves is less smooth, and generally covered with scale-like imbrications, the terminations of previous stages of growth.

It is from this mollusc that the highly coveted jewel, the pearl, is extracted, which, under the article PEARL, will be more amply described; and from the valves of the *M. margaritifera*, the type of that genus, commonly called the Mother-of-Pearl Oyster, numerous elegant trinkets and ornaments are fashioned by the skilful artist. In China these shells are most abundant, but they do not yield so fine pearls as those in the Persian Gulf and other parts of the East. The valves, nevertheless, constitute an important branch of commerce, and ships of large burthen have brought them to England in such quantities that they formed a portion of the vessel's ballast. See AVICULA.

MELECTA (Latreille; CROCISA, Jurine). A genus of long-tongued bees, belonging to the family *Apidæ* and sub-family *Cuculinæ* (which see), having the body ornamented with patches of hairs of a white or silvery colour, the wings with three complete cubital or submarginal cells; the paraglossæ, or lateral divisions of the labium, nearly as long as the palpi, and the maxillary palpi five or six-jointed. The species are amongst the handsomest of our indigenous bees, and are parasitic in the nests of the species of *Anthophora* and some other mason bees about the entrances of which they may be observed flying in company with the real architects of the nests, which seem to take no notice of the presence of these their enemies. It has been generally considered that we possessed but a single British species of this genus, *M. punctata*, Villars; but Mr. Newman has lately published the description of six species in the tenth number of the Entomological Magazine, which, however, we believe are considered merely as varieties of the common species.

MELHANIA (Torskald). A genus of tropical trees, two of which are the red-wood and black-wood of St. Helena. The flowers are monadelphous, and the genus is ranked in the natural order *Byttneriaceæ*. These exotics are kept in our stoves, and potted with loam and moor-earth, but are very subject to be preyed on by insects, which, if suffered to remain, prevent their growth.

MELIACEÆ. A natural order of plants containing fourteen genera and thirty five species. The type of the order is the *Melia Azedarach*, or bead-tree, a native of Syria. The order is particularly distinguished by the stamens being united into a tube bearing the anthers; the leaves are usually pinnate, and most of the species, which are all either trees or shrubs, are natives of tropical forests. The fruit

some of the species is poisonous, but the bark of several is employed medicinally in countries where the plants are found wild. The order contains the following genera, viz., *Turræa*, *Quivisia*, *Sandoricum*, *Melia*, *Trichilia*, *Ekebergia*, *Guarea*, *Heynea*, *Cedrela*, *Swietenia*, *Chloroxylon*, *Flindersia*, *Carapa*, and *Wallsura*.

MELIANTHUS (Linnæus). A genus of evergreen shrubs, natives of the Cape of Good Hope. The flowers are didynamous, and are ranged in the order *Rutaceæ*. They are common in every greenhouse, easy of cultivation, and readily propagated by cuttings.

MELICA (Linnæus). A genus of grasses, two of which are natives of Britain, where they are called melic-grass. They are not economical plants.

MELICHRUS (R. Brown). A pretty genus of evergreen shrubs from New Holland. The flowers are pentandrous, and belong to the natural order *Epacrideæ*. They thrive in loam, sand, and moor-earth mixed, and cuttings of the young shoots strike root readily.

MELICOCCA (Linnæus). A genus of tropical fruit-trees called in this country honey-berries. The flowers are octandrous, and the plants belong to *Sapindaceæ*. The fruit is almost black, but very sweet and pleasant. They succeed very well under ordinary stove management.

MELILOTUS (Tournefort). A genus of annual, biennial and perennial herbs belonging to the *Leguminosæ*. The melilots are very similar to the clovers, with which they were once generically combined. *M. officinalis* was formerly used as a medicine, as an ingredient in plaisters, poultices, and emollient fomentations. It has a strong smell and bitter taste; but notwithstanding both, some cattle are fond of it. The celebrated Gruyère cheese owes its peculiar flavour to the seeds and flowers of this plant. The flowers are much resorted to by bees, and hence it has been called the honey-lotus.

MELISSA (Linnæus). A genus of well-known garden herbs, commonly called balm, of which there are five species. They belong to the natural order *Labiatæ*.

MELITTA (Kirby). Under this name Mr. Kirby, in his invaluable Monograph on the English Bees, separated those species which have the lower lip, or tongue, as it is called, very short, and which have subsequently been formed into the family *Andrenidæ*, (which see.)

MELITTIS (Linnæus). A genus of plants called bastard-balm, found plentifully in British woods. It also belongs to *Labiatæ*.

MELLIFERA—Honey-collectors (Latreille). A sub-section of aculeate hymenopterous insects, corresponding with the Linnæan genus *Apis* (see the articles Bee, Apidæ, Hymenoptera, &c.), divisible into the two families *Andrenidæ* (*Melitta*, Kirby), and *Apidæ* (*Apis*, Kirby).

MELOCACTUS. Is the *Cactus Melocactus* of Linnæus, commonly called the turk's-cap or melon thistle.

MELOCHIA (Linnæus). A genus of tropical undershrubs, bearing monadelphous flowers, and belonging to the natural order *Byttneriaceæ*. They are stove plants, and easily propagated by cuttings.

MELOE (Linnæus). A genus of coleopterous insects belonging to the section *Heteromera* and family *Cantharidæ*, having the body large and distended, the wings entirely wanting, and the elytra short, oval, and folding partially over each other at the base; the antennæ are eleven-jointed, of nearly equal thickness throughout, or dilated and singularly knotted or elbowed in the centre, especially in the males. These insects are of a comparatively large size; they are very inactive, crawling on the ground or amongst low herbage, upon which they feed; they emit an oleaginous liquid from the joints of the limbs, when disturbed, of a yellow colour and disagreeable odour. They are found in spring, and some of the species, especially the type *Meloe proscarabæus*, are sufficiently common. They possess in some degree the vesicatory powers of the *Cantharides*, and are indeed employed in some parts of Spain in lieu of the real blister fly. From this circumstance Latreille has conjectured that they were identical with the ancient *Buprestis*; but this can scarcely be, as they do not agree with the description of that insect, which is said to have resembled a wasp. The early history of these insects has been the subject of much discussion amongst naturalists, and may be cited as an example of the comparatively great extent of our ignorance of the real history of these tribes, and with the hopes of inciting persons who feel an interest in entomology to look at insects with a different eye than that of mere collectors. According to Gœdart and De Geer, the female meloe digs into the earth, and there deposits a mass of yellow eggs, from which, in due time, the larvæ are excluded, which are described as having six legs, two antennæ, and two long threads at the extremity of the body. These larvæ have never been observed above one eighth of an inch in length, and the most curious portion of their history is, that they fasten themselves upon the bodies of bees and flies, and suck their juices. Kirby and Leon Dufour, however, regarded these supposed larvæ as apterous insects, belonging to the order *Parasita* or *Anoplura*, the former naming them *Pediculus Melittarum*, and the latter even establishing a distinct apterous genus for their reception, *Triungulinus*. Since this period, however, several observers have endeavoured to solve the difficulty, the most recent being Mr. E. Doubleday, from whose pleasant paper in the Entomological Magazine the following quotation is derived:—"It is but rarely that we see a meloe in this neighbourhood (Colchester), but after diligent search, I found a few *Proscarabæi* of both sexes. These I placed on some light earth, under a bell glass, giving them plenty of ranunculus leaves to feed upon. The females, in particular, fed well, and grew wonderfully large in the abdomen; therefore I felt sure that I should soon have lots of good eggs, and then of course lots of larvæ, which would not be mere *Acaridæ* (*Pediculidæ*), but *bonâ fide* young meloes. One morning I found that something particular was going on amongst them. The old ladies, no doubt with much exertion, had scooped out places in the earth wherein to bury their eggs, and soon after a lump of bright orange eggs, about the size of a Palma Christi seed, was deposited in each, and carefully covered over. This was just what I had expected from what I had read about this matter. I now set the mould aside, keeping it a little moist, and covered up so that nothing could get at it. Thus it remained for about two months, when out sallied a host of little animals of a light brown colour, having, as near as may be, the shape of Kirby's figure in the *Mon. Apum*, which ran about the glass as swift as a

Yankee pony*, allowance being made for their difference in size. If I am not much deceived, I saw some of them actually making their way through the egg-shell. I put a lot of them into a glass jar, with some ranunculus leaves and some flies, principally *Syrphi*, and *Muscæ;* to these latter they soon attached themselves, just at the base of their posterior legs, remaining fixed so long as their victims lived. I supplied them with fresh food for some days, but with all their feeding they grew none the bigger, and in about three weeks they were all dead. A friend of mine, not an entomologist, but a lover of natural history, has since told me that he tried to rear the larva from the egg, but met exactly with the same fate as myself." Of the fact, then, that the *Triungulinus*, as it has been called, issues from the egg of the meloe, there is abundance of evidence; and hence, taking it for granted that these little active animals are the real larvæ of the meloe, Latreille and some other recent authors (including Drs. Brandt and Erichson, who have lately published a valuable monograph upon the genus in the *Nova Acta Naturæ Curiosorum*) have endeavoured to account for the curious circumstance connected with its economy, by considering that it attaches itself to bees in order to be by them carried into their provisioned nests, where, like some of the other genera of *Cantharidæ*, it is supposed to attach itself parasitically to the larva of the bee. It must be admitted, however, that this is but conjecture, and that direct observation is needed as to the matured state of the larva and pupa.

Mr. Stephens has divided the British species into two genera, from the structure of the antennæ; but if this character were allowed to influence the generic distribution of this group, there would be a great number of similar groups required. There are nine British species, including the type *Meloe proscarabæus* (Linnæus), *Proscarabæus vulgaris* (Stephens), which is of a black colour, shining and punctured, with the sides of the head, thorax, antennæ, and legs, violet. The elytra are slightly rugose. It is advisable that chemical experiments should be made, to ascertain the medical properties of these insects.

MELOLONTHIDÆ (MacLeay). A family of *Coleopterous* insects, belonging to the section *Pentamera*, and sub-section *Lamellicornes*, having the upper lip composed of a transverse plate, and generally deeply emarginate beneath. The mentum is as long as, or longer than, wide, somewhat narrowed in front. The maxillæ are horny and truncate at the extremity, with several (generally five or six) strong teeth; the legs are slender, and the tibiæ rather narrow; the antennæ nine-or ten-jointed, and terminated by a large lamellated club, varying in the number of its joints from three to seven, and the plate being very large in the males of the typical species; the body is oval and sub-convex; the elytra shorter than the abdomen, and the clypeus divided by a strong suture in front of the eyes.

This is a very extensive family, comprising many handsome species, which cannot, however, vie in splendour with the *Cetoniidæ*. In the perfect state these insects are eminently phyllophagous, that is, feeding upon the leaves of trees, for which the structure of the mouth is conveniently adapted, the maxillæ, as represented in our article Insect, p. 853, fig. 105, being fitted for cutting the leaves by their confined action, whilst the internal basal structure of the mandibles, fig. 97, p. 852, are equally adapted for chewing them when cut. It is, however, in the larva state that these insects are most especially injurious to the agriculturist and horticulturist, feeding upon the roots of various plants; and as they remain three or four years under the latter form, and acquire considerable size, it may be easily conceived that in seasons when they abound, they are capable of inflicting real injury.

Of these insects, the most common is the cockchaffer, constituting the type of the family, and which, from our earliest years, we have been taught to look upon as one of the most despised of the insect tribes; and yet this insect, in several interesting particulars, is not behind many of its more showy brethren. The peculiar structure of the mouth, the very beautiful fanlike antennæ of the males, and the curious pointed extremity of the body, through which children are in the cruel practice of running a pin, round which the insect whirls in its endeavours to escape, are characters which ought to rescue these insects from the tortures which are inflicted upon them, even without any regard being paid to their natural history. It is advisable, indeed, that means should be resorted to for the destruction of these insects when they happen to abound to an injurious extent; but this ought surely to be effected in the most summary manner. During the day they remain inactive in the trees and hedges; but no sooner is the sun set, than they emerge from their retreats, and fly, humming, round the trees, in search of their mates. Their existence in this state is but short, and their motions exhibit but little energy; they fly with heaviness and irregularity, and strike at whatever object may happen to be in their way. After coupling, the male soon dies, and the female deposits her eggs in the ground, digging six or eight inches into the earth. At times, and in favourable seasons, these insects swarm to a very great extent; and there are various statements on record, in which their numbers are described as incredible, and the damage which they committed not yielding to that caused by the locust. Of these accounts perhaps the most remarkable is that given in one of the early volumes of the Philosophical Transactions, by Mr. Molineux, in which their appearance in certain districts in Ireland is narrated. They were first noticed in Galway, and thence penetrated inland towards Heddford. They were seen in the daytime hanging from the boughs in clusters, like bees when they swarm, dispersing towards sunset "with a strange humming noise, like the beating of distant drums, and in such vast numbers that they darkened the air for the space of two or three miles square. In a short time they entirely ate up the leaves, stripping the trees as bare as in the depth of winter; they also entered the gardens, and attacked the fruit trees in the same way. Their multitudes spread so exceedingly that they infested houses, and became extremely offensive and troublesome. Their numerous young also, when hatched, did still more damage than all the swarms of the perfect beetle, eating up the roots of corn and grass. This plague was happily checked in several ways. High winds and wet mizzling weather destroyed millions of them in a day; and during this weather the swine and poultry watched under the trees for

* Your readers cannot fail to recollect the "very severe pony," which was chased three times round a field by a flash of lightning which at last gave up the pursuit, "not being able to come within a rod of it."

their falling, and fed and fattened upon them; and "even the poorer sort of the country people, the country then labouring under a scarcity of provisions, had a way of dressing them, and lived upon them as food." Smoke also was employed, and by burning heath, fern, &c., the gardens were partially saved. And Mouffelt, in his Theatre of Insects, informs us, that in 1574 so great a number of cockchaffers were driven into the river Severn that they hindered the mills from working, and were with difficulty destroyed by the united efforts of the people, and the different kinds of hawks, ducks, and other birds, which devoured them with eagerness. In 1751 also the county of Norfolk suffered greatly from their ravages, a great many crops being totally destroyed by these voracious insects. Various plans have been proposed for their destruction when they happen to abound. Torches held for a few minutes under the bushes stupify them, and they fall to the ground on beating the bushes with a stick, when the cockchaffers are collected and killed. Children are also employed to follow the plough and collect the larvæ, or white worms as they are called, as they are turned up. This, however, can only be done at certain seasons of the year, and after the end of the autumn it would be ineffectual, as the larvæ burrow deeper into the ground to avoid the rigour of winter. Pigs and poultry may also be similarly employed, and rooks are too well aware of the dainty treat which awaits them to be far behind the plough; they will also even pull up the dead roots of grass where the larvæ harbour; and hence they are mistaken by ignorant persons for the real cause of the mischief, and scarecrows are placed to drive these useful auxiliaries away, of which an instance is given by Mr. Spence, in the Introduction to Entomology, who endeavoured to convince one of these self-willed farmers that the rooks were his friends but who only replied that "he couldn't beer to see d' nasty craws pull up all d' gress, and sae he'd set d' bairns to hing up some aud clouts to flay em awey. Gin he'd letten em alean they'd sean hev reated up all d' close." The planting of various vegetables to which they are more especially partial, in the neighbourhood of plants which it is desirable to preserve, and the spreading of soot around the roots of the latter, have also been suggested, but the benefit resulting from these modes must be very partial, even if they could be adopted to any extent. The most advisable plan, as suggested by the abbé Rosier, is to keep a strict search for the insects for several seasons, by children and women, and to destroy as many of them as possible, and as soon as they make their appearance. The larvæ of these insects are thick curved fleshy grubs, differing so slightly from those of the *Cetoniidæ*, of which we have given a figure, that a more minute description may be dispensed with. At the commencement of the spring they quit their winter retreats at a depth in the earth, and come within a few inches below the surface of the ground; and when full grown, at the end of the summer of the third year, they again descend to the depth of two feet, where they become pupæ, having previously constructed an oval cell, very smooth on the inside. In the month of February, or even earlier, they assume the perfect state, but remain for a considerable time in a weak state, not venturing into the air until the fine days of May or the beginning of June.

The genera belonging to this family of insects are numerous, including *Melolontha*, *Amphimalla*, *Serica*, *Omaloplia*, *Hoplia*, *Anomala*, *Anisoplia*, all of which are British; *Dephu cephala*, *Euchlora*, *Monochela*, and numerous other exotic genera, of whose habits no particulars have been furnished.

The genus *Melolontha* is distinguished by its ten-jointed antennæ, having the club of the male seven-leaved, and that of the female six-leaved. There are three British species, 1. *Mel. Fullo*, a large species, handsomely mottled with white, on a dark brown ground, found but very rarely on the coast of Kent, and by some authors considered as a species which only accidentally finds its way from the opposite coast of France. 2. *Mel. vulgaris*; the common cockchaffer, brown tree beetle, blind beetle, chaffer, Jack Horner, Jeffry cock, May bug, brown clock, dor, miller, acre bob, May bob or oak web, as it is variously termed in different parts of the country; and 3. *Mel. Hippocastani*, Fabricius. See Steph. Ill. Mand, vol. v. 412.

The June bug or fern web, *Melolontha solstitialis*, is of small size, and belongs to the genus *Amphimalla*, Latreille, having the antennæ only nine-jointed.

MELON. Is the *Cucumis Melo* of Linnæus, a well-known cultivated fruit belonging to *Cucurbitaceæ*.

The melon is chiefly cultivated in hotbeds or in pots, and requires a considerable degree of skill and incessant attention to grow it in perfection. The gardener's aim is to have ripe fruit about the first of June, to do which requires the constant labour of at least three or four months.

The varieties of the melon are numerous; but very few of them are worthy of cultivation, the larger varieties being particularly deficient in flavour. Mr. Knight recommends the green fleshed and Salonica or white fleshed variety. The seeds of the melon should be sown early in March, in middle-sized pots, previously netted with hay so as to secure the removal of the entire ball; a rich, sandy, and adhesive loam is placed upon the hay, and a single seed planted in each pot, which is then plunged to the rim in a moderate hotbed. In April the plants will be ready for transplanting, with the ball entire, either into the frame or into a larger pot, at least ten inches broad at the rim, if it is intended to fruit in one; this pot being first filled with a soil composed of five parts of chopped turf with its herbage, and one part of the recent poultry dung well incorporated together. About the beginning of June the fruit, if successful, will have attained a considerable size; but it requires very great care and skill to ripen it before the month of August. Great care should be taken to water the plant at the roots whenever the soil becomes dry, or the leaves begin to droop.

MELONIA (De Blainville; Melonites, Lamarck). A fossil mollusc of microscopic size, classed by Fichtel with the *Nautili*.

MELYRIDÆ (Leach). A family of coleopterous insects belonging to the section *Pentamera*, and sub-section *Serricornes*, having the palpi short and filiform; the mandibles emarginate at the tips; the body generally long and narrow, with the base of the head concealed by the broad shield-like and sub-convex thorax; the tarsal joints are entire, with the claws unidentate or margined with membrane; the antennæ are serrated and pectinated in the males of some species. The species are of small or but moderate size; they are very active, elegantly coloured, and are found upon the flowers or leaves of plants, where they evidently subsist upon other insects which frequent the same situations. The family is but of small extent,

comprising the genera *Malachius*, *Aplocnemus*, and *Dasytes*, which are British, and *Lygia*, *Melyris*, and *Pelecophorus*, which are exotic; the typical genera *Melyris*, Fabricius, having the antennæ short and gradually enlarged to the tip, and being composed of several African species, the type being *M. viridis*, a common species inhabiting the Cape of Good Hope.

MEMBRACIS (Fabricius). A curious genus of exotic homopterous insects, belonging to the first section of the family *Cercopidæ*, and having the anterior tibiæ dilated, the scutellum not developed, the body being covered above by the large semicircular prothorax, which is elevated like the top of a helmet, and is not thicker than a card: there are numerous species, all of them inhabiting South America.

MEMECLYON (Linnæus). A genus of Indian trees, one of which bears edible fruit. They belong to the class *Octandria*, and to the natural order *Melastomaceæ*. They grow readily in our stoves, and may be propagated by cuttings. These plants have been separated from *Melastomaceæ* by M. De Candolle, and united with *Mouriria* and *Petaloma* to form a new but doubtful order called *Memecyleæ*.

MENISPERMUM (Linnæus). A genus of climbing plants, chiefly natives of America. They give a title to a natural order, viz.:—

MENISPERMACEÆ, which contains eight genera and and twenty-nine species, all twiners or climbers with small inconspicuous flowers. Dr. Lindley says "they are extremely dissimilar in habit from the orders placed near them, and occupy their present station entirely on account of certain minute but important characters in their fructification. With the exception of *Schizandra coccinea*, none of them are worth cultivating as ornamental plants." The famous Columba root, so much esteemed for its intense bitterness, is the produce of the *Cocculus palmatus*. The poisonous drug called *Cocculus indicus* in the shops is the seed of a species of *Cocculus*, probably *tuberosus*. Several Brazilian species of *Cocculus* and *Cissampelos*, are said to possess powerful febrifugal properties. The genera comprised in this order are *Cocculus*, *Cosinium*, *Tiliacora*, *Wendlandia*, *Cissampelos*, *Menispermum*, and *Abuta*; these compose the first tribe of the order; the second tribe containing only *Schizandra*.

MENTHA (Linnæus). A genus of useful and highly ornamental herbs, belonging to *Labiatæ*. The *M. viridis*, common mint, is one of our most useful culinary herbs, and in constant requisition by the cook.

MENURA—Lyre-tail. A very remarkable species of bird, a native of New Holland, found only in that country, and being the only one of the genus and even the family, as well as only a single species. It belongs, in Cuvier's arrangement, to the dentirostral family of the great order *Passeres*, with which it agrees in the bill being notched, and also in the general form of the legs and feet. But in its air and gait there are some resemblances to the poultry family, though those resemblances are rather slight. They consist in the prevailing tint of the plumage, the short and rounded wings, and the produced feathers in the tail of the male bird. Very little analogy, however, can be founded upon either of those resemblances, and therefore the bird, as we have said, stands alone.

The characters are: The bill broader than high at the base, and triangular in the section there, like the bills of the thrushes. For the greater part of its length the bill is straight, but the point of the upper mandible is hooked, and furnished with a notch on each side. There is a distinct ridge along the culmen of the bill; and the nostrils are placed in the middle of the bill, in prolonged grooves, very large, oval, and partially covered with membrane, which is beset with feathers as in the bills of the jays. The feet are slender, and the tarsus twice as long as the middle toe. The three front toes are of equal length, the internal one free, but the external joined to the middle as far as the first articulation. The claws are nearly as long as the toes, convex on the upper sides, and blunt. The wings are heavy, rounded and concave, the first five quills increasing regularly in length from the first; and the four next them being equal in length, and the longest in the wing. The tail has very long feathers, and in the male those feathers have a peculiar form, which we shall notice afterwards.

In some respects this is the most beautiful bird of New Holland; and in that country, as well as everywhere else, it stands alone, without there being any genus with which it has any considerable affinity. The colonists, according to the habit which most colonists have of calling new birds of the colony after old birds of the mother country, have given this bird the name of the wood pheasant, and sometimes of the lyre pheasant, on account of the peculiar form of the tail. These terms are misapplications, however, and ought to be discarded; and our knowledge of the bird must rest wholly on the description of itself, without any assistance from analogy.

When the weight, concavity, and roundness of its wings are considered, we need hardly mention that this is a bird which can neither feed upon the wing, nor make long flights, though its wings are, like those of the *Gallinidæ*, remarkably well adapted for rapid ascents and descents. Accordingly, it is like these in their native localities, a bird of the woods, and passes much of its time in trees or bushes, though it is also found upon the ground, and feeds principally there. Its feeding time is early in the morning, and the male struts about with something of the air of a dunghill cock, though we believe he is monogamous, and no battles of gallantry occur. It is found chiefly in places rather upland, where the ground is dry and covered with trees or brushwood; and its short round wings adapt it well for moving about in such places.

As we said, there is only a single species, *Menura lyrata*, which is about the size of a pheasant, though not so elegantly formed. It is generally speaking of a greyish brown colour, with the throat, and the upper coverts and quills of the wings, reddish brown. None of the colours are bright, neither do they form any very striking contrasts; but, notwithstanding, their general appearance is very striking. It is the tail of the male bird, however, which forms at once the most striking external character, and the greatest beauty of the bird. The tail consists of sixteen feathers, twelve of which, six on each side, have the shafts exceedingly slender, and very few fibres instead of webs; but these fibres are long. The two feathers in the middle have their external webs closely set and straight; and the inner webs almost entirely wanting. The two external feathers are bent like the branches of a lyre; and when the tail of the animal stands erect, it bears a slight resemblance to that instrument, these feathers resembling the frame of a lyre, while the twelve slender ones resemble the strings. It is from this form of the tail that the bird has received its name, which is

not inexpressive of the appearance of this appendage. Lyres, for that would be the best English name for them, and it is also the French one, are peaceable and harmless birds, remaining quiet in the shade of the thick branches and leaves during the day, so that they are but seldom seen at that time; and nothing is known with certainty of their nests, the numbers of their broods, or even their time of breeding. The male and female are usually found together, or at least not far apart, when they come out in the mornings and evenings to feed on the ground; and they are apparently very much attached to each other. They are not often seen, except by those settlers who reside very close on the forests in remote parts of the colony; for though their habit appears to be that of feeding upon the ground only, yet they do not frequent grounds on which there are no trees, the shade of these appearing to be indispensable to them in the heat of the day, as well as during the night. The structure of the bill is decidedly insectivorous, or at all events adapted for collecting worms, mollusca, and other small ground animals; and the claws are adapted for scraping, though not so decidedly as those of poultry. In fact the birds, and the country which they inhabit, are both so different from anything else that we meet with, that they would require to be both carefully examined, in order that any just conclusion might be arrived at respecting the adaptation of each to the other, or the use of the birds in the general economy of nature.

MENYANTHES (Linnæus). An aquatic genus, found in America and in Britain, where it is called buck-bean. The genus belongs to the natural order *Gentianeæ*. The different species require to be grown in little pools or cisterns, and are propagated by dividing the roots.

MENZIESIA (Smith). A genus of North American and British undershrubs, belonging to the *Ericaceæ*. These were associated with the heaths by Linnæus and others, until separated by Sir J. E. Smith.

MERCURY. This extraordinary metal differs materially from the great bulk of mineral bodies in being occasionally found flowing in a metallic state through the earth. The greater part of the mercury of commerce is, however, procured by distilling native cinnabar, when the metal rises in vapour and is afterwards condensed like steam. Mercury has a very great specific gravity, being heavier than all other fluids. It may be congealed when artificial freezing mixtures are resorted to, and it may then be fractured. The name *quicksilver* is given to this mineral, on account of its fluid form and silvery aspect.

MERGUS (*Mergus*). A genus of web-footed birds, to which the name of goosander is given, at least in some of the species. These names are by no means applicable, because the birds have neither the appearance nor the habits of geese of any description. Their characters are: the bill rather longer than the middle size, and much more slender and hard in its texture than the bills of ducks, not being a dabbling or sentient bill like theirs, but a prehensile bill of a very peculiar form. The mandibles are straight for the greater part of their length, but the upper one is much hooked at the point and very sharp, and the cutting edges of both mandibles are in all their length beset with short but strong and sharp teeth inclining backwards. The bill is thus fitted for taking an exceedingly firm hold of slippery prey, and the birds use it in capturing fish. The nostrils are placed about the middle of the length of the bill, of an oval form and open. The legs are short, placed far backwards as in the divers, and in consequence of this, these birds are much more awkward walkers than the ducks. The wings are of moderate length, but they are clean and firmly made, and the plumage of the body is also close and compact, so that the power of flight is considerable, and when necessary it can be extended to long distances with comparatively little fatigue. As is the case with the ducks, there is an enlargement of the pulmonic end of the trachea, which no doubt answers the purpose of a magazine of air, and enables the birds to remain much longer under water than they could do if not provided with such an apparatus. As the bill of this genus of birds is not adapted for dabbling in quest of soft prey in the mud like the bills of the ducks, or for dividing vegetable matter like those of the geese and swans, it has to find its food by ranging through the waters, and, generally speaking, by diving. In this operation it is by no means so expert as the divers properly so called, and therefore the bird is provided with a more effective apparatus for securing its prey in the hook of the upper mandible and the teeth with which both mandibles are furnished. The principal food of these birds is fish, in the capture of which they are by no means inexpert, so that when they make their inland excursions in temperate climates during the winter, they levy more severe contributions on fish-ponds than any birds which resort to such places, not excepting even the herons, which, though expert fishers and ravenous feeders, by not being either swimmers or divers, are necessarily confined to those portions of the water into which they can wade. In addition to fish, the birds of this genus live upon aquatic reptiles, such as frogs and water newts. They are, in short, abundant rather than particular in their feeding, and hence their flesh is rank and unsavoury, and rarely used as food even by those northern tribes whose supply is the most scanty.

All the genus, at least with some doubtful exceptions, are birds of the high latitudes of the north—that is, they summer, and nestle and rear their broods there. They may also inhabit the high latitudes of the southern hemisphere; but we are very much in the dark as to the economy of living nature in those latitudes, so that we are unable to ascertain with anything like precision, in what respects they agree with or differ from the same latitudes of the northern hemisphere. What lands, or whether any lands of considerable extent may be within the southern polar circle, is not discovered, and apparently not easily discoverable. But if there are few or no lands clear of ice in the southern summer, that is, in our winter, it is perfectly clear that very few birds at all similar to those which visit us from the extreme north in winter, can resort to the regions of the South Pole to breed. Of the birds which have been observed there, to as high latitudes as there are resting places for birds, the greater number, if not the whole, are either long-winged birds which are discursive over the wide ocean, or birds almost wingless, which never move far from the same locality at any season of the year.

There are some other circumstances in the physical geography of the southern hemisphere, which render it necessary that we should not apply to that hemisphere the knowledge which we possess of the aquatic birds which are migrant in the north. In that hemisphere the sea is open fairly round throughout the

whole year for a considerable extent of latitude; and the atmospheric current which results from this, cuts off the polar portion from the portion nearer the tropics, and thus there is not the same interchange of climate and alternation of annuals in the opposite seasons in that hemisphere as there is in the north. In consequence of this the birds which are met with in the most southerly parts of the extensive lands, whether New Holland, Africa, or America, are resident birds, totally different from ours even in corresponding latitudes; and no winter visitants similar to our winter visitants arrive there. So tropical indeed is the ornithology of these countries, that the humming birds are found up to the very extreme point of South America, and they are accompanied by a vegetation which is also tropical.

The seasonal migrations of the aquatic birds of high latitudes is one of the most interesting parts of their history, because they are evidences of the geography of different localities, and very correct tell-tales of the weather in the regions from which they come; and it is of importance to know that the general knowledge which they afford us with regard to the north, does not at all apply to the corresponding latitudes of the south.

The genus *Mergus* are all migrant, though they are not all equally polar in their summer residence and economy. One species, at least, lingers in a straggling remnant upon some of the remote isles north-westward of Scotland, and also in the extreme north-west of the main land. It is true, that this is but a remnant; and, unless the winter in the high latitude is exceedingly severe, the birds are not, generally speaking, numerous even in the northern parts of Britain, and they are comparatively rare in the southern. In the western part of the continent they are, perhaps, more abundant, and certainly extend more to the south than any part of Britain; but the continental winter is, latitude for latitude, colder than ours; and the birds which take the range of the North Sea, necessarily pass to the Netherlands or the North of France before they find a resting place. It is the same with all the birds which come from the regions of the poles in winter, the whole of them get more southerly in France than they do in England. We have already mentioned that these birds feed chiefly upon fish and aquatic reptiles; and their bills are not adapted for taking, or their stomachs for digesting, vegetable matter of any kind, and none of them are known to feed upon the land, for which they are equally ill adapted by the structure of their bills, and their short and backward feet. The latter are so ungainly, that they could pick up hardly any land substance, not even an insect or a worm; and their pace is so slow and wriggling that they could follow nothing which possessed any degree of land motion. They are, therefore, entirely cast upon the waters for their subsistence, and when frozen out in one place, they have no alternative but to take their departure for another.

The species of these birds were for a long time very much confused by describers, and multiplied to at least double the number that really exist; and it was reported by some naturalists that a species was met with in tropical latitudes on the coast of Brazil, but this is very unlikely, and contrary to the analogy of the birds, which, when they migrate from their polar localities, seek the inland lakes and rivers, or at all events the estuaries rather than the open sea. The cause of the multiplication of species beyond the real number, was the same as that which had introduced confusion into many other parts of ornithology; the females are differently coloured from the males, and the young are different from the mature birds of both, so that in any one of the species, those who founded their distinctions upon colour alone could easily divide it into three. There are at least four well-authenticated species, one of which certainly breeds in some parts of the British islands, another probably does so though more rarely, and the other two are rare even as stragglers. The English names given to the different species vary; the largest being called Goosander, two of the others Merganser, and the remaining one the Smew, or white nun.

The *Goosander* (*M. Merganser*). This is the largest species of the genus, the male being about four pounds in weight, twenty inches long, and upwards of three feet in the expanse of the wings. Its summer residence is in the northern parts of both continents, and it is probable that a few, though a very few, may linger during the summer about the extreme north of Scotland. In winter it is very discursive, and more so in proportion as the winter sets in more early and severe. It visits many parts of the British coast, according as these lie more in the line of its progress southward; and on the continent it finds its way to the lakes and ponds of Germany and even of Switzerland. As it inhabits round the entire circumference it is equally migrant in Asia and America as in Europe; and as Finland is a country abounding in pools and streams, many stop to breed there.

Goosander.

The bill is ample in the gape, but rather shorter than in some of the other species. In the greater part of its length it is slightly bent upwards, but the tip of the upper mandible is strongly hooked downwards, and consists of a nail of harder texture than the rest of the bill. The cutting edges are very strongly toothed, so much so that the bird is popularly known by the appellation of "Jack-saw." The general colour of the bill is red; but a portion round the nostrils, the ridge of the upper mandible, and the nail on its tip are dusky. The inside of the gape is bright orange. The head and crest, the last of which is most conspicuous in the male, together with the upper part of the neck, are dark green, passing into black on the chin and throat. The lower part of the neck, the outer scapulars, the breast, and all the under part of the body, are white with a tinge of yellowish red. The back, and scapulars next the back, are black, fading into greyish toward the rump, and the

tail, which consists of eighteen pointed feathers, is of a grey colour. The principal quills and coverts are brownish black, with the exception of the middle secondaries and the extremities of their coverts, and these form a white speculum or wing-spot. The head and neck of the female are rust-coloured, the upper part is of a greyish tint, and the under part white with a yellowish shade. In consequence of this she has been figured and described as the "Dun Diver;" and the young male, which resembles her in colour, has been considered as the male of the same. The bill and feet are reddish ash colour.

This species is strong and active, and a most successful fisher, so that when it comes southward its visits to fish ponds are by no means courted. The nest is generally formed among rocks and stones, though sometimes in the holes of trees; the eggs are rather numerous, being a dozen or more; they are of a yellowish white colour, and taper almost equally to both ends. In some countries they are eagerly sought after as articles of food, though the flesh is hardly eatable by anybody. The male attends the female during the incubation; but as soon as the young appear the sexes separate, and the males associate in one place, while the female and her brood remain in another, till the end of the summer, and probably till the pairing time again comes round. In all probability this is the reason why the male was described as one species under the name of goosander, and the female and young male as another species, under the name of the dun diver. This is a point in the economy of birds to which it is necessary to attend, especially where the females and young resemble each other in colour, and are different from the males.

Red-breasted Merganser (*M. serrator*). This is a smaller species than the former, measuring only about one foot nine inches in length, and two feet and a half in the stretch of the wings, and its weight does not exceed two pounds. It is, however, a bird of more powerful wing than the goosander, and therefore it is more discursive. It breeds far to the north, as far as Hudson's Bay; but as it also ranges far to the south in the winter, stragglers remain to breed in southerly places. In severe winters it is not uncommon on some parts of the northern shores of the Mediterranean, and it is particularly abundant in the lagoons about Venice. It quits all these southerly latitudes when the spring begins to break; and about the beginning of June it reaches its most northerly latitudes, where it immediately begins the grand business of the season. The nest is usually in concealment, close by the margin of some fresh water. Externally the nest is formed of dry stalks and withered grass, and the bird pulls the down from its own breast to form a soft lining for the interior. The eggs are about the size of those of a common duck, of an ash-coloured white, and averaging about a dozen in number.

The bill is long for the size of the bird, measuring full three inches from the gape to the point; the edges are toothed in their whole length, more closely than the goosander, but they are not so distinct, neither is the point of the upper mandible quite so much hooked. The feet and middle part of the breast red, with some dusky mottlings on the latter. The hind part of the head has a loose crest pendant over the nape, and that and the head and the upper part of the neck are deep green, with reflections of purple. The upper part of the back is black, the lower part and the sides of the flanks mottled with brown and grey. A spot on the shoulder, the scapular feathers next the wing, the wing-spot and the belly, white; but the wing-spot is surrounded by black, and crossed by two lines of the same colour. The head and neck of the female are brownish, the breast mottled with grey, the back ashen grey, the wings dull brown, with only one black bar across the wing-spot.

The *Smew, or White Nun* (*M. Albellus*), is, like the rest, a native of northern climates, and very abundant in both continents. It is smaller than either of the former two, more elegant in its form, more decided in the markings of its plumage, more vigorous on the wing, and more discursive. It is in fact one of the most elegant of the aquatic birds, and one which is very lively in its motions, whether in the air or in the water.

The male bird measures about a foot and a half in length, and two feet three inches in the expanse of the wings; and its weight is a pound and a half or a little more. The bill is about two inches in length, tapering toward the extremity, which has a strong hooked nail, but the edges are not so deeply toothed. The prevailing colours are pure black and white, finely contrasted with each other, only some portions of the black have beautiful green reflections in some positions of the light. This is the case with a large and well-defined spot on each eye; and the under part of the crest is black, which marks very perfectly the contour of the hind head, and makes the upper or white part of the crest appear like a detached streamer. The rest of the head, the neck down to the shoulders, and all the lower part, are spotless white, except the under sides of the wings, which are beautifully waved with black lines. The middle of the back is black, but the scapular feathers are white, except a few elegantly curved of black, which extend toward the breast, and the anterior of the three pairs of curves almost meet in front. The edge of the wing, the primary quills, and the greater coverts and secondaries, are black, only the last two have white tips, which form a broad patch and two narrow bands of that colour. The tail, which consists of sixteen feathers, is dark ash colour. The female is not nearly so large as the male; the crest is also smaller and reddish brown, the spot on the eye is dusky; there is a pale brown collar round the neck; the shoulders and breast are pale brown; and those parts which are black in the male are dull ash colour in the female. The bill and feet in the male are bluish black; those in the female are pale blue. The young males are marked in the same manner as the female, and this has of course given rise to the supposition that both were of a different species from the mature male.

These birds range further to the south than perhaps any of the others, both in the eastern continent and in America; and wherever they visit, the elegance of their forms, and the strong contrast of colours in their plumage, render them objects of great attention.

The *Hooded Merganser* (*M. cucullatus*) is understood to be peculiar to the American continent, unless when it straggles eastward, which, even in Britain, is very rare. It is rather longer than the white nun, but shorter in the wings, and not so handsome a bird. The bill is very much toothed, resembling that of the goosander both in shape and colour. The eyes are small and golden yellow, and the feet reddish. The head is furnished with a large crest which spreads like

a hood, and is black at the base and tip, and white in the middle part. The neck and upper part of the back black, broken by two bars of white extending from the breast. Under part white, passing into reddish brown backwards, and delicately marked with black on the sides and flanks. The primary quills, and the tail feathers, of which there are twenty, are dull black. The smaller coverts are ash, but the greater coverts and secondaries form two white lines and two black ones in the middle of the closed wing. The female is smaller than the male, and tinged with russet colour.

MERIANIA (Swartz). A genus of beautiful West India evergreen shrubs, known by the name of the mountain or Jamaica rose. The flowers are decandrous, and the plants belong to *Melastomaceæ*. They succeed in the stove, and may be increased by cuttings.

MESEMBRYANTHEMUM (Linnæus). A numerous genus of succulent plants, commonly called the fig-marigold, from the shape of their flowers, which are icosandrous, and their fig-like fruit. They belong to the order *Ficoideæ*, and are chiefly natives of the Cape of Good Hope. So numerous are the species, that they are divided into eight sections, significant of their forms or manner of growth. The dwarf kinds should be kept in small pots in very sandy or gravelly soil, and require but little water at all seasons, but particularly when they are dormant. They only require to be defended from frost in a green-house or frame, and are easily propagated by cuttings kept dry till they produce roots.

MESPILUS (Linnæus). Is the generic name of the common medlar, of which there are three sorts cultivated for their fruit, and one species, the *M. grandiflora*, is ornamental. The flowers are icosandrous, and belong to *Rosaceæ*. See MEDLAR.

MESSERSCHMIDIA (Linnæus). A genus of trees and climbing shrubs, natives of the West Indies, formerly called *Tournefortia*. They belong to *Boragineæ*. They are stove plants; but as their flowers are by no means showy, they are only met with in general collections.

METROSIDEROS (Gærtner). A fine ornamental genus of trees and shrubs, chiefly found in New Holland. They belong to *Myrtaceæ*. One of the species, *M. verus*, is the true iron-wood of India, and so hardy and heavy as to be fit for the construction of ships' anchors. This tree is kept in our stoves, and grows well with ordinary treatment. The New Holland species are green-house plants, and all require a mixture of loam and moor-earth; and propagation by cuttings of the ripened wood.

MEXICAN LILY. Is the *Amaryllis reginæ* of Linnæus. One of the most splendid of the tribe.

MEXICAN TIGER FLOWER. Is the *Tigridia pavonia* of Jacquin; an estimable though a very fugitive gem of the flower garden, but remarkable both in form and colour.

MEZEREUM. Is the *Daphne Mezereum* of Linnæus, one of our most common ornamental shrubs.

MICHAELMAS DAISY. Is the *Aster Tradescanti* of Linnæus, a common inhabitant of our flower borders.

MICHELIA (Linnæus). A genus of lofty trees and straggling shrubs, natives of India and China, belonging to *Magnoliaceæ*. The flowers are yellow and beautiful, and the trees may be propagated by cuttings or by grafting on the purple Chinese Magnolia.

MICONIA (Ruiz and Pavon). A genus of evergreen tropical shrubs, separated from the genus *Melastoma*, though closely allied thereto. The foliage is good, the flowers white, lilac, or rose-coloured. They affect a soil of loam and moor-earth, and may be propagated by cuttings.

MICROGASTER (Latreille). A genus of minute parasitic hymenopterous insects, belonging to the family *Ichneumonidæ* and sub-family *Braconidæ*, having the second submarginal cell minute, the abdomen and ovipositor are small, the lower parts of the mouth are not elongated, and there is not any remarkable space between the jaws when closed. These little insects are amongst the most destructive enemies of various smooth lepidopterous larvæ, amongst which the caterpillar of the common white butterfly of the cabbage (*Pontia brassicæ*) affords the most common example, and which is often observed, after it has ceased feeding and taken its station upon some outside window-frame, paling, &c., to produce a great number of minute oblong balls of silk of a pale yellow colour, instead of undergoing the ordinary transformation to a chrysalis. These little balls are the cocoons of a small species belonging to the present genus, of a black colour with yellow legs (*M. glomeratus*), the eggs of which had been previously deposited by the parent fly, in the larva upon the body of which it takes its station, repeatedly plunging its ovipositor between the rings and lodging an egg at each thrust, the larva appearing all the while to take but little heed of the proceedings of its enemy. The little parasites as soon as hatched feed gregariously upon the fatty substance of the larva, bursting out simultaneously when full grown, and immediately encasing themselves in the yellow cocoons above mentioned, and which, as observed by Mr. Haliday, the indefatigable historian of these minute tribes, "are composed of a very fine glossy silk of one colour, which can be wound off like that of the silkworm, whilst in most of the remaining *Ichneumones* they are of a gummy texture and banded. They are arranged in various modes, examples of which, and a minute account of the process of construction, may be found in the second volume of Reaumur's Memoirs. The larvæ are generally supplied with a twofold secretion of silk, that which comes out first being of a looser and coarser texture, and serving for a common envelope for the whole society. The sections into which the genus has been divided do not appear to be characterised by a particular disposition of the cocoons, as this differs in species the most nearly related; some are collected into a ball, and entirely concealed within a thick cottony mass attached to a stalk of grass (as *M. globatus*, *imbricatus*, &c.); others are fastened round a twig, and arranged side by side like the cells of a honeycomb (*M. alvearius*, *alvearifex*). In many they are scattered or collected in an irregular heap, and covered with a loose web of open texture, but tough, as is the case with *M. glomeratus*, the most familiar species which keeps down the numbers of the common white butterfly. A correspondent in Loudon's Magazine, vol. iii. p. 52, affirms that the caterpillar of the butterfly spins the outer web over its parasites, and Gœdart has written the same; Madame Merian has a similar statement relative to the caterpillar of the *Cynthia Cardui*, and its microgaster. I am more inclined, however, to place my faith in the usual accuracy of Reaumur. It would be a singular fact that the caterpillar of a butterfly, which for its

own transformation produces only a few threads which fasten the tail and girt the middle of the chrysalis, should become provided with the superabundant supply in consequence of its interior being nearly devoured. In the case of those species indeed which infest the tribes of *Bombyces* and *Arctiæ*, it appears that the imperfect cocoon spun by the caterpillar may serve for the envelope of its parasites. In general they are found in lepidopterous larvæ, but Mr. Curtis has obtained one species out of that of an aphidivorous fly."

In the eighth number of the Entomological Magazine, Mr. Haliday has given a monograph of the genus, describing fifty species, and indicating more than twenty others described by previous authors. They are all of minute size, not exceeding one eighth of an inch in length.

MIDGE. The ordinary English name given to numerous minute species of *Tipulidæ*, having the appearance and being of the size of the common gnat, but wanting the elongated proboscis of that insect. They chiefly belong to the genera *Chironomus*, *Corethra*, and *Tanypus*, and are often miscalled gnats, which name ought to be restricted to the family *Culicidæ*.

MIGNONETTE. Is the *Reseda odorata* of Linnæus, a well-known flower-garden plant.

MILFOIL. Is the *Achillea anglica* of G. Don, a common plant in every pasture, belonging to *Compositæ*.

MILIOLA (Lamarck). A minute shell which has been found on Fuci in the island of Corsica, it is also frequently met with in a fossil state. It belongs to the family *Spherulacea*.

MILIUM (Linnæus). A genus of grass, chiefly annuals, found in different parts of Europe. The *M. effusum* is the millet-grass of English botany.

MILKWORT. Is the *Polygala vulgaris* of Tournefort, a common plant found in dry pastures.

MILLERIA (Linnæus). A genus of tropical annuals, named in honour of "the prince of gardeners," Philip Miller, F.R.S., many years curator of the Chelsea botanic garden. In our collections they are treated as tender annuals, i. e. sown in a hot-bed or hot-house, and planted out in the borders before Midsummer, where they ripen seeds. They belong to the order *Compositæ*.

MIMETES (Dr. R. Brown). A genus of evergreen shrubs from the Cape of Good Hope, belonging to the *Proteaceæ*, and nearly allied to the type of that order. These plants do not thrive well with much moisture, and therefore require to be grown in well-drained pots and in light sandy loam. They may be propagated by cuttings if kept free from damp.

MIMOSA (Linnæus). A genus of plants so called, because some of them imitate the action of animals by shrinking from the touch of other bodies. The Mimosas are distinguished from *Acaciæ* by their jointed pods and sensitive properties. They grow well in the green-house mixture of loam and moor-earth, and may be propagated by cuttings, but much more conveniently by seeds. They belong to the natural order *Leguminosæ*.

MIMULUS (Linnæus). A genus of very interesting annual and perennial herbs, natives of America. The flowers are didynamous, and the genus belongs to the natural order *Scrophularinæ*. They grow in any rich soil, and are readily increased from seeds which ripen abundantly. There are many new varieties of the Chilian species.

MINERALOGY. Our earth has sometimes been defined as a "huge mineral," but the discoveries in modern chemistry show that it is composed of a vast number of compound bodies continually acted upon by changes of temperature, and the solvent character of the fluids which percolate through the interstices which it contains. The characters of these bodies differ most materially both in their external appearance and in their effects on the human frame. Thus we find in the same neighbourhood poisons of the most deadly character assuming forms of the most exquisite symmetry, whilst metals which are of the greatest service in domestic economy and the useful arts are apparently worthless if not repulsive in their appearance.

The iron that forms the warrior's weapon as well as the more useful implements of the agriculturist, can only be procured with advantage by an acquaintance with the mineral bodies with which our earth is so thickly studded; and the steam engine, that mighty abridger of time and space, owes much of its utility to this country having given a peculiar degree of attention to practical mineralogy. The great importance of the mineral kingdom in a scientific point of view is in no shape confined to the natural history characteristics of mineral bodies; and though the properties which some minerals possess of phosphorescence, electricity, and magnetism, may only serve to excite the attention of the curious, yet the ablest mathematician may find ample employment in the more abstruse problems of crystalisation and polarised light. This is, at the same time, the science which includes within its ample range the marbles of the statuary and the architect, the metals of the manufacturer, the gems of the jeweller, and the soils of the agriculturist. It can never, therefore, be deemed uninteresting or unimportant. Nothing can be more beautiful than the caverns to be met with in primitive rocks, whose walls are lined with pure and various coloured crystallised topaz, beryl, and rock crystal; and the gneiss, granite, and mica slate, with imbedded grains and crystals of sapphire, chrysoberyl, garnet, emerald, and ruby, seem to realise the oriental tales of diamond valleys and emerald caves. But it is not the beauties of the gems alone that attract our attention; the varying composition of the mighty masses which compose the crust of the earth's surface, and their conversion into soils no less than the operations at once mighty and minute which turn the hard and sterile rock into soft and fertile earth, are well worthy of our attention. Some idea may be formed of the method in which this is performed by referring to the instance of porcelain granite. "This substance," says Sir Humphry Davy, "consists of three ingredients—quartz, feldspar, and mica. The quartz is almost pure siliceous earth, in a crystalline form. The feldspar and mica are compounded substances; both contain silica, alumina, and oxide of iron; in the feldspar there are usually lime and potassa; in the mica, lime and magnesia. When a granite rock of this kind has been long exposed to the influence of air and water, the lime and the potassa contained in its constituent parts are acted upon by water or carbonic acid, and the oxide of iron, which is almost always in its least oxidised state, tends to combine with more oxygen; the consequence is that the feldspar decomposes, and likewise the mica, but the first the most rapidly. The feldspar, which is as it were the cement of the stone, forms a fine clay; the mica,

partially decomposed, mixes with it as sand, and the undecomposed quartz appears as gravel or sand, of different degrees of fineness. As soon as the smallest layer of earth is formed on the surface of a rock, the seeds of lichens, mosses, and other imperfect vegetable bodies which are constantly floating in the atmosphere, and which have made it their resting place, begin to vegetate; their death, decomposition, and decay, afford a certain quantity of organisable matter, which mixes with the earthy materials of the rock; in this improved soil, more perfect plants are capable of subsistence. These, in their turn, absorb nourishment from water and the atmosphere, and, after perishing, afford new materials to those already provided; the decomposition of the rock still continues, and at length, by such slow and gradual processes, a soil is formed in which even forest-trees can fix their roots, and which is fitted to reward the labours of the cultivator."

We cannot better illustrate the general character of our mineral treasures than by briefly referring to that universally diffused one—iron. The immense supplies for the arts of life are usually drawn from the oxides. It is so abundant that there are few fossils free from it, and many mineral waters contain it. When we examine any chasm in the earth's surface, it will generally be found tinged with a reddish hue, and the intensity of the colour will generally furnish some indication of the amount of ferruginous matter that it contains. But a better and equally simple test may be found in the use of a little of the infusion obtained from bruised gall nuts in water, which on being blended with the suspected body will become of a dark colour. This mode of ascertaining the presence of iron is exceedingly valuable as, on account of the universality of this mineral, there are many sites entirely valueless as domestic residences from the quantity of iron with which the water is impregnated. But we are not to suppose from this that pure or native iron can be raised from the earth in every region, as the cases in which it really occurs are very rare. Where it is so found there can be little doubt that it is generally of meteoric origin. Such for example is the mass weighing about 1600 pounds found by Professor Pallas in Siberia, and a mass weighing fifteen tons discovered by Rubin de Celis in Peru.

There are several varieties of mineralised iron which generally consist of the metal combined with oxygen. Indeed the native oxides constitute a very extensive and important class of metallic ores. They vary in colour, depending upon mere texture in some cases; in others, upon the degree of oxidisement. Some varieties are magnetic, and those which contain least oxygen have the greatest magnetic power. The hæmatite, or red iron-stone, is of a very peculiar character. It occurs in globular and stalactitic masses, and it may be proper to observe that most of our iron plate and wire is made from it. But clay-iron-stone is the mineral which produces the greatest quantities of cast and bar iron. This in a great measure arises from the proximity of coals with which it is usually accompanied.

When we look at either of these minerals, it must be sufficiently obvious that they bear but little resemblance to the bright and shining body to which they are afterwards reduced. The essential part of the process by which this is effected consists in decomposing them by the action of charcoal or coke at high temperatures. Thus the argillaceous iron of Wales, Shropshire, &c., is first roasted, and then smelted with limestone and coke; the use of the former being to form a fusible compound with the clay of the mineral by which the latter is enabled to act upon the oxide, and to reduce it to the metallic state.

Our space will not admit anything like a detailed history of the science of mineralogy, or of the various systems of classification that have been pursued; and, for a view of the mineral bodies themselves, we must refer the reader to their alphabetical order in the present work. It may, however, be proper to state that as a science it is little more than half a century old. Previous to that time fine collections of minerals existed, but more advantage may now be derived from studying the beautifully arranged cases of specimens in the British Museum for a single morning, than could have been derived from a lifetime according to the old and inaccurate mode of classification. In the beginning of the last century the descriptive language of mineralogy was vague and ambiguous, each author using that which seemed to him best to answer his present purpose. Now, however, a slight acquaintance with chemistry and the mathematical sciences enables the mineralogist to as accurately discriminate his specimens, and communicate his knowledge to others, as in the classification of a library.

The celebrated Berzelius has attempted to establish a pure scientific system of mineralogy, by the application of the electro-chemical theory and the doctrine of chemical proportions. The views which he disclosed are novel and highly important. He defines mineralogy to be the science which treats of the elementary combinations of inorganic substances found in or upon the earth, and of the various forms and different foreign admixtures under which these bodies make their appearance. The object of Berzelius is to shew that the influence of the electro-chemical theory extends as much to mineralogy as to chemistry; and also that the doctrine of definite chemical proportions is equally applicable, and will give the same degree of mathematical certainty to the arrangements of a mineralogical system which it has already given to chemistry. "From the electro-chemical theory we have," says he, "been taught to seek in every compound body for ingredients of opposite electro-chemical properties, and we have learned from it that the combinations cohere with a force which is in proportion to the degree of opposition in the electro-chemical nature of the ingredients. Hence it follows, that in every compound body there are one or more electro-positive, and one or more electro-negative ingredients. By electro-positive ingredients he designates such as have inflammable bodies, or salts for bases; and, by electro-negative, the oxygen and oxides which go to the negative pole of the voltaic battery. In other words every substance called a basis, in chemical combination, must have another which acts the part of an acid, though the latter, when uncombined, may not be distinguished by an acid flavour, or the property of changing vegetable blues to red. The body which, in one case is electro-negative, may, in another case, be electro-positive, and may be united to a stronger electro-negative, that is, it may be the basis to a stronger acid.

Berzelius divides simple bodies into three classes; *Oxygen—simple combustibles not metallic*, or *metalloid*, and *metals*. A general notion of their arrangement

may be derived from the following brief tabular view:—

1. *Oxygen.*	Sodium,
2. *Metalloids.*	Potassium,
Sulphur,	Molybdena,
Nitric,	Tungsten,
Muriatic Radical,	Antimony,
Boron,	Tellurium,
Carbon,	Silicium,
Hydrogen.	Columbium,
3. *Metals.*	Titanium,
Arsenic,	Zirconium,
Chrome,	Osmium,
Uranium,	Bismuth,
Zinc,	Iridium,
Iron,	Platinum,
Manganese,	Gold.
Cerium,	Rhodium,
Yttrium,	Palladium,
Glaucinium,	Mercury,
Aluminum,	Silver,
Magnesium,	Lead,
Calcium,	Tin,
Strontium,	Nickel,
Barium,	Copper.

Each of these bodies may constitute a mineralogical family, composed of the simple body, and all its combinations with other bodies which are electro-negative with respect to it; that is, with those which, except in a few cases, stand above it in the preceding table. The families are divided into orders, according to the different electro-negative bodies with which the electro-positive is combined.

MINNOW (*Leuciscus phoxinus*). A genus of soft-finned fishes with abdominal fins, belonging to the carp family, or the first into which Cuvier divides the soft-finned orders. The minnow is of small size, rarely exceeding three inches in length, and seldom measuring as much. It is in fact the smallest of the family, and we believe there is only one known species of the genus. Minnows are exceedingly abundant in all the clear running brooks and streams of every part of England, and of the temperate parts of the continent. They do not occur in the larger rivers, except in little eddies of shallow water, where they can pass their time undisturbed by the violence of the current. They are exceedingly fertile, and though they form no inconsiderable portion of the food of every larger fish which inhabits or visits the same waters, they still remain the most abundant of the whole; and in the fine clear trouting streams, however abundant trout may be, there are probably ten thousand minnows in the shallows near the banks for every trout which is in the pools or stronger currents. When the water becomes swollen by a heavy fall of rain, the minnows are, so to express it, broken loose from their moorings, and vast numbers of them are at the mercy of the stream, against which their light weight and small strength are but ill able to contend. It is then that trout and pike and other fishes, which can head the water with more security and power, are on the alert and fare sumptuously on the agitated and defenceless minnows. The angler takes advantage of this, and either places a minnow on his hook, so bent as that its body may wriggle as it is drawn along, and show the bright lustre of the scales in various points of view, or he has an artificial form of a minnow prepared, of the same form as the real one, and used in the same manner. The real minnow is by far the better bait for trout, and also for large perch, and for salmon; and if the water is of the proper height and colour, and the angler understands it, and can handle his tackle well, finer fish may be obtained by this than by any other method of rod and line fishing. They can also be landed with greater certainty and in less time, inasmuch as a stronger line may be used than in fly-fishing, or in fishing with the smaller species of bait. The artificial minnow is better adapted for fishing for pike, inasmuch as the pike are more voracious than the fishes which have been mentioned, and more readily bite at any substance which is moving in the water, without any great nicety as to what may be its nature.

The minnows themselves are voracious enough in their little way; and, though they are incapable of swallowing a live fish of any considerable size, they nibble away at a dead one. They are by no means alarmed or even disturbed at the presence of man; and in the clear little pools of the streams of pure water, the boys sometimes amuse themselves with what they call making "minnin tulips." [It is to be understood that the words minnow and minnin have exactly the same meaning, and appear to have been derived from the Latin *minimus*, the smallest.] The tulip is made in this way—a crumb of bread or piece of worm is dropped into the water, usually tied to a small pebble with a bit of thread, in order that it may sink the more rapidly and be the less easily removed. The minnows, which are sporting about through the water, crowd to the descending substance from all sides, and when it reaches the bottom there are generally as many heads in contact with it as can be wedged round, the axis of the fishes being inclined upwards toward the tails, and thus the whole bearing some resemblance to the petals of a flower, though certainly not much to those of a tulip. A small metal button which is bright and shining will produce a similar assemblage, but a tulip collected by such an object is a very fading flower.

The capture of minnows is an equally easy matter. A crooked pin at the end of a bit of thread fastened to a small twig, and baited with a little bit of earthworm, furnishes ample tackle for the youthful angler; and when there is little stirring in the waters, the pin itself will sometimes do without any bait. There are few places in which minnows are taken for any other purpose than as bait for other fishes, or as a first attempt in angling to the boys; but where they can be taken in sufficient quantity by means of a small meshed casting net, which can be readily done in some places, they are said to be very delicious, though the dressing of a single minnow, or even a dozen or two, would be a most unprofitable waste of the culinary art. In the matter of fishes as an article of food, our judgment is in some danger of being carried away by mere size; and yet of fishes of the same genus or the same family the small species, when of equal age and in equal condition, are invariably more finely flavoured than the large ones.

The minnow, being a delicate little fish, spawns in the warm season; the operation is soon over, and the young are alive in the course of not more than a week from the time of their being deposited in the fine gravel, in shallow water, and freely exposed to the sun, which is their usual nidus. It is said that the female minnows are diandrious, or always attended by two males when depositing the spawn; and it is probable that other fresh water fishes have the same

habit. When the young minnows first come out of the egg they are exceedingly minute, and so transparent that hardly any part of them is visible, except the eyes, which are large and dark coloured. The little things require indeed to have their eyes about them, because they are exposed to many enemies. The more advanced fry of those fishes which spawn early live upon them in a great measure; and so do the larvæ of many insects which pass that stage of their existence in the waters.

At all times, indeed, the minnows appear to be destined as the prey of one or another of their fellow inhabitants of the waters; and in this way, small as they are, they are not unimportant in nature's economy. When the trout and salmon ascend the brooks and streams for the purpose of spawning, the minnows serve them in great part as food in situations and at a season when other food for them is but scanty. The young again are ready to supply the young of those fishes; and thus the minnows, endowed themselves with highly prolific powers, are the cause or the means rather, of keeping up those races which are more useful to man. The upper part of the minnow is of a dusky olive colour, a little mottled, and gradually passing into a lighter tint on the sides. This passes into a tint of delicate pink in the summer season; but the pink is the nuptial livery of the fish, and wears off in the winter. The irides and gill-covers are silvery white, and the fins brown; those on the under side of the body paler than the others. The body is long and slender; the head about one-fifth of the length, exclusive of the caudal fin. The tail is large for the size of the fish, and very much forked. The dorsal and anal fins are also pretty large; and altogether this little fish is a clever swimmer. The body is covered with very minute scales, and marked with a distinct lateral line, which is straight in the posterior part of the body, and bent upwards in the anterior part. The minnow, though one of the smallest of our native fishes, is far from being one of the least interesting; and it is so generally distributed, and so little prone to concealment in its habits, that it may be said to be more open to observation than any of the rest.

MINT is the *Mentha viridis* of Linnæus. A common garden herb.

MIRABILIS (Linnæus). A genus of South American tuberous rooted herbs long cultivated as ornamental plants in gardens. They belong to the fifth class of Linnæus, and to the natural order *Nyctagineæ*. The marvel of Peru is universally known, it having a place in every garden. The roots must be taken out of the ground during winter, and kept in a dry place out of reach of frost. In the spring they should be replanted in the open border, to flower in the autumn.

MIRBELIA (Smith). A genus of evergreen shrubs, natives of New Holland. The flowers are decandrous, and belong to the natural order *Leguminosæ*. The best soil for them is a mixture of loam and moor earth, and the cuttings will strike roots in sand under a bell glass.

MISTLETOE is the *Viscum album* of Linnæus. A curious parasite shrub growing on different sorts of trees in English woods. It belongs to the order *Loranthe*.

MITE. The ordinary English name of various minute apterous insects, forming the Linnæan genus *Acarus*, or the order *Monomerosomata* of Leach, by whom, however, these insects have been constituted a distinct class of the articulated animals, in which respect he has met with no followers. The structure of the insects being referrible to the arachnidous type, although the mode of respiration by tracheæ differs from the more typical *Arachnida;* but in this group the characters derived from the respiratory organs have recently been proved by the researches of M. Duges to be of but a secondary importance. Various interesting peculiarities relating to these insects are detailed in the article ACARUS; but the chief motive in our again noticing them is to mention the very valuable discoveries lately made by M. Duges, an indefatigable French naturalist, by whom it has been proved that they undergo metamorphoses consisting in some groups of an increase in an additional pair of legs, whereby one of the sections proposed in the group by Latreille and Hermann (*Trombides hexapodes*) is found to consist only of insects in an imperfect state, whilst in others the change of form is complete. This is especially the case in the water mites, the larvæ of which have a very large head and six legs; the pupæ are inactive, attaching themselves by a single pair of very short legs to the bodies of other aquatic insects, and being composed as it were of an oval bag with a narrow neck; the insect in this state having been formed by M. V. Andouin into the genus *Achlysia*, and being specifically named *A. dytici*, from taking up its residence beneath the elytra of the great water-beetle *Dyticus marginalis;* they also attach themselves to the slender filaments composing the tails of the water-scorpions (*Nepa* and *Ranatra*).

MITELLA (Linnæus). A genus of small North American perennial herbs, belonging to *Saxifrageæ*. The flowers are white and pretty, and well fitted for rockwork.

MITRA (Lamarck; VOLUTA, Linnæus). This very numerous and truly elegant genus of molluscs was confounded by Linnæus with his genus *Voluta*, from which it so essentially differs in many characteristic distinctions that its separation is obviously necessary. These are that the summit of the spire is always pointed, and never terminated in a papillary form; the plaits on the columella gradually diminish in size towards the base; the upper are consequently larger than the lower; they are always transverse and parallel to each other; the columella lip exists, though sometimes very thin, and only visible at the base, and some species possess an epidermis. The general form of the *Mitra* is turretted or subfusiform, base notched, no canal, no operculum. No shell presents greater beauty of sculpture and colouring than some of this species. They are of every possible pattern, with transverse grooves, punctures, granulations, striæ, and sometimes smooth, the colours of every hue. In some species the upper part of the whorls, being crenulated and the outward lip dentated, are additional characters, distinguishing them from the *Volutes* in which these never occur. Four subdivisions may well be formed of this genus: the first, of such as are turriculated, the aperture very narrow, ribbed, and with one plait, the *M. tæniata;* secondly, those turriculated, the aperture wide, and large spiral whorls, the *M. episcopalis;* thirdly, the sub-oval species, with a short spire, generally tuberculated, the *M. microzonias;* and lastly, those of an oval form and a very short spire, by some authors called the *M. olivaria*, an example of which is the *M. dactylus*. The

animal is not described; they inhabit the seas of hot climates, and several fossil species are known.

MODECCA (Jacquin). A curious genus belonging to *Passifloréæ*, discovered at Sierra Leone, and also in India. In the stove it requires a soil composed of loam and moor earth, and may be propagated by cuttings placed in heat under a glass.

MOLE (*Talpa*). A genus of mammalia belonging to the order *Carnassier*, and to the insectivorous division of that order. The common English name mole is derived from "mould," "mowle," or "moole," all of which are varied pronunciations of the Anglo-Saxon name for that portion of the surface substance of the earth which consists in great part of decayed vegetable matter, is more favourable for the roots of growing vegetables than any other kind of earth, and which is on this account more frequented by earth-worms and ground larvæ. In a state of nature the mole is the regulator set over these; and, as it has to perform more severe labours in the procuring of its food than any other known animal, it is both in instinct and in structure better adapted for this purpose. Of all animals the mole is the most ravenous and the most impatient of hunger, so that a very brief suspension of feeding works it into an absolute frenzy; and if two moles are shut up together, for even a very short time, without anything to eat, they speedily engage in desperate combat, and never desist until one is vanquished, and then the conqueror instantly begins to make a meal of the other. Among animals inhabiting the surface of the ground in the ordinary way, this would be reckoned a very cruel disposition; but when we consider the habits of the mole, and the mode in which it must proceed in the finding of its food, we must regard this extreme and ungovernable appetite as the very perfection of its character. Other animals have to pursue their food through the air or the water; and upon examining them it will be found that their instinct for food is strong in proportion to the degree of fatigue which they must undergo in the procuring of it. The mole has to pursue its food through the solid earth, and therefore the analogy requires that its propensity for feeding should be strengthened in proportion to the labour which it must undergo. We shall afterwards have occasion to notice more particularly the structure of their permanent covert-ways, or passages which the mole constructs for itself under the ground; but we may in the mean time mention, as illustrative of the general fact of its adaptation to the place which it occupies in nature, that the mole finds no part of its food in those permanent covert-ways or galleries, but that every time it eats below the surface (and it does this for the greater part of its active life) it must bore through fresh earth, and thus, for a small portion of its meal, it must undergo more fatigue than most surface animals require to undergo in the course of an entire day.

In nature we find that the resource of every creature is in very exact proportion to the necessities of that creature; and this law is as perfect in the mole, obscurely labouring under ground, as it is in those gay children of the sun which wanton in the brightness of the tropical day. The adaptation requires two parts: there must be organs fitted for the work which is to be performed, and there must be the requisite impulse to use those organs. In both these respects the mole is a perfect model of nature's workmanship. Its organisation is more complete in what may be called dead strength than the organisation of any other animal with which we are acquainted; and the appetites which impel it to labour, and the senses which direct it in its labours, are of a very high order. We have already said that the cravings of hunger in the mole are frequent and violent, beyond all example in animated nature; and it will immediately be seen that, in an animal which has to bore for perhaps several yards through the solid earth in order to procure a single worm, this very strong impulse is necessary for putting it into motion. But the impulse is only as it were the mere beginning—the stimulating cause of the mole's operations. It is essential, and without it the guides and the organs of working would be vain and useless, but so would it be an idle torment to the animal without them. In considering only its underground operations, sight would be of little use to the mole, though, as we shall afterwards have occasion more particularly to remark, there are seasons and situations where the use of this sense becomes necessary to the common mole. Smelling and hearing are the two senses which are most essential to an animal living under ground, and digging along the solid earth for its food: and it is perhaps no exaggeration to say that in both of these senses the mole is more highly endowed than any other animal with which we are acquainted. It is probable, indeed, that there is in this animal a more general sense than either of these two, and one which, as it has not "a local habitation" in any specific part of the animal, has not "a name" in the vocabularies of describers. But, notwithstanding this, the existence of the sense is not in the least doubtful. The fur of the mole is the most delicate, and the most abundant, surface for surface, which is found on any animal. Fur of every kind may be regarded as a species of organ of what is called touch, not in the mere pile of the fur certainly, but in the sensation which is instantly communicated to the root of the fur, as we find in many animals, and especially in those whiskers of nocturnal animals which guide them in their rambles. Upon the same principle there is no question that the exquisitely delicate fur of the mole, which yields to a touch quite imperceptible by us, is one of the finest organs of feeling in the whole animal kingdom. Nor is there any doubt that this fur communicates to the owner the slightest concussion of the earth over its nest or its gallery, without any assistance from the allocated senses of hearing and smelling, how acute soever they may be for their particular purposes. The produced nose of the mole, and the large development of the olfactory nerves, are proofs that its sense of smelling is exceedingly keen; and, though an external concha or shell to the ear would be an incumbrance to it in its operations, there is no doubt that its hearing is very acute, for its internal ear is remarkably well formed. This, however, is a portion of the physiology of animals upon which we require to exercise no ordinary degree of caution. In all cases we are apt to take ourselves as models; and, as we are adapted only for the exercise of our senses in the free air, we are very apt to judge in our manner of those animals which dwell in the waters or in the earth, and as such have very different media through which impressions are communicated to them. In consequence of this we are very apt to impute to some single sense having specific organs and a local situation, that impression which is in reality conveyed to the whole body of an animal by the element in which that animal resides.

It is not easy to form a correct estimate of the senses of the mole by any analogy drawn from animals which inhabit the free air and enjoy the light; and as we are apt, in all our judgments of animals, to carry this analogy along with us as the standard of our judgment, we are apt to err in the case of so very singular an animal as the mole, unless we use the greatest caution, and throw the case upon its own individual facts—a mode of proceeding which is most essential to the naturalist in evidence.

That the mole possesses senses different from those of animals which live above ground and enjoy the light, is undoubted; but what those senses are, it is impossible for us to determine to a minute shade. We call them hearing and smelling, and there is no question that both of these senses are very acute in the mole. It really seems, however, that naturalists, even those of most commendable zeal and ability, are apt to lay too much stress upon those localised senses, and to neglect, or leave out of their estimate, that more general, and, as one would say, more primary sense, which belongs to the whole frame of the animal, and not to any particular organ. This is the "muscular feeling," of which some account will be found in the article MAMMALIA; and as it is the real foundation of every species of animal feeling and perception, whatever may be its immediate organ, we ought to make it the very foundation of all our speculations and judgments with regard to the senses of animals, whatever may be the form and development of the organs of those senses. We have already remarked, that the fur of the mole is well adapted for communicating every species of impression to the system of the animal; and we may now add, that the naked parts of it appear to be fitted for the same purpose. It is true, that the snout of the mole is cartilaginous, and that the under sides of the paws are covered with callous rather than a delicate and flexible skin. But these are matters of minor importance, because the fact of feeling depends not upon the mere external part so much as on the internal one with which that is connected. We have a striking example of this in the ox. A blow on the horn of that animal, though it does not of course inflict any pain, and not in the case of a mere blow any injury upon the horn, is yet more severely felt, and causes more acute anguish to the animal, than a blow with the same instrument, and struck with the same force, upon the muscular parts. It is indeed a remarkable fact that the muscles of animals, which are pre-eminently their working structures, are really the parts which suffer the least from blows and bruises, and that tendon, and especially the periosteum of bone, are vastly more sensitive than flesh. Knowing these facts, and it is necessary that every student of nature should know them, we must be cautious before we come to any positive or general decision as to what part of an animal can, and what cannot, feel acutely. Upon this principle it is highly probable that the callous skin of the mole, and even the roots of its paws, large and hard as those organs are, conspire with the fur, and the organs of hearing and smelling, in helping the animal to delve its subterraneous way after its food. Still there is something very curious in the matter. The larvæ of the ground insects, that is, those of the cockchaffer and others, which are so exceedingly destructive to vegetation in fields and meadows, do not appear to be possessed of much sensibility, and therefore it is natural to suppose that the mole should be able to come upon them unawares. The earth-worm is, however, an exceedingly sentient creature, both as respects changes of the atmosphere and concussions of the earth. Heat and cold, drought and moisture, the beating of the earth, the tread of a heavy animal, and almost anything which produces a change or a disturbance, puts the earth-worms in motion. It is therefore not a little singular that these very earth-worms should form the principal food of the mole, and that it should obtain a sufficient number of them to repay the labour of its digging a mine after them in the earth. To this mine we shall afterwards have occasion to revert, and we shall then remark on the curious similarity which there is between the mining of moles and the mining of colliers; but we are in the mean time speaking of the general habits of the animal, and its general adaptation to that singular place which is assigned it in nature.

From the time of Aristotle downward there have been mistakes respecting the sense of sight in the mole. There is no question of the accuracy of all that is stated by Aristotle respecting every animal which came under his observation, and perhaps he is more to be relied upon than any naturalist of the long period which intervened between him and our illustrious countryman, Ray. There is, however, one caution to which we must carefully attend if we would avail ourselves of the accuracy of the great Grecian naturalist; and this caution is especially necessary in the case of the mole. In Italy, in Greece, and in other parts of the south of Europe, there is a mole resembling the common mole in form and manners, but which is to all appearance blind. It has eyes, indeed, but they are the most rudimental eyes with which we are acquainted, being not larger than grains of mustard-seed, and having the skin over them without the slightest separation or opening of eyelids. It is true that we are not warranted in predicating absolute blindness of the animal, even in this case; because it is impossible for us to state precisely the degree of development which is necessary before an eye can see. We know that if a well-developed eye which is habitually used in daylight were to be reduced to the state of the eyes of this southern mole, it could not by possibility see; but still this gives us no positive criterion as to the quantity of development in an eye which is absolutely necessary for the function of vision. Thus we are thrown upon the facts of the particular case; and experiment has clearly decided that the common mole not only sees, but sees well, though in the case of the mole of the south of Europe, which has no external opening to the eyes, the fact has not been decided.

There is a passage in Shakspeare's Romeo and Juliet, which has been quoted by almost every describer of the mole since the time which Shakspeare wrote. But, notwithstanding the number of times that this short passage has been quoted, we shall quote it again for the purpose of doing justice both to the mole and to Shakspeare. How he came by it is not for us to say; but it is certain that Shakspeare was acquainted with a fact in natural history of which professed naturalists were ignorant for a long time after his death. The passage to which we allude is as follows:—

> "Pray you, tread softly, that the *blind* mole may not
> Hear a foot fall!"

The scene of this passage is laid in the neighbour-

hood of Venice, and the mole of that country is the blind one; but how he came to know that the moles of that country have the eyelids unopened is a question which we cannot solve. The probability is that, like most others, he had taken his notions of the animal from the description of Aristotle, or rather from the popular opinions grounded upon that description; and that, as Aristotle described this blind or southern mole, the mole of authors and also of popular story, in the time of Aristotle, was the southern mole, and not the common mole as found in this country; for our mole has not only eyes, but very brilliant ones, though they are very small.

That the mole of the more temperate and cold districts of Europe should have its eyes capable of being opened, and that the mole of the warmer parts should not, is a curious fact in the physiology of the two animals; and we believe that there is a corresponding difference in the habits of the animals. The southern mole, or blind mole, as it may be called in contradistinction to the other, is never, we believe, found on the surface. The soil of the Apennines, where it is understood to be more abundant than anywhere else, is always full of worms, of larvæ, of ground insects, or of all of them, and therefore the mole finds under ground a constant supply for its voracious appetite, and consequently it is never forced to come to the surface. Our mole, on the other hand, is sometimes starved out in its subterranean pastures, and compelled to come to the surface to feed upon what it can find there. When above ground it is rather dexterous in the capture of the smaller rodentia, and even of birds, which it tears open and devours with the greatest voracity. Indeed its ultimate attack upon them is an effort of frenzy, comparable on a small scale to the spring of the lion or the tiger, and if once it can lay hold, there is scarcely any possibility of shaking it off. Birds, when it can surprise them, are an easy prey, and so are the different species of field-mice. Rats are, however, more untoward customers; and, though a hungry mole very readily attacks a rat, the rat defends itself so stoutly that the battle is usually a drawn one, or rather it is more a matter of chance than of superiority which shall gain the day, for they never desist until one is killed, and whichever may be the victim, the vanquished is eaten as a matter of course. Those surface excursions of the mole are usually performed during the night. This, however, is not always the case; for the appetite of the mole goads it on so forcibly, that it will brave all circumstances in order that it may feed. Hence, at peculiar seasons, especially when the autumnal droughts have sent the worms far below the surface, the mole is often found prowling about in daylight. It proceeds stealthily through the grass, in consequence of the softness of its fur and the slowness of its motions upon a level surface, and therefore it is not often seen by human beings. Dogs of keen scent find it out however; and sportsmen, especially if their pointers are not highly bred, are sometimes apt to find them standing at a mole instead of more noble game.

The fact of the mole standing alone in its economy (for, with the exception of the blindness alluded to, there is hardly any difference between the two species), it is one of the most interesting animals in the whole class of the mammalia. It is one which certainly disfigures the surface of the ground, and spoils many of the operations of the farmer and the gardener. At the same time we must not come to too hasty a judgment against it on the whole. In wild nature there is no question that it is an exceedingly useful animal, and it is very doubtful whether the persecution with which it meets in cultivated places is altogether judicious. There is no doubt that human cultivation by being artificial, in a great measure alters the state of things, so that many of the children of simple nature, which are very necessary there, are not required, or even become nuisances where man cultivates. Still, it must be borne in mind that cultivation can never be rendered wholly artificial; but that whatever man does in the way of art, he must still leave far more to be done by nature. This consideration ought to give him a feeling for all that is natural about him, and make him consider well whether he may not destroy any species of animal beyond the limit to which his artificial cultivation extends; for if he does this he may rest assured that he is destroying the balance of nature, and thereby doing a mischief to himself.

There is no doubt that the portion of full-grown vegetables, and also of those in a moderately advanced stage of their growth which is in the ground, is much smaller than that which is in the air; but, excepting in those countries where the mole is not wanted, and therefore not to be found, the portion of the vegetable which is in the soil is most essential to it, and without it the portion above the surface would instantly perish. In such places, too, the beginning of all vegetation is in the soil; and though nature has adapted matters so beautifully, that, generally speaking, the insect tribes are dormant at the season when the seeds of vegetables are sprouting, yet there are some which germinate at the time when insects, more especially the ground larvæ, which are exceedingly voracious, are in full activity. The roots of young vegetables, and the young rootlings of old vegetables, being blanched by their covering of mould, are the most succulent parts of the plants, and therefore the parts which hold out the greatest temptation to those predatory insects. The rook, and some other surface feeders, render great service to man in the destruction of these subterranean spoilers; but the service which they render is, as a matter of necessity, confined to the larger plants, which give indication above ground of the spoiler that is attacking them below. This takes place chiefly in the cultivated lands, and not in the rich grassy meadows, the turf of which is, on some occasions, so completely cut by the larvæ of the cockchaffer, as that many square yards of it, not more than an inch thick, may be rolled up like a blanket. The places where such depredations occur are the favourite hunting grounds of the mole; and although, in the course of its hunting, that animal disfigures the surface, by throwing up little mounds of earth here and there, there is no question that it renders the most essential service to vegetation by the destruction of the small animals upon which it feeds. On many points of natural history we are in some danger of being guilty of what is usually called a *hippolytism*, or putting the cart before the horse, and making the cause and the effect change places; yet, when we find two circumstances always in close juxtaposition, though we cannot decide positively which is cause and which is effect, we may generally conclude that there is a reciprocal advantage, and that the one is necessary to the other. Now, we find that there is

no mole in the barren grounds, or in grounds which are so habitually sour that they have a constant tendency to be covered with moss, to the destruction of more kindly vegetation. We do not find the mole in any situation where the soil is very thin; and when man habitually turns the soil, either with the plough or with the spade, the mole departs, as if conscious that its labours are not wanted. Wherever we find mole-heaps, mole-hills, and mole-runs, there is invariably richer grass upon the surface than there is in places which the animal never visits. We do not mean to say that the mole is in any respect the cause of the superior fertility of those places in which it is found; but the mole is chiefly, if not exclusively, an animal-feeder; the animals upon which it feeds all subsist upon the roots or buried seeds of vegetables (for there is nothing else accessible to them); and therefore the mole must, from the incessant craving of its appetite, destroy a vast number of those spoilers. Whether the disfiguring of the surface, which results from the labours of the animal, is or is not compensated by its labours in the cultivated field, we do not take upon us to determine; but it is certain that, in wild nature, the mole is, in temperate climates, a grand conservator of the more kindly vegetables; and, as it is one of the most singular of the mammalia, it is at the same time one of the most useful. The mole is, in fact, placed under such peculiar circumstances, endowed with powers so singular and so great in proportion to the volume of its body, and furnished with so strong an impulse to activity, that obscure as it is in its dwelling and its operations, the judgment of sound philosophy would dispose us to set it down as almost the very *chef-d'œuvre* of all the mammalia. On this account, and also because the animal is both despised and persecuted, we shall enter somewhat more largely into the consideration of it than we have done into that of more showy and sunward animals. This account, in order to make it perfect, will require some systematic arrangement. We shall not formally divide it into sections; but the following is the order in which the different parts of the description most naturally present themselves to our consideration:—First, the organs of nutrition, which determine the character of the animal; secondly, the organs of locomotion, which point out its adaptation to the place which it occupies in nature; thirdly, the organs of sense, which conspire with the former; fourthly, the organs of reproduction, which are so peculiar that we cannot, in justice to the subject, pass them entirely in silence, though we shall touch upon them with that lightness and delicacy which ought to characterise a work intended not so much for professional naturalists as for general readers; and, fifthly, the manners of the animal, more especially in the construction of its place of abode, its grand subterranean passages, and the more temporary mines in which it seeks its food. In all these we may take the details on the general description rather than on the distinctive notice of the two species, inasmuch as the manners of both species do not appear to differ much, except in so far as they are modified by climate.

In considering the organs of nutrition in any animal, the teeth claim our first and principal attention, because more depends on them than on any other part of the organisation; and if we study them well, they enable us to determine the quality, and even to form a tolerable estimate of the quantity of food which the animal requires. It is upon this principle that Cuvier, the most philosophic of naturalists, founded his classification of animals upon the teeth, in every case in which it was possible so to found; and it is worthy of remark, that, whenever circumstances compelled him to abandon this character, and have recourse to another one, the classification is loose and imperfect, and it becomes impossible to arrive at any knowledge of the individual genera from the characters given to the order. Upon referring to the article MAMMALIA in this work, the reader will at once see that this is remarkably the case in the order *Edentata*, in which the character, as dependent on the teeth, is negative, and more especially in the *Pachydermata*, in which the distinctive character of the order has no reference to the teeth.

The mole is one of those animals which possesses the greatest number of teeth; and though the analogy is not perhaps absolutely perfect throughout the whole system, as indeed no analogy of nature discoverable by us can be, still it is true that the voracity of every animal increases in proportion as its teeth are more numerous, whatever may be the structure of those teeth, or the nature of the food for the prehension and preparation of which they are adapted. The mole has eleven teeth in each side of both jaws, and consequently forty-four in the whole, which is a greater number than is possessed by the most formidable of the regular carnivora. Counting them from the middle of the front, there are on each side of the upper jaw three incisors, one canine, and seven grinders, of which three are true, and four in advance of them false. The incisors are small, but they are arranged with great regularity, so that, in their edges, they are as keen and trenchant as knives. The canines are very strong; they stand much out, and they are planted in the jaw with great firmness by means of two roots, the anterior of which is by much the larger of the two, and goes very deeply into the jaw—so deeply, indeed, that its extremity reaches the nasal bone, which is placed as a sort of key-stone between the fangs or roots of those teeth on the two sides. This structure of the canines gives them a very powerful hold, inasmuch as the deeply-inserted anterior fang is the point upon which the tooth would turn, and the tooth will not turn upon this point without an absolute fracture of the jaw of the animal. It is in consequence of this that, when the mole once fastens, it cannot be made to quit its hold unless its jaws are absolutely broken, or some severe injuries inflicted on its head. The three foremost false molars are small, leaving room for the canine tooth to take effect; but the fourth one is large, trenchant in the edge, and approaching more nearly to the form of a true carnivorous tooth than the cheek-tooth of almost any other insectivorous mammalia. The true grinders differ little from those of the other insectivorous carnassiers, only the points with which their crowns are beset are particularly sharp. The teeth in the lower jaw are the same in number as those in the upper, but they are different in their arrangement. Here, then, are four incisives on each side, with one canine, and six molars, of which three are false and three true. There is indeed some uncertainty about the system of dentition in this lower jaw, some comparative anatomists being of opinion that the last incisive tooth of the four is really the canine, and others being of opinion

that this character belongs to the tooth immediately behind it. The fact is, that, though the teeth in the lower jaw are of a highly trenchant, and even carnivorous character, there does not appear to be among them anything which can be decidedly called a canine tooth in the proper sense of the term. This is rather a curious circumstance in the mouth of the mole, inasmach as the rest of its teeth are of a more carnivorous character than those of any others of the insectivorous mammalia. In consequence of this formation of the teeth, the mole does not kill its prey, when that prey is warm-blooded, by one decisive bite, as is the case with the regular carnivora. Its great strength, and the powerful cross motion which it has in its fore paws, enable it to master the prey, and hold it down; and the first wound which it inflicts is that of tearing open the belly of the victim, and devouring its vitals. Though it has been sometimes said that the mole will occasionally feed upon farinaceous roots, such a mode of feeding is by no means probable, inasmuch as the digestive organs of the animal are wholly of a carnivorous character. The stomach is indeed large for the size of the animal, but it is membranous, and the intestines have not even a vestige of a cæcal appendage, which is rarely, if ever, wanting in vegetable feeders. Besides the smaller inhabitants below the surface of the earth, and mice, and occasional birds, the mole has no hesitation in despatching frogs and newts, and perhaps even the smaller snakes; but it has been well ascertained that it will not attack a toad, even though reduced to the utmost extremity by that hunger of which it is so impatient. The cause of this seems to be the peculiar secretion given out by the skin of the toad, which protects that most harmless and inoffensive of animals from the attacks of almost every foe. This secretion is exceedingly acrid, and thus it repels even the hungry mole, which is, without question, the most voracious of all animals. Still moles find abundance of food. When seen, they are always in good condition; and in places which are suited to them they are very numerous, notwithstanding the labours of human mole-catchers, and the disposition which the animals have to prey upon each other. This disposition is so great, that two moles of the same sex, or even of different sexes, except at a particular season, cannot meet without a combat, which invariably ends in the devouring of the weaker one by the stronger. It should seem that there is some provision with regard to this in the ruts or highways which the moles make, for these are always so constructed as that only one mole can pass along; and though the same common path is sometimes used by several of them, the weaker ones always contrive to escape into a side-gallery when they find the stronger advancing upon them; and, as no animal absolutely hunts its own species as regular prey, they by this means make their escape.

The organs of motion in the moles are as peculiar and characteristic as any others of their system. The general form of the feet, and their adaptation to the subterranean operations of the animals, have been partially alluded to in a general way in the article Mammalia. It will be necessary, however, to advert to them somewhat more in detail, in order to enable the reader to form a correct estimate of this most singular of all European mammalia. The mole may be considered as the most perfect type of digging animals; and there is no other genus which is so admirably fitted for making its way under ground. The anterior extremities—that is, the fore paws, or hands, as we may term them—are differently placed and articulated from those of every other animal. They are placed more in advance or nearer the head than in other animals; they are very short, but firm, in all their individual bones; and they are provided with very powerful muscles. The blade-bone is long and slender, presenting some vestiges of spinous processes, by means of which it has much more firm imbedment in the flesh. The clavicle is also both long and strong, and projects forward, so that the shoulder-joint, or articulation of the humerus, advances to nearly the middle of the neck; and while this structure enables the fore paws to act more in advance than if the shoulder-joint were placed as in the other mammalia, it at the same time furnishes the neck with a support on each side, by means of which the pointed and cartilaginous muzzle can bore through the soil with rapidity and certainty. The humerus is of a very peculiar structure, appearing as if the round or medial part were obliterated, and the two ends of the bone brought close upon each other. The radius is short, but very stout, entirely separated from the cubitus; and the olecranal process projects as far as the articulation of the arm with the fore arm, or that which answers to the elbow-joint in man. The bones which form the hand are very finely constructed. With the exception of the last phalanges which carry the nails, the bones are all remarkably short; and though the upper joints have much motion, the under ones are stiff and firm, and the hand cannot be bent backwards even to a straight line. The palm or flat of the hand, or fore paw, is turned outwards; so that, when the mole digs, the earth which it removes is not thrown under the belly of the animal, as is the case in those animals which dig by the downward action of the feet in a direction parallel to a mesial plane. It is thrown upwards; and, as the hands really work in advance of the thick part of the head and body, it is really thrown forwards; and when it accumulates in such quantity as to impede the operations of the animal, it is forced to the surface in those little heaps which are usually found marking the course of moles on their feeding grounds. These little heaps, which consist of earth simply thrown out of the way of the animal as lumber, must not be confounded with the permanent mole-hill afterwards to be spoken of, which is a much more curious and elaborate structure; neither must the fresh heaps which are seen on the feeding ground be considered as indicating the position of the permanent galleries, along which the mole passes and repasses, and in which alone it can be taken. In those temporary openings which are made in the operation of feeding, it would be in vain to set a mole-trap; because the mole never passes them a second time, though they are generally at no great distance from a permanent gallery. The fore paws of the mole bear some slight resemblance to the hands of the human subject; but this resemblance is very slight, as the thumb and fingers act in the same direction, and the paw in its general shape bears some resemblance to a pointed shovel, the most effective instrument for at once dividing and removing the soil The last bones are entirely incased with large claws, and the principal bend of which the hand is susceptible is the joints of those, by means of which the claws are brought so as to form rather less than a

right angle with the palm and direction of the fore arm. The mole is not seen when vigorously at work, because it works under ground; but there is no doubt that it works with the claws bent in this angular manner, because it is the position in which they can act with the greatest effect. Indeed it is not possible to imagine an instrument better fitted for its work than this is, and it would make the very best model for a hoe.

The hind legs of the mole have five toes and five long claws on the feet, as well as the fore ones; and they are well adapted for digging; but in other respects their structure is not so peculiar as that of the others. The bones of the pelvis are exceedingly narrow, and the fore or under part of the pelvis is open, so that in the female the young do not pass in the same manner as they do in the more typical mammalia. There are certain other peculiarities in the system of reproduction, especially in the female mole, which are highly interesting in a physiological point of view; but they can hardly be described in a way which would interest the general reader. We may mention, however, that the female has three openings to the body, one of which is so completely closed in the young state that there is no distinguishing the young male from the young female, except by internal dissection. Both are readily taken for males, and this is the point which it is desirable that common observers should know, because want of attention to it has probably led to some erroneous conclusions with regard to the relative numbers of the sexes. Most authors who treat on the mole concur in stating that the number of females is very small as compared with that of males. To a certain extent this is probably the case, but it is doubtful whether there be any animal in which the number of males so greatly predominates over that of females as is alleged of the mole. Moles are monogamous, in as far as the males are concerned; and the females are not only monandrous, but they are so reluctant to associate that they have to be taken by efforts as desperate as those which wived the Roman brigands to the Sabine women. In those animals which have the male polygamous, the females are all much more numerous than the males; and we are not aware that in any species of animal the female can be correctly described as polyandrous. In nature we never find a disproportion of the two sexes, without there being some purpose which it answers; and it is not easy to say what purpose of this kind could be answered by a great excess of male moles above females. We shall, however, have occasion very slightly to notice "the loves of the moles," which in the describable part of them are different from those of all other creatures; and so we may now content ourselves with holding up the disparity of the sexes as a point not completely established. There is another point which renders the distinction of male and female moles a matter of some difficulty. The mammæ of the females bear some slight resemblance to those of the marsupial animals, inasmuch as they are hardly visible, except when required for the use of the young. The young too are produced in a very immature state, though certainly not rudimental, like those of marsupial animals. There is no doubt that those peculiarities in the structure of the female are given to her for the purpose of adapting her for seeking her food when in the gravid state; for she must provide for herself and her young without any assistance from the other sex.

Of the organs of sense we have already partially spoken. There is little doubt that, of the senses allocated to particular organs, smelling is the most acute, and the one upon which the animal chiefly depends for finding out that food, the capture of which is so laborious, and the appetite so perfectly ravenous. The extremity of the snout is drawn out into two cartilaginous tubes, which lead to various cells, thickly ramified with the olfactory nerves. This snout, however, has various other functions to perform. It opens the earth, and guides the motions of the animal in digging; it throws up the earth to the surface, when it accumulates in such quantity as to impede the operation of digging; it appears to be an organ of touch; and it is to some extent prehensile, and assists the animal in capturing its food, or in forcing it to the mouth, which is far under this curious organ. There is no question that the hearing, considered merely as a local sense, and without reference to the general sensibility of the body, is very acute; for, though there is no external ear, the interior is both ample and well developed.

Thus, in respect of three of its senses, we must regard the mole as being not inferior to any other animal. In respect of smell, it must indeed be the most acute of any, because of the element through which it has to bore in quest of the greater part of its food. It is well known that nothing tends so much to intercept or take off odours of all kinds, and more especially animal odours, than fresh mould, of that rich and loamy nature which forms the richest pasture of the mole. So well is this known, that those people of inhospitable climates, who are constrained to live in great part upon sea-birds, whose flesh is rank, contrive to sweeten it by burying it in the soil. The mole has necessarily to contend against this disadvantage of its pastures; and, as no production of nature is left deficient for the ordinary overcoming of any difficulty or hardship that may lie in its way, we may conclude, as a matter of course, that there is a keenness of scent in the mole far surpassing that of any animal which feeds on the surface of the earth. The hearing we cannot so well understand, because we have no good instance of the effect of hearing when both the sounding body and the hearing ear are in the earth. It is highly probable, however, from the great development of the labyrinth of the ear, that the sense of hearing is exceedingly acute as well as that of smell. That the sight is much less so is true, though the common mole is not blind; but it has no use for eyes in its subterranean occupations, which consume the greater part of its time; and as nature is never prodigal any more than stinted, eyes to the mole as fully developed as those of surface animals would be contrary to the general law. We have already mentioned the mistake in which the alleged blindness of the common mole has in all probability originated; and we shall now add that the little eyes which it possesses are remarkable for their brightness, as well as for the apparent perfection of their structure. When examined in profile, the cornea or anterior coat of the eye is remarkably convex and highly transparent, but blackish grey when viewed in front. The interior coats are deep black, and the retina is very finely developed. The crystalline lens is very convex as well as the cornea, which would lead one to conclude that the mole has eyes of very short focal length, and which consequently see very acutely within their range.

What may be the difference in manners between the blind mole of the south, which has the eyelids closed, and our common mole, it is impossible to say, as very little is known respecting the former. There must be a difference, however, and analogy would lead us to suppose that the blind mole remains much more habitually under ground than the common one. There are various causes which compel the common mole to be a surface-walker, and even a swimmer, at which latter operation it is by no means inexpert; and when it swims, its glossy fur takes down little air bubbles, which sparkle like pearls through the water, in the same manner as those on the fur of the water-shrews. This power of swimming is absolutely indispensable to the animal, because it runs under ground yet flooded during rains; and there are instances in which the failure of food to supply its ungovernable appetite compels it to cross streams of considerable breadth. In the summer drought it is reduced to equal straits, for many of the larvæ are then on the wing, the worms are down below its depth, and the ground is too much consolidated for its working along with the requisite degree of speed. It is at such times that the mole is found on the surface, but never exposed to the full light of the sun. At such times it feeds on mice and ground birds, the first of which are out of their holes, and the second are reposing on the ground by the time that the evening twilight gets dusky. The mole has thus an opportunity of exercising its powers as a surface hunter, and also of obtaining a full meal with less labour than is required to procure it a scanty one under ground. It is true that it often perishes of hunger, or of hunger and rage jointly, before it can meet with a mouse or a bird; but, if it does scent the one or the other, it is a crafty, a daring, and, generally speaking, a successful hunter. It proceeds upon the scent, gliding so softly through the grass that it makes neither rustle nor foot-fall until it is close upon its victim, and then it finishes its work in a perfect paroxysm of energy.

Intense energy, in every sense in which the words can be used, is indeed the character of the mole, and it possesses this in a higher degree than any known animal. This demands a powerful stimulus and efficient organs for execution, and we have seen that the mole is furnished with these in an extreme degree. All its movements indeed, and all its operations indicate an excess of animation, and that in an animal which in our common speech we set down as having little or none. The one of these parts of its economy not only requires, but necessarily involves, the other. The food could not be acquired by such labour as a mole has to perform, were it not for the great energy and strength of the animal; and the energy and strength could not be kept up without the copious supply of food. It is doubtful, indeed, whether such an animal as the mole could exist habitually on the surface of the earth, and exposed to the vicissitudes of the weather. The supply of an animal must, in every case, be equal to the waste, and exposure to vicissitudes of weather is a much greater source of waste than one would be apt to suppose, as we find that animals freely exposed to the open air, even though spared the labour of finding their food, do not fatten so readily, or to the extent of those which are sheltered. Now, in its common habits, the mole may be said to be always sheltered, with very little variation of temperature, and in a situation where there can be comparatively little drain upon it from the action of the atmosphere. Thus we see that the place which has been assigned to the mole in nature, humble and grovelling as we deem it, is highly favourable to the development and the maintenance of its animal powers.

There is another point very strongly established by the economy of the mole, and that is the connexion between great energy of living power and the easy destruction of the same. The mole, notwithstanding the quality which we have mentioned, perishes of hunger sooner than any other creature, and less exposure or contingency of any kind is fatal to it.

The habitation and general mode of action in the mole are well worthy of study. Except at pairing time, and that is of brief duration, moles are strictly solitary, and each one has its own stronghold or castle. This is very elaborately constructed, and generally placed against a wall, near the roots of a tree, or in some place where it is in part sheltered. It rises with a dome in the form of a conicle, and having the base three or four times as great as the altitude above the surface, into which it gradually fines off so as to drain off the water, and it is so hard and firm that none can penetrate through. The interior consists of two galleries nearly circular, and a circular habitation within. The lower gallery, which has by much the greatest diameter, is placed nearly on a level with the surface of the ground, and the upper one about midway between the lower and the top of the dome: five or six sloping passages lead from the one gallery to the other, and at least three lead from the upper gallery to the nest or habitation, which is placed below the upper gallery, but rather above the lower one. Those galleries and passages are not formed by removing the earth and throwing it on the surface, as the mole does when it hunts. They are, as one would say, bored in the solid earth, without the removal of any part of the materials. In consequence of this they are smooth and hard, and not liable to be filled up or be disturbed as the animal moves along. The passages between the galleries, and also those which lead to the nest, are ingeniously placed, so that one of them never opens opposite the entrance of another; and in this way the castle and its outworks are quite a labyrinth to all but the builder and proprietor. This very ingenious and very elaborate structure is understood to be made in the latter part of summer, and the mole makes it its regular home and resting-place from the time of the autumnal rains until the warm season again sets in. It is generally said that a new one is made in a different place every year; and, though it is impossible to establish the fact in all cases, this is by no means improbable, because the labours of a mole are carried on with so much vigour and perseverance, that it is sufficient to exhaust a considerable space of all the underground prey which it contains in the course of one season. Much must, no doubt, however, depend on the extent and nature of the pasture. There is one peculiarity of the mole's habitation which we have forgotten to mention, and to which there is something similar in the burrow of the marmot: immediately under the nest there descends a passage more free at its entrance than any of the others. This curves downward to a depth nearly equal to the height of the dome, and then curves upward again at a little distance from the nest. The precise use of this is

not known; but it may serve either as a sally-port or as a means of drainage.

We shall suppose the fort constructed in the manner that has been stated; but, even though it is, the labours of the animal may be said to be little else than begun, unless, indeed, the castle is constructed upon, or closely adjoining, a previously-made run, which is almost always the case where moles are numerous, and occupy a considerable breadth of ground. There is one main thoroughfare or highway, which is either the one by which the mole arrives at and constructs the castle, or one made leading from it; generally, we believe, it is the former, unless where a mole breaks ground in a new place altogether. Besides this, there are other galleries branching out in all directions from the habitation, generally ramified into new branches after a little distance, and very often bending round until they come into the main road or roads. Some of these are sufficiently near the surface for the mole to throw up heaps at least in the first formation of them; and others are too deep for this; but in all cases of a second passage along the same gallery the body of the animal smooths it, and converts it into a permanent passage. Those passages cross and meet each other in a variety of directions, and those of one mole not unfrequently cross those of another. It does not appear that, even when there is this kind of territorial interference, the one mole wages voluntary battle upon the other; but, if two happen to meet, there is a mortal combat, and no quarter.

The feeding of the mole is in new runs opened up from one or another of these galleries, and thus its distance from the castle always becomes greater and greater, while the intermediate ground is mined in all directions. There is thus a very considerable resemblance between the working of a mole under ground and the working of a coal-mine by narrow galleries; but whether the directors of coal-mining ever studied the under-ground plan of the mole, it is impossible to say.

The degree of strength which the mole gives to its habitation is always very nicely proportioned to the degree of danger to which it is exposed. In safe and secluded places the crown of the dome is only a few inches thick, while in exposed ones it is a foot or more. It is the same with the main roads, and all the galleries which are used as permanent passages. The instinct which regulates those adaptations is a very curious one, and quite inexplicable upon any principle with which we are acquainted. That it depends upon anything like a knowledge of the circumstances on the part of the animal, in any way analogous to our knowledge, cannot possibly be true; and therefore, as is the case with all that we call animal instincts, it is impossible for us to explain it upon any principles of our philosophy. The very word instinct might tell us this, and thus spare us the idleness of wondering about it; because the real meaning of instinct is that which proceeds entirely from the animal itself, and to the cause of which we have therefore no clue, though we may observe the phenomena. It has often been observed that when a mole carries its gallery against the foundation of a wall, a large stone, or any other obstacle through which it cannot make way, it turns downwards, upwards, or to a side, according to circumstances; and that, when it crosses a footpath, it mines more deeply than when it is approaching or leaving such a situation. We have even heard it said that moles work more deeply in places pastured by cattle than in those pastured by sheep; but we cannot vouch for the truth of its instinct extending to this extraordinary length. Its instincts are so curious, however, and impressions are made on its senses by means so different from those that affect us, that our judgments respecting it must, in all cases, remain very imperfect.

The size of the galleries, even the principal ones, which connect the castle with the most remote pastures, are never so large as to admit two moles, though they are always such that a single one can move freely along. The hunting run, from which the earth is thrown up in successive heaps, is at first no bigger than to allow the animal to squeeze itself along; and this tightness assists it in digging, by giving it a firm hold on the sides of the passage. Should the run be afterwards converted into a road, which is very frequently the case, the mole casts up no more earth, but presses the sides with its body as it goes along, and thereby gives the passage sufficient consistency for keeping it open. Of course there is an end to all hunting after the sides of the passage are thus compressed, and indeed a mole rarely hunts twice in the same run. On the contrary, its underground food is almost entirely obtained by digging anew in the earth, so that the animal has need of all its stimulating appetites. When alarmed, the mole can proceed along those main roads, which are worked smooth, with a degree of rapidity far greater than one would suppose, if the fact had not been established experimentally by an author of undoubted veracity. M. Henri le Court, who was driven from Paris by the horrors of the French revolution, retired to the country, and observed nature with the same earnestness and the same unobtrusive quietness as our illustrious Gilbert White; and it is a fact worth mentioning that the great Ray himself studied nature when in retirement from political persecution. The French naturalist above mentioned paid particular attention to the natural history of the mole, and was the first who threw much light on its habits, or elevated it to that rank which it is entitled to hold among the productions of nature. The method upon which he fell to ascertain the full speed of the mole was very ingenious. He found a mole road of considerable length, into which he placed straws, intersecting the passage perpendicularly, and placed on the tops of them, above ground, little flags of paper. When all was ready for measuring the time, and he had ascertained that the mole was in the road, he went to a horn which he had placed in the road more distant from the mole's castle, and then, "winding the horn with a hideous cry," as Geoffroy St. Hilaire says, he sent the mole post haste to its castle, leaving the worms to their fate. On comparing the time and distance, it was ascertained that the speed of the mole was nearly the same as that of an ordinary horse trotting; from which it should seem that the passion of fear operates as powerfully on the mole as the passion of hunger; and this still farther establishes the character we have endeavoured to show that it possesses of intense energy in all its animal action. Whether it may run as fast at other times we have no means of ascertaining; but certainly its motion on the surface of the ground is very slow as compared with this. Along the run, when at this velocity, its mode of action cannot be seen; but it is understood to be a very curious kind of gallop,

in which the feet, instead of striking under the body of the animal, strike outwards laterally against the concave sides of the run; and, from the distance between the feeding-ground and the castle, it is highly probable that the mole has often to travel over as much distance in the course of a day as a larger animal grazing a rich pasture. At the times when the hunger of the mole is satisfied it retires to its castle, or other place of repose, and is understood to remain about five hours in profound sleep after it has had a very full meal; and when this sleep is over it returns to its severe labour with the same violent energy as before. It does not sleep on the cold earth, but forms for itself a snug bed of dried vegetable matter, or sometimes of green leaves; but it does not appear in any case to feed upon even the most succulent roots of vegetables; for whenever a mole, in a state of captivity, has had only this kind of food presented to it, it has invariably died of hunger.

The time of reproduction varies a good deal with the season; for moles are so very sensitive, that a warm season and a cold one, or a wet and a dry, will cause them to differ a good many weeks; and there is a great difference in the time of their production in the more northerly and southerly latitudes which they inhabit. February is understood to be the average pairing time in the warm places of England, two months the time of gestation, and consequently the time of production April; but, owing to the susceptibility of the animals to temperature, the young are often not produced till the summer is pretty far advanced.

As both sexes live solitary, the pairing does not take place during winter, when they keep their castles, nor until they begin to live in what may be called their summer encampments. Those encampments are more simple structures than the winter strongholds, and they are generally made near the extremity of the former year's working. The intersection of two runs, which is generally marked by an ordinary mole-hill, is chosen for this purpose, and an excavation sufficiently large for the nest is formed by throwing up fresh earth in the centre of the hill. Being at a distance from the castles, and near the unbeaten part of the feeding-ground, the moles are brought nearer to each other in their summer encampments, and it is then that the pairing takes place. At other times moles shun each other, and at these times the females are said to shun the males by every means in their power. This, however, only excites them the more, which is the true physiological cause of all this species of shunning; and, as several males are often in pursuit of the same female at the same time, desperate battles of gallantry often occur in the galleries, and many a mole is said to form a meal for his rival and mistress jointly. When one succeeds in capturing the female, he does not actually bury her in two cross roads; but he is said to drive her there, and keep her prisoner, until the cravings of hunger compel him to take his leave, after which he takes his departure, and returns no more. The female instantly begins to construct a nest for her young, generally, as is said, at the cross roads above alluded to, and she barricades those ends of them which are nearest the main roads and castles. This is said to operate as a sort of *taboo* upon all well disposed moles, for it is said to be held sacred by the rest, and that a certain portion of the pasture near it is also reserved for the female during that time when she is least able to perform labours of the usual severity. The young vary considerably. Four or five is the number most frequently met with in a nest, but occasionally there are six, and at other times only three. It is understood that the nursing lasts till they are about half-grown, and that they are able to build castles for themselves by the autumn of the same year. Many of these circumstances are, however, a little obscure.

We shall not enter upon a question which has excited some controversy, namely, whether, upon the whole, moles do most good or harm; but in this, as in all questions of a similar nature, the whole turns upon the meaning attached to the word good; and therefore we would say with the casuist, that "in wild nature moles are good *absolute*, but among cultivated grounds and gardens they are good only *secundum quid*;" which, logically speaking, throws the argument upon the *quid*, which is the "irreducible case" in reasoning, and therefore always best left alone. That moles are useful in wild nature must be true, because they are generally distributed, and also numerous; but whether they are or are not injurious to man, as a cultivator of the ground, must depend upon the nature of the individual case. That the absence of moles does not conduce in any very high degree to the natural fertility of a country is a fact established by the case of those countries in which there are no moles. In Ireland, for instance, there are no moles, at least none which have been hitherto seen either personally or in their working; and Ireland, from enjoying more of the warm atmosphere and dripping sky of the Atlantic, ought, latitude for latitude, to possess a much more vegetating climate than Britain. Such, however, is not the fact; for whether it arises from the nature of the subsoil, from humidity, or from any other cause uninvestigated, it is unquestionable that there is in Ireland a tendency to run into moss, and ultimately into turf bog, to which there is no parallel in Britain, excepting in those high and cold places of the north which lie above or beyond the ordinary haunts of the mole. We do not mean to say that the mole is the preventive of those consequences in England; but we do mean to say that the presence of the mole is an evidence of soils fitted for growing the most kindly grasses, and that such soils are always the richer the more abundant that the moles are in them. Where the soil is cold and sour, from impenetrable under-strata of clay or gravel, into which no worm can penetrate, and where water, impregnated with salts of iron, literally corrodes the surface, as it always does in such places, we never meet with a single mole-hill or run; and, if by chance a worm is found, it is blanched and tough, so as hardly to be eatable by the most hungry creature that feeds upon such food. If, indeed, one wishes to form an accurate judgment of the value of lands without trusting implicitly to the tests of land doctors, who are all more or less given to quackery, there are few better criteria than the presence or the absence of moles or mole-runs. Following the analogy of nature, which is no bad guide in such cases, we would be strongly induced to believe that, whatever it may be, there is really some connexion in usefulness between the very rich ground and the mole. In a state of nature we find them together; and as the mole, though it may disfigure the uniformity of the surface, never by any chance turns its pasture into a waste, or lessens the quantity or vigour of surface vegetation,

we are inclined to the belief that, in places in or nearly in a state of nature, the mole must be a very useful animal, whether we may be prepared or not prepared to say in what its specific use consists. The usual ground upon which its advocates take their stand is the drainage effected by its runs, and the loosening and turning up of the soil by its heaps and hills. We do not think that there is much, or anything, in either of these. They are too exclusively formed upon human contrivances for being at all applicable in wild nature. It is true that we have often seen a mole-run upon a slope discharging water like a copious spring. We also know that the earth thrown up in mole-heaps is finely pulverised, and remarkably well adapted for the renewal of garden beds, or for a top dressing to the ground in which the heaps are cast up, if spread at the proper season. Such circumstances, however, prove nothing. The water which flows off by the mole-run would very speedily run off the surface, or soak into such soil as moles work; and reducing a portion of the earth by any other means would answer just as well as the heaps. The fact is, that the mole follows the law of all the other carnassiers, and is valuable for what it consumes, not for what it does in the way of any kind of labour. It is unquestionable that the labours of the moles are valuable only in so far as they destroy the underground animals, which feed principally upon the roots of vegetables, or as they destroy the ground mice, which, however, are not so destructive, at least to the farmer, as those mice which attack corn after it is in the rick; and voracious as the moles are, and ample as is the quantity of food which a single mole requires, their structure and habits alike prevent them from performing any very important service in this way.

The enemies of the mole have generally had practice along with them; and thus, in the haunts of an expert mole-catcher, the trade of destroying them is not an unprofitable one; and there is no doubt that, under peculiar circumstances, it is useful as well as profitable. In Holland, and also in some parts of England, though to a less extent, the mole sometimes does injury by mining through dams and fences, and so letting out or letting in water in places where it is not required. In such situations, and also in lawns and gardens, where it is desirable that the surface should not be disturbed, there is no question that the operations of the mole run counter to the operations of man; but in wild places, especially in woodlands, it is very probable that the operations of the mole ought not to be disturbed, nor is it at all unlikely that many a mole-catcher receives his fee for destroying a mole in a situation where its labours are far more useful than his own. Some of those mole-catchers are very expert in their business, and capture a vast number in the course of the season. Mr. Bell, in his work on British Quadrupeds, now in course of publication, in a very clever article on the mole, gives an account of the success of some of those mole-catchers. He mentions, among others, a Mr. Jackson, who seems to have paid more attention to the economy of his game than most persons of his craft, who for five-and-thirty years has been destroying them at the rate of about twelve hundred a year. It appears from the accounts given by Jackson that the moles make provision for obtaining a supply of water without the necessity of any surface travelling. If there is a pond, a ditch, or any other permanent supply of water within a moderate distance of the feeding grounds, they open a passage to it, with branches, so that each of the colony may reach it by turns, without any chance of collision with his neighbours. The same authority mentions that, if such a supply of water is not accessible, the moles dig wells in various parts of their runs, and carry them to such a depth as that they can command a permanent supply of water at the bottom. Le Court, who has been already alluded to, was perhaps, however, the most successful of all mole-catchers that ever embarked in the profession; for, though his labours did not extend over a very great breadth of country, he contrived, for five months running, to catch at the rate of twelve hundred moles in the month. He caught them at all seasons and under all circumstances; and sometimes he caught the female mole when in season, and found the attachment of the male so strong that it was literally starved to death beside the trap; nor was he less successful in training others to the capture of these animals, so that, though we are greatly indebted to him for information on the subject of moles, the moles themselves, as a race, are under no very particular obligations to him. He had studied the subject so long and so intimately, that he knew at once, from the aspect of the ground, and the sound which it emitted when struck by a hoe or mole spade, whether there was or was not a mole-run under it. He also knew the time at which to place his traps so as to make sure of his victims, and seldom failed in any one attempt.

The mole-traps used by Le Court were not of the same form as those which are chiefly made use of by mole-catchers in this country. With us the mole-trap is but a clumsy instrument. It consists of a little wooden cylinder, or frequently of a simple bit of board, with two grooved hoops applied to the under side. This instrument is let into the ground, so that the opening of the cylinder or of the hoops answers to part of the mole's run; and in either case there are placed two gins or nooses, which lie in grooves of the cylinder or the hoops, and are connected with a piece of stick outside on the surface of the ground, which answers the purpose of a spring. When free to act, this spring draws the nooses tight enough against the upper part of the cylinder, or against the board, for holding a mole in confinement in spite of its utmost effort to get free; and to prevent this from taking place there is a peg on the under side, which confines the end of a bit of string, and so prevents the stick from pulling the gins until this peg is removed. This peg is so placed as that the mole shall strike it with the greatest lever power, and drive it from its place; and while, when he "comes thundering on," in his career to rest or to feed, he loosens and drives out the peg, he as invariably fastens himself beyond a mole's means of extrication. Clumsy mole-catchers, in their zeal to make the spring of the trap strong enough for catching powerful moles, sometimes contrive to make it catch only itself; and at other times they place it in so bungling a manner that the mole easily gets his snout under it and bores it out of the ground, and, if moles are capable of laughing on such occasions, laughs in his sleeve at the bungling conduct of his intended destroyers. We know not whether this may at any time happen to the regular and more celebrated professors of the mole-catching art; but as one passes over grounds where mole-traps have been set with industry, if not with skill, it is no uncommon sight to observe half

the traps dangling at the tops of the released springs, with not a mole in one of them.

Le Court's traps were of a construction somewhat different, and contained the springs on the under side, so that they could not be jerked out of the ground. The springs were of steel, so formed that when free to act they crossed each other with considerable force, and held the mole against the board to which they were attached. When set, those springs were kept apart by means of a lozenge-shaped piece of iron, the two points of which bore against the insides of the springs, but which was so slightly held in its place that a mole could not strike against it without instantly displacing it, and as certainly being secured with the springs. Mr. Bell mentions that the mole-catchers of this country have made some improvement in this species of instrument; but in much-frequented runs he deprecates the use of a box trap for catching moles alive, because, when more than one get into such a trap, they kill and devour each other. If the simple destruction of moles were the only object in this case, this cannibalism would be of no consequence; but of course the mole-catcher is paid in proportion to the number which he produces. We know not what vestige the victor mole may leave of the vanquished one after the feast of skulls is finished; but very probably they cannot be much worse than the famed cannibal cats of Kilkenny, which left the "two tails and a bit of claw" as evidence that there had been more than one at the fight and the feast. If this is the case, we think the fact of the moles eating or not eating each other is one of very minor importance; because, if the brush is evidence that a fox has been killed, the tail ought to be equally good evidence in the case of a mole.

We must, however, leave the general description of these animals, interesting though they are, and very briefly notice the two species, than which we are not aware that any others are found in any part of the world. It is true that those describers who are fond of multiplying species have contrived to manufacture several out of the common mole, because that animal is subject to considerable variations of colour. Some are found perfect albinos or white all over, others are found yellow; some are found ash-coloured, and some spotted or mottled with different colours. We have not, however, the slightest evidence that any one of these is a species, or even a permanent variety capable of transmitting any one of its variations of colour to its posterity even in one generation. In breaking up lea in some parts of the country, especially when it is done with a deep furrow and the ground friable, moles are often turned up in considerable numbers, both in the mature and the young state; and, though we never saw one perfectly white, we have seen them of a pale ashen colour, interspersed with others of the usual dark hue. Those deep ploughings of their grounds, which destroy camp and highway and castle, are of course sad catastrophes to the poor moles, worse in all probability than earthquakes to human beings; and though, in the moment of their disturbance, they would bite, and bite keenly, they very speedily perish after their exposure to the air. From this obvious blending of the different colours in the same locality there is no reason to doubt that they are all the same identical species, and that there is really no mole in Europe except the two species to which we have alluded. As little does it appear that there are any other species of true mole in any part of the world; for the golden mole of the Cape, the musk rat of Russia, the star-nosed mole of North America, and various other allied genera, some of which have occasionally been called moles, differ in more respects than mere specific ones from the moles properly so called. We shall therefore restrict them to the two species to which we have alluded, and of which we shall now give a very brief notice.

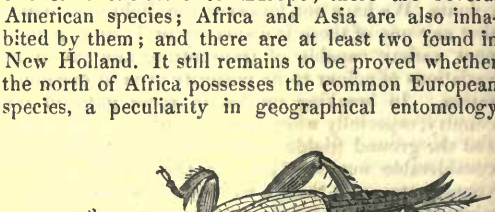
Common Mole (*Talpa vulgaris*). This animal is so common in most parts of the country as scarcely to require any particular description. It is known by various names in different districts. "Mole," which is its common modern English name, is obviously a contraction of the older one, which is not an unusual way of changing names. The old English name is "mouldiwarp," or "mouldwarp," which simply means that which turns or casts up the mould or soil. In different places the pronunciation is different. In many parts of Scotland it is the "moudiwort," in others the "moudiwark," and in others again it is simply the "moudie." All these are, however, the same word, differently pronounced or contracted, and they all have the same meaning. The intermediate authors sometimes call it "moule," and that as well as "mole" are simple allusions to its working in the mould or earth. We also call an embankment of earth a "mole;" and the word "mall," which is applied to a walk cast up or elevated above the mean surface so as to be dry, is still the same original word. In those parts of the midland counties, especially along the slow-flowing rivers which discharge their waters into the Humber or the Wash, there is a process for the improvement of land which is still called "warping;" and though it is really a depositation of mud, and not a casting of it up, it is also derived from the same Anglo-Saxon verb "*Weorpan*," "to turn or cast up." This process consists in allowing the tide or flood, or both together, when loaded with matter which is known to be useful to land, to flow over the low grounds, and remain there till it deposits its load, after which the water is allowed to drain off, and this produces a new surface soil, bearing some slight resemblance to what would be obtained by the spreading of mole-hills. These etymologies show the attention that the common mole attracted even in comparatively early times. The whole length of the common mole is nearly eight inches, the head being about an inch and seven lines, the body three inches and seven lines, and the tail one inch and two lines. The teeth are six incisives above and eight below, all of equal length. Two canines in each jaw; eight false molars above and six below, and six true molars with tuberculated insectivorous crowns, making in all twenty-two teeth in each jaw, and of course forty-four in the whole. The body is thick and massy for the size of the animal, and of an oblong form, with very little distinction of neck, in consequence of the advanced position of the shoulder joints, to which we have already alluded. From the shortness of the legs, and the peculiarity of their articulation, the whole under part of the animal may be said habitually to touch the ground; and the edges of the fore paws, that is, the inner edges, the very opposite of what takes place in the sloths and ant-eaters, are applied to the surface. The head, though thick and strong towards the neck, tapers gradually towards the muzzle; and that organ has a great deal of

muscular power as a digging instrument, and not a little as a prehensile one. The eyes are exceedingly small; and even when the animal has occasion to use them, their lids open but a little way, though the eyes themselves are bright and shining. All the teeth are remarkably sharp, and more especially the canines, by means of which, though the mole does not kill its prey in the business-like manner of the true carnivora, it very speedily tears open those animals which it masters while yet alive, and devours their vitals ere they have ceased to feel pain. The incisive teeth are small, but bite very keenly, and the false grinders are shaped like the canines, only much smaller, and they use these in tearing. The true grinders are broad, and have many tuberculous prominences for dividing the food; but there is no proper grinding motion in the jaws. The fore feet are accordingly stout, and formed and used in the manner already explained, the carpus being wholly, the metacarpus partially concealed under the fur. This fur is very short, delicate, and silky, and being inserted perpendicularly in the skin, and not sloping in one direction more than in another, it is not ruffled by any action of the animal against the earth through which it works. The colour may, generally speaking, be said to be deep black; but it is so far iridescent that it shows different colours. If seen from the side toward which it is bent, it is velvet black without any reflections, whereas, if seen from that toward which it is bent, it is glistning grey. In different lights it shows various shades of colour intermediate between those two extremes; and though it does not under any circumstances display the brilliant lustres of the golden mole of the Cape, the whole of its hair has metallic glosses. The tail of the mole is scaly, but the scales are interspersed with longer and stiffer hairs than those on any other part of it, with the exception of the whiskers. The skin of the mole is an exceedingly delicate and beautiful fur, and by no means without durability; but the individual skin is small, and it is not easy to procure a sufficient number for any other than trifling articles.

The *Blind Mole* (*Talpa cæca*). In its general habits, this animal does not appear to differ much from the common mole, though, as we have already said, it is but rarely seen, and altogether an exceedingly obscure animal in its habits. So far as we know, it has never been met with to the northward of the Alps, or indeed almost anywhere but in the Apennines, though there is no doubt that it is the mole described by Aristotle.

Their distinctions are structural, however, and, as such, they are sufficient to warrant us in regarding it as a different species. It is probable that it may be found in other parts of Europe besides those in which it has hitherto been actually found, because it does not appear that there is any circumstance connected with it which necessarily confines it to climates warmer than those inhabited by the common mole; and this is rendered the more likely by the fact of its being found among the mountains rather than in the low countries. It is smaller than the common mole, being about a fifth part shorter from the muzzle to the tail, and its snout is more flattened in proportion. Its colours and general aspect are, however, so like those of the common mole, that a casual observer can distinguish but little difference between them. The characteristic differences are in the incisive teeth and the eyes. In the common mole these teeth are all of equal length, whereas the blind mole invariably has the two middle ones longer than any of the rest. The eyes of the common mole are small, and the eyelids open only as a little slit; but the eyes of this one, though supplied in nearly the same manner as those of the other, are little else than rudimental; and, instead of being a slit, the opening of the eye is like a mere pin-hole, through which the eye cannot be observed without the most careful examination. But even this circumstance does not warrant the conclusion that this mole is absolutely blind, because we are unable to tell what is the minimum size aperture through which an animal can see. We want farther information respecting the economy of this species, and the points in which it differs from the common mole; and, indeed, the habits of both moles are so different from those of most other mammalia, that few subjects better deserve attention from the observers of nature.

MOLE-CRICKET (Gryllotalpa vulgaris, Fabricius; Gryllus gryllotalpa, Linnæus).—The very expressive English name of an insect belonging to the family of the crickets (*Achetidæ*), but having the burrowing habits of the mole, its fore legs being very similar in general form to the fore feet of that quadruped. We have already, in the article Cricket, given a general account of the habits of this insect; but a few additional particulars from more recently published works will not be thought out of place in mentioning the insect in its alphabetical situation. Unlike the majority of the crickets and *Gryllidæ*, the female mole-cricket is unprovided with an exserted ovipositor, so that it is difficult, on inspecting the abdomen of a specimen, to ascertain to which sex it belongs, the same number of segments being found both in the male and female. The wing-covers, however, furnish more certain proofs, the disc in the male being more closely reticulated with nervures; there are also one or two cells at the base, which are, moreover, larger in the males than in the opposite sex. It is a curious circumstance also that a genus so extraordinarily formed as this is should be distributed nearly over the entire surface of the globe. The species are but few in number, but widely extended. The common mole-cricket is exclusive to Europe; there are several American species; Africa and Asia are also inhabited by them; and there are at least two found in New Holland. It still remains to be proved whether the north of Africa possesses the common European species, a peculiarity in geographical entomology



Gryllotalpa vulgaris.

exhibited by various other insects. They seem to prefer cultivated spots, such as kitchen gardens, corn fields, &c., digging a deep cell in the earth, to which they retire during the winter, and which communi-

cates with the surface by a vertical gallery, from whence it excavates various other passages. That they are very destructive to vegetation where they take up their abode is certain, although it is a matter of dispute whether it be by feeding upon the roots, or merely by burrowing round them, that this injury is produced. M. Féburier, who has paid much attention to these insects, and has published a long account of them in the Nouveau Cours d'Agriculture, vol. v., p. 163, gives the following reasons for believing that the insect is carnivorous:—Its galleries are more numerous in places where the ground contains the fewest insects, which of course it is compelled to hunt after more extensively; and in gardens where the vegetables are planted in regular rows, and in which the weeds are carefully extracted, the galleries of the mole-cricket do not run from plant to plant, but pass indiscriminately at the sides of the plant or over its roots, destroying them only where they happen to be very tender, and to lie in its way. Moreover, if the beds be manured in the neighbourhood of the mole-crickets, they soon make their way to the manure, especially if it be cow-dung, although there be no trace of vegetable to be seen in it. It has indeed been said that this proceeding had for its object the deposition of its eggs in a situation where, subjected to greater heat, they would hatch the more quickly; but on the other hand it is certain, that they prefer hard ground for the reception of their nests, and that, if the beds are not hard enough, they will burrow into the paths; hence M. Féburier concludes that it is only for the pursuit of the insects which frequent the manure that they approach it. Having placed several individuals together, one of them was devoured by the rest; and the structure of the mouth seems also to indicate carnivorous habits. Mr. Gould also fed a mole-cricket for several months on ants. On the other hand, from some observations published in the second number of the Revue Agricole, we learn that dahlias and some other plants have been ascertained to be attacked by these mole-crickets at the roots, and not only perforated, so as to allow a passage to the insect, but the interior of the stems also consumed to a considerable height, and the plant entirely cut asunder. M. Turpen, also, having placed three mole-crickets in a box of earth with a leaf, during the day they buried themselves, but on opening the box at night they were found occupied in devouring the leaf, and the same was observed the two next nights; but on the fourth the largest individual killed and devoured the other two; hence it is beyond a doubt, that the mole-cricket is both herbivorous and carnivorous, and that we have good reason for attributing to it at least a great proportion of the mischief which is laid to its charge. The situation where they reside may be known not only by the yellow and languid appearance of the vegetables, as well as by the little elevated ridge of mould which they cast up like the field-mouse rather than the mole, in the immediate neighbourhood of their central burrow. Various plans have been suggested for their destruction, but they seem to be quite impracticable to any extent, especially as the reproductive powers of the insect are very great. It must, however, be regarded as a rare insect in this country.

MOLORCHUS (Fabricius). A genus of coleopterous insects, belonging to the section *Tetramera*, and sub-section *Longicornes*, having the elytra very short like those of a *Staphylinus*, and considered by Latreille and some other authors as synonymous with the Linnæan genus *Necydalis*, which see.

MOMORDICA (Linnæus). A genus of climbing plants, natives chiefly of India. They are mostly annuals, and belong to *Cucurbitaceæ*. The *M. elaterium*, or squirting cucumber, belongs to this genus, and is found in the south of Europe; none of them are cultivated.

MONEYWORT is the *Lysimachia nummularia* of Linnæus, a handsome British creeping herbaceous plant found in damp meadows, and sometimes cultivated as an ornamental plant.

MONKEY. The general English name of by far the greater number of the quadrumana, or handed animals, whether we regard number of species, number of individuals in a species, or differences of form. With the Apes and Baboons, notices of which will be found under their respective names in the alphabetical order, the monkeys, in their various families, comprehend the whole of the four-handed animals properly so called; for, though the *Jemurs*, the *Loris*, the *Galago*, and the *Tarrier*, and even *Aye-Aye*, which belongs to a totally distinct order, are in some respects handed animals, they are quite distinct from the true quadrumana in their food and in many of their habits. Under the article Ateles there will be found an account of one group of the American monkeys, namely, the spider-monkey, and those allied to it, which are remarkable for the vast production of their extremities, their slenderness, the awkwardness of their motion upon the ground, and their extreme agility upon trees. In the article Mammalia, more especially in the department of it which relates to organs of climbing, there will be found some remarks on the general analogies of the different groups; and we shall devote this article to what remain of the monkeys in addition to the explanations formerly given, as by this means we shall save space, and, described in juxtaposition, both the agreements and the differences of the several families will be more clearly understood than if they were described, even at greater length, in articles widely separated from each other by the alphabetical arrangement.

Monkeys of all families are forest animals, generally living in trees, among the branches and twigs of which they make their way with very extraordinary celerity. Much of the food of the whole of them is vegetable, consisting not of leaves, but of fruits, succulent or farinaceous, with which the forests of tropical countries abound; but there are few, and perhaps none, which do not add insects to their vegetable food; and so fond are they of this addition, that they may often be found hunting for insects in the fur of each other in a manner which but ill accords with our notions of cleanliness.

Formed for a particular purpose in nature, namely, that of getting from branch to branch of trees with the greatest expedition and ease, the whole of them are what we would call unshapely animals. The position of their eyes, which are directed forwards in all the species, and the rude resemblance which their faces have to human beings, together with the hands, which, though most unlike the human hands, are still grasping instruments, further increase the repulsive feeling which we have in looking upon them. No man likes to be caricatured; and as the monkeys are vulgarly considered as a sort of general caricatures of the whole human race, their appearance

is repulsive to every body. This repulsiveness of appearance is, however, somewhat redeemed by their extreme agility; and on this account, though monkeys are in some instances very mischievous and very ugly animals, they are attractive in a menagerie, especially to the young; and, where extensive collections of live animals are kept, a crowd will be generally found in front of the dens or cages containing the monkeys. The true apes are animals of more grave character; and the baboons are exceedingly repulsive in their appearance, and offensive in many of their habits, as well as exceedingly ferocious in their dispositions; so that the monkeys are the only division of the quadrumana which can be looked upon with anything like satisfaction. This satisfaction is not produced by their appearance, but by their actions, their lively motions, their mischievous tricks, and, in minds of more tender cast, by the extreme attachment which the mothers have for their young, and, indeed, all the individuals of any one species for the other. When exhibited in our comparatively cold climate (for our temperate weather is more rigorous than the depth of winter to those children of the tropical forests), the efforts of two monkeys to keep each other warm, by each clasping round the body of the other, and the still greater efforts which a male and female make to keep a young one warm between them, are among the prettiest displays of animal solicitude with which we are acquainted.

There is of course none of what we are in the habit of calling kindness—that is, kindness from a forethought purpose, and with the intention of producing a specific effect, of which a knowledge has been obtained by experience, in any part of the conduct of monkeys, any more than in that of other creatures not endowed with reason; but still the act of an irrational animal tells upon our feelings, very much in the same way as if it were the act of a rational one; and therefore we feel a sympathetic pleasure in the apparent kindness of such an animal, very nearly allied to what we would feel in the case of that which we consider an analogous action performed by one of our own species. This is no doubt a mistake in the philosophy of the case; but it is a mistake on the part of kindness; and it is not only a confession on our part of the delightfulness of tender conduct, but it strongly induces us to be tender of the animals themselves; and thus, by our sympathy with those irrational creatures, we, without perhaps knowing it, make them the means of kindheartedness in ourselves, which is one of the most valuable results that we can obtain from the study of animals.

The active means which these little creatures (for they are, generally speaking, little in volume of their bodies, though large in the lineal dimensions,) must employ in the finding of their food, and the danger to which their young are exposed from more powerful animals, render it necessary that the females should be able to carry the young along with them in their rapid movements among the branches. For this purpose both mother and young are beautifully adapted. The pectoral part of the body of every monkey is by far the most muscular and robust in its form, while the ventral and sacral parts of the trunk are attenuated, so much so that this portion appears, in some of the species, as if it were nothing more than a stalk to the hind legs; at all events it is never such as to impede their motions or encumber them by its weight. Now the young monkey so applies itself to the body of its mother as that it in no way impedes her motions, and is, in fact, the least possible burden to her that so much additional weight could be. The clavicles are stout and long for her size, by which means the breadth of the chest is ample, and the shoulder joints are thrown wide apart. The fore legs of the young clasp her round the neck, or at all events the hands upon these hold on the immovable part of the shoulder, between the clavicle and the blade-bone, so that their points of adhesion do not interfere with any of the moving parts. These members in the young one are so long that it can reach the pectoral mammæ of the mother without weakening its own hold or cramping her motions; and then its hind legs clasp the body so far forwards, that they leave the posterior extremities free for every operation of climbing. Therefore a female monkey, loaded with a young one, has very nearly, if not altogether, the same use of her organs of motion as though she were without any load, because the young one adheres by its own exertion, which exertion strengthens in proportion to its weight. This is not confined to the monkey tribe, but extends to all those tree mammalia which carry their young along with them as they climb in search of their food. Such mammalia have seldom more than two at a birth; and it is highly probable that nature endows them with additional strength to compensate for the labour of carrying their young ones, and the exhaustion of suckling them. The way in which nature adapts the capabilities of females to the necessities which their functions in the economy of nature require, is both a curious and a beautiful portion of physiology, and it deserves to be studied with far more attention than it has hitherto met with. Common observation tells us that, if the safety of the young required, the degree of strength or courage, or both, with which the female can be endowed for the occasion, is not to be estimated by any ordinary comparison between her and the male. A common hen, when she has no brood, is one of the most feeble and timid of creatures; but give her once a following of chickens to gather under her wings when they are cold or wearied, and the eagle herself has not more daring. She can not only set the raven and the kite at defiance, but will at once fly in the face of a dog or fox with such determination as to send them speedily to their retreat.

Now, in the same manner as this mother is furnished with the means of protecting her offspring in their helpless state, we may naturally suppose that every other mother will be strenghened for the time according to the necessities which that time involves; and that among others, the female monkey will be endowed with additional strength and energy, in order to enable her to carry the burden of her young one, and at the same time procure the additional supply of food which the drain occasioned by that young one renders necessary.

There is no monkey found native in any temperate climate; neither is there any which is perfectly at home and in full vigour when carried to such a climate. It is true that monkeys are more hardy than apes properly so called, and perhaps even than baboons, though the repulsive appearance and offensive manners of these last hold out little inducement for making experiments upon them; but still even in our climates, and protected in buildings, if these buildings are not artificially warmed, they suffer severely in the winters of the mildest districts of England, and can-

Diana Wanderoo Howling Monkey

Capuchin Probosus Negro

not at all exist in climates which are much colder. This is not very seriously to be regretted; for, notwithstanding all the liveliness of their tricks, monkeys are ugly and mischievous creatures, and perhaps none are more offensive, except those human beings who, in common parlance, are described as making certain remarkable approximations to the monkey. On this part of the subject there is something very curious, and which, very probably, would furnish curious information if our limits and our purpose would admit of our working it out. It is this: whenever a human being seeks to entertain an audience, or otherwise to amuse his fellows, not by mental wit, or any other accompaniment which belongs to man as man, but by harlequinade, buffoonery, or any thing else belonging to the category of what are usually termed monkey tricks, if his visage and person are not naturally distorted and deformed, so as to deviate as far from the proper type of man as possible, then he must eke out his deformity by piebald clothing, and padding and paint, and wriggle his limbs into flexures as inhuman as those of a spider-monkey; nor must it be concealed that since theatrical exhibition fell from its high and intellectual state, and sunk to the tom-foolery of the rabble, an ugly face is a surer passport to fortune than the highest intellect that ever graced a classical stage. It is in some such fashion as this that the study of the monkeys at once schools us in the fooleries of our own species, and chastises us for the practising of them.

In the wild woods of the Oriental Islands, of tropical Africa, or of America, the monkey is in its place, and it is a beautiful specimen of that perfect adaptation which runs through the whole system of nature; and it would certainly take nothing from the wisdom —and, *certes*, very little from the real mirth of society, if the real monkeys would kennel with their kindred of the woods. *De gustibus non disputandum est*, and, if any of the *Bimana* will prefer monkey to man, we have no right to quarrel with his election.

In the tropical forests the different genera of monkeys are exceedingly numerous and highly characteristic. They are rarely if ever found in open countries, as neither their food nor their organisation fits them for finding their subsistence upon the ground. Accordingly, they are found in patches, of which patches there are three principal ones, and the monkeys of each are so distinct from those of the others, that it may with truth be said, that not a single species is a common inhabitant of two.

The three patches of the globe, or monkey lands to which we have alluded, are the south-east of Asia and the adjacent isles, the west and south of Africa (though some compilers, Sir William Jardine among the rest, in his Naturalist's Library, plants them on the east of Africa, and fetches Guinea there for their accommodation)*, and the tropical forests of America. In all of these districts the monkeys differ in appearance from those of the others; though they agree so much in their habits and the essential parts of their organisation, that the generic differences do not follow the geographical ones, unless between the monkeys of the eastern and the western continents.

But, notwithstanding the interest which this family of animals has excited; and the quantity of description which has been published concerning them, their natural history is still in a very confused and imperfect state. One cause of this is the extreme difficulty of exploring the haunts of many of them; another is the delicacy of the Oriental ones, which cannot bear even the temperature at sea, or the passage round the Cape, and of course are rarely brought alive to Europe; and a third is the avidity with which animals and the skins of animals used to be bought up for the purpose of increasing the raree-show attractions of museums, without any inquiry respecting the native locality of the animal, or its habits in that locality, which are not only the most important, but almost the only important parts of the whole matter. At this day there are more species of monkeys in European museums than have been actually discovered in a living state in any part of the world; and this circumstance alone throws a great deal of uncertainty into the whole natural history of the race. From distinctions which we shall afterwards notice, it is very easy to decide whether any monkey is a native of the eastern continent or of America. The African and the Asiatic species also, as observed in the two countries, generally speaking, differ from each other; but it was for a long time difficult to ascertain whether skins and specimens of dead animals were Asiatic or African, because the two were blended together in the general market at the Cape, and the sellers cared little or nothing for the country of the specimen, so that they obtained their price for it. The researches which have been recently carried on in the natural history of India by British officers on the different stations, now that India is at peace, and especially those carried on in Java by the example and under the patronage of Sir Stamford Raffles, have thrown much light upon the natural history of that highly interesting portion of the world; and those labours have gone a considerable way in deciding what species of monkeys of the eastern continent are Asiatic, and what are not.

We shall not take the strictly systematic arrangement of monkeys according to their genera, because some of these are not very distinct. There are some differences in the structure of the teeth, which indicate corresponding differences in the food and disposition of the animal. Some, for instance, have the canines strong and a good deal produced, and the cheek-teeth with tuberculated or insectivorous crowns, while others possess these characters in a much lower degree. There is none of them, however, which can be considered as absolutely of a carnivorous character; and there is none which can be regarded as having the mouth exclusively adapted for vegetable feeding, though the greater part subsist chiefly upon vegetables. We shall take our principal division according to the geography—noticing first the monkeys of the eastern continent, and then those of the western, the former being intermediate between the latter and the apes and baboons; and we shall add such generic names as are usually given by others.

1. Monkeys of the Eastern Continent.—Most species of these are exceedingly numerous, and they are very agile in their motions. Their tails are often long, but they are not prehensile.

The Red Monkey (*Cercopithecus ruber*) is one of the species which has been longest known. The characters of the division to which it belongs are:—

* "It (the Diana monkey) is a native of the *eastern* coast of Africa, principally in Guinea, is about eighteen inches in length, with the tail exceeding two feet."—*Nat. Lib., Mam.*, vol. i., p. 133.

the facial angle about fifty degrees; the head rounded; no projecting ridges at the eyebrows, but the margins of the orbits smooth; the nose flat, with the nostrils opening in nasal grooves; the ears of moderate dimensions; the mouth furnished with cheek-pouches, external of the teeth; the buttocks with naked callosities, and the tail longer than the body. The red monkey is an African, found in Senegal, where it inhabits the woods, and is a very active little animal. Its body is about sixteen or seventeen inches long, and its tail nearly the same. The upper parts are not red, but of a reddish-fawn colour, very bright. This colour passes into greyish on the limbs, and the face, the cheeks, and all the middle of the under part are pure white. The face is peculiarly marked, there being a black band over the eyes, which has the appearance of eyebrows, and two black bands on the lips, which resemble mustaches. The hair of these is not, however, more produced than the differently coloured hair by which it is surrounded. This is one of the species which has been longest known, and it is mentioned by the earliest of modern naturalists. It is an active species, and very lively, dancing about in a very peculiar manner when in a state of confinement; but it is exceedingly irritable, and liable to do mischief if tampered with. It has been frequently brought to this country, and, like the rest of the genus, its form, though by no means symmetrical for a walking animal, is rather more handsome than some of the other monkeys. The nature of the country which it inhabits, in which there are detached trees rather than close forests, requires that it should be better able to walk than many of the others; but still its walk, although tolerably rapid, is leaping and inelegant. Contrary to the structure of the apes, its hind legs are longer than its fore ones; and its hind feet are particularly long, and so articulated, that it can either apply the whole tarsus to the ground, or only the metatarsus; and when it does the latter, it possesses the same number of joints in the leg as those animals which are properly digitigrade. The fore feet are always plantigrade in the monkey tribes, the carpus being very short as compared with the tarsus.

The Varied Monkey (*Cercopithecus mona*). In a race of animals not very remarkable for their beauty, this has often been described as surpassing all the others in that respect; and the markings of its colours are certainly very striking. The native country of this monkey has not been very satisfactorily made out, or at all events there are some disputes about it. It is African, and is understood to be a mountaineer, and to inhabit the mountains of Atlas, though we are not aware that any European has hitherto observed it in those mountains. Its manners in a state of nature, and the fact as to whether it is more a tree or a ground animal, have not been satisfactorily ascertained. From the specimens which have been kept in confinement, it appears, however, to be more hardy than almost any other of the monkeys; and it is also susceptible of a good deal of education. It is an animal of great cunning and resource, and is perhaps the most expert pickpocket of all the four-handed race. It can open locks by turning the key; empty a pocket so gently as that the owner cannot perceive it. It can also play a number of other tricks, and it is more sensible to kindness than any other monkey. There is also nothing particularly offensive in its habits; and, as its colours are singularly contrasted, it is one of the very few which can be kept in captivity without exciting any repulsive feeling. The following is a description, by Mr. Bennet, of a specimen in the gardens of the Zoological Society of London:—"The top of the head is of a greenish-yellow, mingled with a slight tinge of black; and the neck, back, and sides, are of a deep chestnut-brown, passing downwards as far as the shoulders and haunches, where it changes into a dusky slate colour, which is continued on the limbs and tail. The latter organ is considerably longer than the body, and has, on each side of its base, a very remarkable white spot. The under surface of the body and the inside of the limbs are of a pure and delicate white, separated from the neighbouring colours by an abrupt line of demarcation.

"The naked upper part of the face, comprehending the orbits and the cheeks, is of a bluish purple; the lips, and so much of the chin as is without hair, flesh-coloured; on the sides of the face, large bushy whiskers of a light straw colour, mixed with a few blackish rings, advance forwards and cover a considerable portion of the cheeks. Above the eyebrows is a transverse black band, extending on each side as far as the ears, and surmounted by a narrow crescent-shaped stripe of grey, which is sometimes scarcely visible. The ears and the hands are of a livid flesh colour."

The Diana or Palatine Monkey (*Cercopithecus Diana*). This species was named Diana by Linnæus in consequence of the slight resemblance which a white spot on its forehead has to a crescent which was the emblem of the fabulous divinity, whom the ancients made the patroness of hunters. This species resembles the two former in its shape, and, like them, it is an African; but it inhabits nearer the equator, and is chiefly found in the woods. The length of its head and body is about a foot and a half, and that of its tail about two feet. Its general colour is a mixture of black and white on the upper part, passing gradually into ash colour on the head, neck, and lower part of the body. On the middle of the back the black predominates, and so it does also in the tail, the tip of which is entirely black. The crescent of white above the eyes, the points of which extend nearly as far as the ears, is its most remarkable feature, and the one by which it can be distinguished from every other monkey. This species has been frequently brought to Europe; and though, from being a native of very tropical countries, it feels a great uneasiness during our winter months; yet if it is kept warm enough it will live in our climate. It feeds chiefly upon vegetables, of which it prefers nuts and sweet fruits; but it also eats bread, and even eggs, though it does not eat flesh, or attempt to kill any warm-blooded animal for the purpose of eating it. It is, however, an ill-natured and snarling animal, always showing its teeth when a stranger approaches it, and biting severely if it can get within reach. It seems that, in a state of nature, it procures great part of its food by the scent; for, when confined, it smells very carefully at every object, and at the same time turns it round to examine it; so that, if food is given to it in a dish, the first thing that it does is to turn the dish upside down. It drinks a great deal; and, for its size, its appetite may be said to be voracious. The fact of this monkey eating eggs when in a state of confinement would lead one to suppose that the eggs of tree birds form at least a part of the

food of some of the tree monkeys. Indeed, without having recourse to some such food as this, it is not easy to suppose how the countless multitudes of them which swarm in the tropical forests could by possibility exist.

There are many other species of monkeys included in the genus *Cercopitheeus*, as established by the systematists; but some of them are doubtful, because we do not know the changes of colour, or even of shape, that these animals may undergo at different ages. It is ascertained, in the case of some which have longer muzzles than those of this genus in the adult state, that they have them comparatively shorter when young; and it is possible that these young ones may have been erected into species, as has often been done with the young of other animals. We shall, therefore, only mention the names of the principal ones, with their localities as far as these are known, for their manners differ but little.

The Golden Monkey (*C. auratus*) is golden yellow on the upper part, and pale lemon yellow or whitish on the under. It has the hair on the sides of the head and on the breast very long, and each knee is marked by a black spot. It is understood to inhabit the south-east of Asia, both the main land and the islands.

Mustache Monkey (*C. cephus*) is an African, of a greenish-brown colour, with the distal half of the tail red, and the nose and lips bright blue.

The White-nosed Monkey (*C. nictitans*) is an inhabitant of the forests of Guinea, and has the nose and the lower part of the chin white, the former being generally a good deal produced. On the other parts it is blackish mixed with grey, and passing into lighter on the belly.

Vaulting Monkey (*C. petaurista*). This one is also an African, and gets its name from the height which it can leap from the ground, and also the distance from branch to branch. Its colour on the upper part is reddish, passing into white, and the point of the nose is also white. The outsides of the legs have a greenish tinge, and the insides are grey.

The Grey Monkey (*C. albocinereus*) is a native of the Oriental islands. As its name implies, its general colour is whitish ash; being grey above, with the outsides of the legs of a darker grey, and whitish below. The tail is brown; and a ridge of hairs on the forehead, and also the naked skin on the feet, black.

Red-breasted Monkey (*C. pygerythræus*) is a native of Southern Africa. Greenish-grey on the upper part, whitish on the under, with a black tip to the tail, and red hairs under its insertion.

The talapoin monkey, the purple-faced monkey, the bonneted monkey, and one or two more, have been described as belonging to this genus or subgenus; but they are known only from single specimens, and we are not acquainted with the native locality of any of them.

The monkeys of this genus make the nearest approach to the true apes, being, like them, comparatively short in the muzzle; and thus the generic name, which means "tailed apes," is not inaccurately bestowed. Generally speaking, they are animals of more cunning and resource than the other monkeys; and they are rather more handsome in their appearance, although in that respect even they have not very much to boast of. They are irritable, mischievous, and not to be trusted.

A second genus, or rather perhaps subgenus, of monkeys have received the name of *Semnopitheci*, or venerable apes, from the length of their beards and whiskers, the gravity of their appearance, at least in some of the species, the slowness of their motions, and the length and slenderness of their limbs, which make them look as if they had dwindled to

> The lean and slipper'd pantaloon.

This character is not, however, just, as applied to the whole, at least as they are usually arranged; but they differ from the former section in a sufficient number of particulars for warranting their separation from it. Their leading characters are:—a small tubercle on the last molar of the under jaw, which is wanting in the *Sercopitheci*, from which we may conclude that the present section are more herbivorous; their muzzles are rather more elongated, with the head round, and the nose very flat; the ears of moderate length; the limbs very long, with very short thumbs on the fore paws, placed far back from the fingers, thus rendering the paw by no means an efficient instrument for holding any thing between the thumb and fingers; the tails are long and thin; and the cheeks are furnished with pouches, and the buttocks with callosities. The whole of them are inhabitants of the eastern countries; and of course it is exceedingly difficult to bring them to Europe in the living state; and thus, though many of them are abundant in their native regions, and some are even objects of religious worship, it is but recently that they have been well understood by European naturalists.

Entellus Monkey (*S. Entellus*), though one of the most common and most celebrated in India, has not been long admitted into the European systems. The Zoological Society of London possessed at least one specimen, as well as some of the other species or varieties of this subgenus; but they did not survive long enough for enabling much knowledge to be obtained of their manners in a state of confinement; and though little inference could thence have been drawn respecting their conduct in their native east, yet the peculiar form of their fore-paws, and the additional tubercle upon the lower grinder, would lead one to suppose that they may occasionally make their progress back undermost, after the manner of the sloths, and feed, in part at least, upon green vegetable matter. The specimen which died at the Zoological Gardens, in the early part of the summer of 1833, was described by Mr. Bennet, and dissected by Mr. Owen; and, as those are excellent authorities, we shall quote the description, and briefly allude to the dissection. "When taken at an early age," says Mr. Bennet, "they are readily tamed, become playful and familiar, are extremely agile, although generally calm and circumspect in their motions, and learn to perform a variety of tricks, which they execute with no little cunning and address. After a time, however, their playfulness wears off; their confidence is succeeded by mistrust; their agility settles down into a listless apathy; and, instead of resorting as before to resources of their ingenuity for carrying any particular point, they have recourse to the brute force which they have acquired in its stead. At length they become as mischievous, and sometimes even as dangerous, as any of those monkeys which in their young state offer no such indications of good temper and intelligence. It is of a uniform ash-grey on the

upper parts, becoming darker on the tail, which is greyish brown, of equal thickness throughout, and terminated by a few long hairs running out into a kind of point, but not forming a tuft. The under surface of the body is of a dingy yellowish-white; and the fore arms, hands, and feet, are of a dusky black. The fingers of both extremities are very long, and the thumbs comparatively short. The face, which is black, with somewhat of a violet tinge, is surmounted above the eyebrows by a line of long stiff blackish hairs, which project forwards and slightly upwards. On the sides of the cheeks, and beneath the chin, it is margined by a beard of greyish white, passing along the line of the jaws, and extending upwards in front of the ears, which are large and prominent, and of the same colour as the face The hairs of the fore part of the breast appear to diverge from a common centre. The height of our specimen, which was not yet adult, when in a sitting posture, exceeded two feet; and his tail, which he rarely displayed at full length, but more usually kept curled up in a single coil, measured nearly three feet."

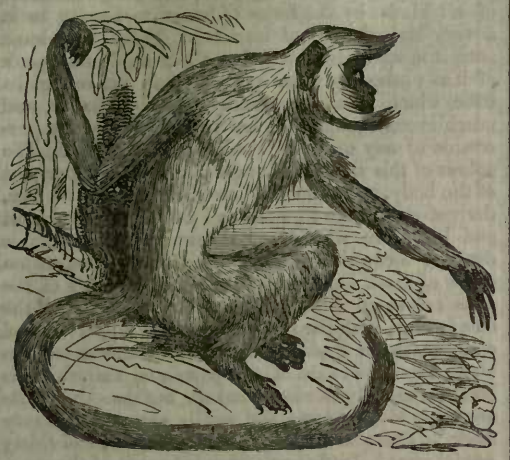
The dissection of this specimen of entellus monkey by Mr. Owen, as well as that of another species to be afterwards noticed, and also of some others by foreign comparative anatomists, would lead to the conclusion that monkeys of this division are very distinctly marked as a separate genus, both in their structure and in their food. We have already hinted at the peculiarity of their general appearance, their lengthened limbs, their long and slender tails, their comparatively grave aspect and manners, and the slowness of their motions as compared with the sercopitheci; and in their internal structures they differ a good deal more. They are not ruminating animals; for no handed animal ruminates, except by a sort of inexplicable formation or habit in the individual, which species of monstrosity is not unknown even among the human race. The author of this article knows two instances of men who ruminated almost as regularly as cattle. Both of them were labourers, men of large body and remarkably strong, but clumsily made, and very dull in an intellectual point of view. Both could take a vast quantity of food at one time; and one at least could take as much of food that pleased him as kept him ruminating away for two days, or perhaps more. The quantity which he took on these occasions was as much as would have sufficed for one full meal to at least half-a-dozen of ordinary labourers performing each an equal quantity of work. He was much disliked by the other labourers; but whether solely in consequence of this rumination, or from some moral cause, we were then too young for ascertaining, but the facts which we have stated are unquestionable. If he had continuous work for a succession of days, with a regular supply of food (for he always bargained for food as well as wages), he did not eat very much more than ordinary men until Saturday came; and then he was understood to lay in as much as served him during the Sunday, the servants at the farm where he worked having instructions to victual him for that day as a matter of course. If, however, David, for that was his Christian name, came to the last day of a job, and had not another immediately in prospect, "the lion of the north" could not have been more zealous in providing for his army during a campaign, nor the redoubted Dougald Dalgetty more industrious in filling his own magazines, than David was in storing his internal receptacles as a resource during the days of uncertainty; and it was alleged, though with what truth we know not, that if, duly impressed with the chance of getting no more during the time, he could victual himself for a week.

Now, if such be the case with human beings, in whom the stomach is simple (and we have heard of many instances besides those alluded to), we may naturally conclude that such of the quadrumana as have compound stomachs may be liable to more frequent instances of rumination. In all animals which have cheek-pouches, those pouches may be regarded as to a certain extent answering the purpose of a simple receptacle of food, something analogous in office, though not in situation, to the paunch of the ruminantia; and when we admit this, the sercopitheci have really a sort of four stomachs; and it is worthy of remark that the monkeys having this structure are confined to one particular region of the world, namely, the south-east of Asia. The specimen of entellus monkey, dissected by Mr. Owen, measured twenty inches in length from the muzzle to the root of the tail; and the stomach measured thirty-one inches along its convex side, or side of greatest curvature, and twelve inches along its least. Its circumference where widest was thirteen inches, and where narrowest a little less than four. It was pretty distinctly divided into three parts, the first of these forming a simple pouch, not very large, slightly divided into two at its extremity, and smooth and simple in its containing surface: the next and by far the larger portion was sacculated, or formed into a series of purses in the inner surface: and the third was long and narrow, sacculated at the commencement, and becoming smooth towards its union with the intestinal canal. This third division was by far the most vascular, and most abundantly supplied with ramifications of the gastric nerves, from which Mr. Owen concluded, with every appearance of truth, that it is the true digestive stomach, and that the other parts are only receptive and preparatory. In addition to these peculiarities of the stomach, the intestinal canal was found to be much longer in proportion than in the sercopitheci, as these again have them much longer than the baboons and monkeys with produced muzzles. The difference in this respect is very remarkable, as the semnopitheci have the intestinal canal about one-fourth longer than the sercopitheci, and one-half longer than the genus *Macaco*.

This remarkable difference in what may be considered the most important system of organs in these animals, as connecting them most immediately with the rest of nature, and regulating the kind of their food, which again must regulate the places where it is to be sought, and the means of acquiring it, is well worthy the attention of every one who wishes to study these animals with success, as showing that we are not to take the mere possession of prehensile paws, or hands on the extremities, as establishing any thing like an identity of food among the animals. It is also worthy of remark that these comparatively slow-going monkeys, which have the digestive system much more developed than the agile ones, stand something in the same relation to them as the larger ruminants do to the more energetic and more simple stomached of the footed animals. This alone would lead us to look upon the semnopitheci as making a slight approximation towards the sloths, if not absolutely in their mode of life, at least partially in their feeding. Accordingly, upon comparing their digestive

organs, it is found that there is a very considerable resemblance between them and the sloths, and also between them and the kanguroos, which are ground animals, and quite different in their appearance and their other habits. But though the species of this genus, or, at all events, some of them, are very plentiful, it should seem that their habits in a state of nature are obscure, as compared with those of the more active monkeys; for we know exceedingly little of the conduct of any of the species in the forests.

The entellus is an animal of somewhat singular appearance, of which some idea may be obtained from the annexed cut.



It is generally said that this is the species to which divine honours are paid by the Hindoos; and it is by no means unlikely. Quiescence, and, in some instances, complete and stubborn repose, even in attitudes which are exceedingly painful, as well as unnatural, is the measure of sanctity; and thus the apparent gravity of this animal, its meagre form, and staid and melancholy face, may be good grounds for that adoration which it is said to receive from the Brahmins. The Hindoos not only regard this species with religious veneration, but treat it with the greatest kindness and forbearance, and, in consequence of this, it is exceedingly familiar in the villages of the natives, where it plunders the gardens, and even enters the houses, and helps itself to such fruits as it may find, whether the owners are within or not; and though these are at their meals, and it comes and seizes a large share, they never offer it any violence. It is, in fact, one of the most privileged of animals; and those loathsome insects, for whose accommodation and comfort hospitals are built and endowed, and attendants appointed, at Broach and other places, do not stand higher in the calendar of saintship than the entellus monkey. Though this is a very slow animal in its walking motions, the length of its legs make it a most expert leaper, more so perhaps than any other of the oriental species.

The Negro Monkey (*S. maurus*). This is the middle-sized black monkey of some authors; but, though it has got the name of the negro monkey, it does not inhabit the country of the negroes, but the eastern isles. Java is the island in which it has been principally observed by Europeans; but there is little doubt that it extends over the other islands. We owe the only good description of this, as indeed we do of very many of the animals of the oriental isles, to Dr. Horsfield, whose very able description we shall quote, in preference to taking one at second hand, or of making it up with additions from authorities less worthy of credit. "The covering of the negro monkey," says Dr. Horsfield, "in adult subjects, is intensely black on every part, except the breast, the abdomen, the inner side of the extremities, and the root of the tail; these parts are grey. On the crown of the head the black hairs are slightly tipped with grey; and as age advances, the grey portion becomes more extensive, and also shows itself on the upper parts of the body; but the extremities exteriorly, and the tail, even in the oldest subjects, retain their blackness. The hairs are remarkably long, delicate, soft, and silky. On the sides of the head they are disposed backwards with a slight inclination outward, and on the ears completely conical. They rise with a gradual slope on the forehead; but on the crown of the head they are suddenly deflected, so as to form a dependent crest. On the back and the extremities they lie smooth and close. They are greatly elongated on the sides of the body, between the shoulders, so as to hang down to a considerable length when the animal walks on all fours. On the breast anteriorly, and on the abdomen, they are short, lax, and straggling. In its young state it exhibits a great contrast to that in the adult. Immediately after the birth our animal has a fulvous or reddish-yellow colour; as it advances in age, the colour gradually changes. A grey discolouration first shows itself on the hands, the forehead, and the tip of the tail: from these parts it gradually extends to the neck, the shoulders, and the flanks, and assumes from time to time a darker hue, until the coat of the animal is jet black above, and grey underneath. The face is regularly circumscribed by hairs, which are long, and closely applied to the head; the forehead, which is gradually sloping, is entirely concealed by them. The orbits of the eye are rather prominent, and the bones of the nose short. The nose consists of an angular ridge, which is considerably elevated between the eyes, and terminates, without any fleshy protuberance, by a membrane which is gradually attenuated below, and on each side of which the nostrils are placed. These are large, oblong, slightly curved, and pass backwards into the cranium in a horizontal direction. From the termination of the nose to the mouth a considerable space intervenes; but the lips are small and thin, so as to exhibit, when slightly retracted, the interior of the mouth. The chin is short and small; a circle of grey hairs encloses the mouth in the adult animal, and on the chin the hairs have a disposition downwards, so as to exhibit the appearance of a beard. The upper part of the face is nearly naked; a few straggling stiff hairs are scattered on the cheeks and the upper lip, and on the more prominent part of the nose an interrupted series is observed. The irides of the eyes are of a dark brown colour. The ears are concealed from view by the long hairs which cover the lateral parts of the head; they are margined, and both in form and disposition of external parts closely resemble these organs in man. The neck is short and considerably contracted. The trunk is of great length, broad and robust about the shoulders and breast, and gradually of smaller dimensions towards the loins. The buttocks are marked with very large rough callosities. The mammæ in the adult female

are lengthened and cylindrical. The tail is as long as the body and head taken together; in some individuals, and particularly in young subjects, it exceeds these parts in length: it is cylindrical during the greater part of its length, the base is gradually tapering, and the tip is thickened and terminated by a close tuft of long hairs, of an ovate form. The *Semnopithecus maurus* is distinguished among the Javanese by the name of budeng, from another species which has the same form and habit, but a different external covering. The name of the latter is lutung; but the Malays and Europeans apply this name to both species, and distinguish them by the epithet of black and red; the budeng being denominated *Lutung itam*, and the lutung of the Javanese *Lutung mera*. In Sumatra the name of the 'maure' is latong. The budeng, or the black species, is more abundant than the lutung, or the red species; and the latter, both on account of its variety and comparative beauty, is a favourite among the natives. Whenever an individual is obtained, care is taken to domesticate it, and it is treated with kindness and attention. The budeng, on the contrary, is neglected and despised; it requires much patience in any degree to improve the natural sullenness of its temper. In confinement it remains many months grave and morose, and, as it contributes nothing to the amusement of the natives, it is rarely found in villages or about the dwellings. This does not arise from any aversion of the Javanese to the monkey race; the most common species of the island, the *Cercocebus aygula* of Geoffroy, the *Egset* of Pennant, is very generally domesticated, and a favourite custom of the natives is to associate it with the horse. In every stable, from that of a prince to that of a mantry, or chief of a village, one of these monkeys is found; but I never observed the buteng thus distinguished. The *Semnopithecus maurus* is found in abundance in the extensive forests of Java; it forms its dwelling on trees, and associates in numerous societies. Troops, consisting of more than fifty individuals, are often found together. In meeting them in the forests, it is prudent to observe them at a distance. They emit loud screams on the approach of man, and, by the violent bustle and commotion excited by their movements, branches of decaying trees are not unfrequently detached, and precipitated on the spectators. They are often chased by the natives, for the purpose of obtaining their fur. In these pursuits, which are generally ordered and attended by chiefs, the animals are attacked with cudgels and stones, and cruelly destroyed in great numbers. The skins are prepared by a simple process, which the natives have acquired from the Europeans, and they conduct it at present with great skill. It affords a fur of a jet black colour, covered with long silky hairs, which is usually employed both by the natives and Europeans in preparing riding equipages and military decorations. The budeng, during its young state, feeds on tender leaves of plants and, trees, and, when adult, on wild fruits of every description, which are found in great abundance in the forests which it inhabits."

There are various other species or varieties of semnopitheci found in the oriental Archipelago, the best accounts of which we have from Sir Stamford Raffles, Dr. Horsfield, and the two French naturalists, Diard and Duvancel, who co-operated with the English governor of Java and his fellow-labourers in exploring the natural history of these remarkable islands. We must confine ourselves to very brief notices of these animals.

The *Simpai Monkey* (*S. melolophos*). This species is found in the oriental Archipelago, and also in the southern parts of the Malay peninsula, on the opposite side of the Straits of Malacca. The head and body are about one foot six inches long, of which the head occupies four inches; the tail two feet eight inches; the height at the shoulder, when standing on all fours, thirteen inches; and the height at the crupper sixteen inches. The face of the simpai is very flat, giving it an apparent development of cranium which would lead those who apply the canons of phrenology to the monkey race, and gauge intellect of all kinds by the forms of bones, to impute to it a very high degree of intellect. Those who have seen it in its native localities, however, do not speak of it as possessing more sagacity than the rest of its tribe, which, though, generally speaking, active and mischievous enough, are not remarkable for the possession of any one useful or estimable quality. The colour of this species is bright red on the upper part of the body, with the hair on the sides of the face, the outsides of the legs and tail yellowish; the breast and belly are whitish; the hair on the cheeks is directed forwards; and the head surrounded with a circle of black hairs, and there are long hairs of the same colour on the shoulders; the naked part of the face is blue, with the exception of the upper lip and chin, which are flesh-coloured; and the ears are also blue; the naked skin of the paws and callosities is black; the belly is nearly naked, but the other parts are covered with long and woolly hair, but not very thick. There are seven lumbar vertebræ, and thirty caudal ones. Little or nothing is known of the manners of this animal in a state of nature.

The *Croo Monkey* (*S. comatus*). This species, which is also called the crested monkey, or the mitred monkey, from the length of the hair on the top of its head, is a native of the eastern Archipelago, and was first discovered in Java by M. Diard. It is steel grey on the upper part, the forehead, the upper part of the tail, and the outsides of the legs, and sandy white on the under parts. The paws are differently formed from those of any other of the semnopitheci, the fingers being proportionally much shorter. This difference leads us to infer that there must be a difference also in the habits of the animal; but what this difference is, we know too little of its manners to be able to ascertain. The tuft of black hairs forming the crest or mitre on the top of the head is long; but the hair on the rest of the body is shorter and more glossy than that upon any other of the monkeys, which circumstance would again lead us to infer that it is differently exposed to the atmosphere, and probably that it is to a considerable extent a nocturnal animal.

Chingkou Monkey (*S. pruniosus*). This species is a native of the same countries as those of this division which have been noticed, and, like them, it is but little known. In many respects this species bears a strong resemblance to the croo monkey, and indeed the chief distinction between them is in colour, which is little to be depended on, the more especially as we are ignorant of the changes which these animals may undergo in this respect at different ages, and also of the effects which situations more or less exposed to the elements may have upon them. The general colour of this monkey is black, only there is little

hair on the under part, which gives that a lighter shade; and the blue skin of the upper part shining through the hairs takes off their black appearance. The ears and face are naked, excepting the lips, which are covered with a few white hairs, passing into a sort of tuft at the angles of the mouth. It is understood that the young are of a yellowish-brown colour, pale or sand-coloured on the under part, and thus it is possible that the last-mentioned one may be this species, at an intermediate age between the brown of the young and the black of the old one. The naked skin of the paws is black and very soft; the callosities are of the same colour; the irides are yellow, a colour which very generally indicates a nocturnal habit in animals possessing it, as any one may observe by comparing the eyes of the fox with those of a dog. This is an animal of considerable size, being two feet long in the head and body, and two feet and a half in the tail, and standing fifteen inches at the shoulder, and eighteen at the crupper.

Nestor Monkey (*S. nestor*). This has not, we believe, been found anywhere in the living state, at least so as to be recorded, though a specimen is in the museum of the Zoological Society. Its perfect analogy to the others leaves little doubt that it belongs to the oriental Archipelago, the grand home of this division of the monkeys; and from its small size, and broken colours, it is not impossible that it may be one of those already mentioned in an early stage of its existence. The following is the description of it, as given in the report of the society's proceedings:—"Length of the body and head sixteen inches, of the tail twenty. The prevailing colour is a deep grey with a slight tinge of brown, becoming paler on the back of the neck and on the head, where the fuscous tinge is much more marked. On the loins the deep grey passes into a pure light grey, which is continued on the hinder part of the thighs and along the tail; the tail becomes gradually light in colour, and is for several inches at the tip all white. In passing down the limbs the prevailing grey becomes gradually darker, the colour of the hands being nearly black. The under parts are somewhat lighter than the upper, particularly about the throat. Passing upwards from the throat, the colour becomes much lighter, owing to a great proportion of the lower part of the hairs being exposed. Hence the lips, the chin, and the whiskers, are nearly pure white, the tips of the latter, which are prolonged backwards, being alone grey. Over the eyes is the ridge of stiff black hairs which is usually met with in the *Semnopitheci*. The hairs are of moderate length, measuring about an inch and a half. The moderate length of the hairs, the somewhat light colour, and especially the white of the lower part of the sides of the face, distinguish the species from *S. leucoprymnus*. It may be assumed to be a native of India; but the dealer of whom it was purchased knew not whence it was obtained.

The *Cochin-china Monkey*, or *Douc* (*S. nemæus*). This monkey differs so much from the typical semnopitheci, that Illiger formed it into a separate genus, under the name of *Lasiopiga*, or hairy buttocks, from the circumstance of its not having naked callosities on those parts of the body like the rest of the section. In its appearance it is perhaps the most singular of the whole monkey race, and seems as if it were clothed with a suit of garments of different materials, something like a fantastically-dressed human being. The face is purplish, except a line along the under part of the chin, which is white. The naked part of the face extends in nearly straight lines from the chin by the angles of the mouth to a little behind and above the eyes; and without-side this the sides of the head are covered with long sand-coloured hairs, thickly set and reflected backwards, resembling whiskers of vast size. Across the forehead there is a chaplet of black, and the fingers and thumbs, which are covered with hair down to the nails, are of the same colour. There is a brownish gorget on the upper part of the breast, extending back nearly to the ridge of the neck. The body and arms, as far as the elbow joints, is grey, darker on the shoulders, and deficient of hair on the belly. This grey portion extends forwards to the black chaplet on the forehead, and it terminates a little above the insertion of the tail, so as to have something of the appearance of a close round jacket with short sleeves. The fore arms and hands down to the division of the fingers are yellowish white, with a sort of rosy or reddish brown in it, not unlike the colour of the flesh of some of the eastern nations of the human race. The lower part of the rump and the tail are nearly the same colour, but more inclining to pale reddish bay. The thighs are grey, but with a purplish or brownish tinge, forming a contrast with the grey on the body, and consisting of longer and more shaggy hairs. This colour barely reaches the knee-joints, and does not join the grey on the back, the light bay red there extending nearly from flank to flank, and the posterior part of the colour on the thighs terminating in a darker margin, as if it were a fold. Thus the colouring of this part of the animal has a considerable resemblance to a pair of breeches, somewhat scanty in longitude at both ends, and not girded up in the most seemly guise at their sacral termination. The legs are purple brown, paler in the tint, and not containing so much grey as the thighs; they thus have a slight resemblance to a pair of stockings. The divided part of the hind feet is black, which finishes the fancied resemblance to a human costume, by making the animal appear to be slipshod. Some idea of this animal, in its form, if not in the peculiarities of its colouring, may be formed from the following cut.

We believe that this species was first known in Europe from an imperfect specimen brought from Cochin-China, which was the cause of its being named after that country. It occurs, however, in the islands

and numerous specimens being forwarded to Europe by M. Diard, more satisfactory accounts of it were obtained. From these it appears that the animal actually has callosities on the buttocks, though to cursory observation these are concealed by the long hair on the parts. Indeed it does not appear that there is any good reason for making a separate genus, or even subgenus, of this animal, though it is unquestionably a well-marked and very peculiar species. Its height when standing on the tarsi is about two feet; and the tail, which is rather slender, is about the same length as the body and head. From the accounts it should seem that, though this species keeps much in the covers of those natural forests which overrun every part, not immediately in cultivation, of the lands which it inhabits, it is far from being rare in these, while its geographical distribution is more extended than that of many others of the oriental monkeys. If it could be introduced in the living state, and kept alive, it would be the best show monkey of all the race; because it is a monkey ready dressed, and would not require that fantastic apparel in which these animals are sometimes tricked out, in order the more forcibly to attract the vulgar gaze.

The Proboscis Monkey or *Kahall* (*S. nasica*). From the extraordinary production of the nose, standing out from the line of the face like a great beak, this animal has been made the type of a genus under the name of *Nasals;* but it is doubtful whether the structure of the nose, curious as it is, warrants the separation of it from the semnopitheci, with which it agrees in its more active and important organisation. The face of this monkey bears a considerable resemblance, in all respects except colour, to that which exhibitors give to the standing hero of street pantomime, the venerable and far-famed Punch. Whether the monkey or the mime has the more grotesque visage is a point not worth determining; but the monkey certainly has a supply of nose worthy of the immortal pen of Slaukenbergius himself, and doubtless has been at the promontory of noses. When the animal stands at its greatest height, elevated on the hind feet, it does not exceed three feet, and yet the nose stands full four inches out from the line of the face, and the chin also is pointed. The nostrils are in the under part of this curious proboscis near its extremity, and of an oval form. The face is black, with a bluish tinge, and distinctly marked off by the different colours of the forehead and cheeks; and the yellowish-brown irides of the eyes and large white teeth conspire with the other features and the colour in giving by no means an agreeable aspect to the animal. The upper part of the face is deep red, which extends both over and under the ears, so that only a portion of them appears; and the chin and cheeks have a beard of pale yellowish red, curling upwards on the former, and backwards and outwards on the latter. The general colour of the body is reddish-brown; but it has numerous markings, which, in their general distribution, bear some resemblance to those on the Cochin-China monkey, only the smaller markings are more numerous. The breast and belly are slightly tinged with grey, with a bright bar across the mammæ. The arms to the elbow-joints are bright reddish, with a cross bar of bright colour near the shoulder, resembling the stripes worn by non-commissioned officers of the army. From the elbows to the nails the arms and hands are yellowish-brown, with the naked palms bluish black, the same as the face. There are various markings of pale colour on the lower part of the back; and a portion of the lower part of the body and the tail are pale yellowish-brown. The hind legs are nearly the same colour as the arms, but the hair on the thighs is shaggy, and has a mixture of blackish-grey among the brown.

Some of the characters of this species are not very well made out; but it is said to make a slight approach to the gibbons or long-armed apes in the length of the arms; and also to the howling monkeys of America in the bone of the tongue and the guttural sac.

Another species, or, more strictly speaking, specimen, with a much shorter proboscis, has been brought from the same country as the long-nosed one; but the probability is that it is the young in a state of partial development. The island of Borneo is understood to be the head-quarters of these very singular monkeys; and we are not aware that any of them have been hitherto found in any other place even of the east. Now Borneo, though the largest of all the eastern islands, is the one with which we have by far the least acquaintance, and what we know of its natural history is mostly at second hand, and not always from authorities upon which we can place dependence, and therefore we must receive with some caution the accounts which are given of its productions. The monkeys under description are described as being gregarious, and as collecting each other together by loud cries resembling the word *kahau*, which is the name given to them in their native land. Their times of general meeting are said to be before sunrise and at sunset, which accords with the colour of their eyes as nocturnal or twilight animals. Their places of rendezvous are the trees near the banks of the rivers and streams, among which they move about with great activity, jumping with ease eighteen or twenty feet from branch to branch, or from tree to tree.

The Gilded Monkey (*S. auratus*). This species is not known, except from museum specimens. It is about two feet in length, and the tail about as much. The whole fur is of a bright golden red, with the exception of a black spot on each knee; but the belly is almost bare of fur. The anterior fingers have fur down to the second phalanx, and the hind ones to the roots of the nails. Its characters are decidedly those of the order; and it is presumed that some of its manners at least correspond, though nothing is known with certainty about it. It is understood as being a native of the Molucca Islands; but even on this point we have no certain information.

There are several other species, or rather single specimens, described by authors; but, generally speaking, their appearances are not well made out from the mutilated skins which have been brought to Europe, and eagerly purchased by collectors without much inquiry as to where they came from, or what were their habits in their native land. It appears, however, that the whole of the semnopitheci are inhabitants of the south-east of Asia and the adjacent islands, the islands being their head-quarters. From those which we have enumerated it will readily be seen that those oriental islands are completely a monkey's country, and the same may be said of apes properly so called, with the exception of the chimpansee, which is wholly African, and better adapted for walking than the orans and gibbons of the oriental woods. There is indeed a regular gradation in these

animals, from the oran to the smallest monkey, though we know too little of their habits and history to enable us to arrange them in the proper order of succession. It has been said that at least one of the species (*S. maura*) has been found in the island of Madagascar; but this seems a mistake, the Madagascar animal being allied to the baboons, or at all events to the macacos, the former of which are chiefly African, and the latter Asiatic animals.

That handed animals, far better adapted for climbing than for any other purpose, should be so abundant in the south-east of Asia, the greater part of them chiefly if not exclusively adapted for vegetable food, is a proof of the vast production of wild fruits in that garden of the globe; and the fact that these animals are not so omnivorous in the structure of their teeth as the handed animals of Africa, agrees with the more uniform fertility of the eastern country.

There is still another division of monkeys of the eastern continent to which the name macaco has been given, which name is understood to be a general one for all kinds of monkeys, at least in some parts of the coast of Guinea. The animals which some describers include in this division are not very clearly defined; and if a perfectly natural classification of the quadrumana could be made, it is not easy to say in what place they ought to be arranged. Some of them partake much of the baboon character; others more resemble the apes, at least some species of ape; and others again more resemble some of the monkeys. They have the teeth of the monkeys; and, like the semnopitheci, they have a fifth tubercle to the last molar. They have also cheek-pouches and callosities on the buttocks. Their legs are, however, shorter and proportionally stouter than those of the monkeys, or even the apes; their muzzles are more produced, and their facial angles more acute. When young they are docile and manageable; but when they grow up, the males especially, are ferocious, and their manners partake not a little of the offensiveness of those of the baboons. From their structure, they are of course better walkers than the more typical monkeys, but much less expert in their movements among trees. They are chiefly found in Asia; and some of the species spend a good deal of their time on the ground. We shall mention very briefly one or two of the leading species.

Radiated Monkey (*M. radiatus*). This is an Indian species, particularly abundant on the coast of Malabar, though it stands the climate of Europe better than many of the others, and breeds freely in confinement. Its principal colour on the upper part is greenish-grey, which is also continued on the upper part of the tail; the under part and insides of the legs are whitish. The length of the body is about a foot and a half, and that of the tail not quite so much. It appears a stouter animal in proportion to its size than the more typical monkeys.

The Chinese-bonnet Monkey (*M. Sinicus*) has the fur on the upper part bright fawn colour, with the tail slightly brown, and the under part of the body and insides of the legs whitish. The naked parts of the feet are black, and there is a streak of the same colour on the lower lip, but the face is flesh-coloured. The produced hair on the upper part of the head, on account of which it gets its trivial name of Chinese bonnet, gives it rather an odd appearance. This tuft is divided on the top of the head, and turned towards each side, reaching the ears; and there is a black line a little over each eye, something in the position of an eyebrow, but placed higher on the forehead. The hair over the body of this species is particoloured, the base of each hair being grey, and the remaining part marked with alternate rings of black and yellow, only the yellow predominates. It is a native of the East, being found on the main land of India, and also in some of the islands.

The hair-lipped Monkey (*M. cynomolgus*) is generally understood as being an African, from which country it is very often brought to Europe. This is larger in size than either of the Asiatic species, and approaches more to the structure of the baboons, though it still has the tail nearly as long as the body. The full-grown male is nearly two feet and a half in length, and the tail is little less. It is thus larger than any of the monkeys properly so called; and it is also much more clumsy in its structure, especially in the structure of the fore legs. It has a large head, flattened on the under part, but the muzzle is short and blunt. The nose is flat, and there is a remarkable elevation or ridge and crest which projects over the eyebrows. The fingers are united by membranes as far as the second phalanx, so that this species has not equal command of the fingers with some of the others. In a state of nature there is not much known of its manners, but in confinement it is much less lively and disposed to climb than the lighter and longer-limbed monkeys. It walks readily on all fours, and rests itself by squatting on the callosities. The mouth and hands are indiscriminately used in the operation of feeding, and the cheek-pouches are always filled before the process of swallowing is begun. This last is, indeed, a habit with most of the quadrumana which have cheek-pouches. The position of repose is either on the side, or resting on the callosities with the head bent forward between the knees. The female is considerably smaller than the male, and more handsome in form, if handsomeness can be predicated of creatures which are unshapely in their forms and repulsive in their manners. The head is considerably smaller than that of the male, and, though the crest is not so projecting, it equally covers the eyes. The hair on the top of the head is directed from both sides toward the mesial line, where the two united stand up forming a crest, which has procured this female the name of the agret monkey. The face is bordered with long and straight grey hairs, which give it a curious appearance. The canine teeth of the female of this species, and indeed of all the species of this imperfectly understood division, are very small, not projecting beyond the incisors; and the female has not the same vicious disposition as the male. It appears, however, that she is wanting in an instinct for which many of the monkeys are remarkable, and which has been so long known as to have been made the foundation of some ancient fables. We mean the instinct of attachment to her offspring. Very many of the handed animals are remarkable for the most solicitous tenderness in this respect, and it displays itself in so many little attentions and endearments to the young one by its mother, that it goes a good way to redeem the other and more offensive habits of the animals. But the female of this species, at least, when in a state of confinement, pays little or no attention to her offspring. A pair which were kept in the French menagerie produced one young one in 1817, and another in 1818, and on both occasions the mother neglected them, and

they soon perished. No conclusion with regard to the conduct of the animals in a state of nature can, however, be drawn from this, at least with certainty, for confinement alters the natural dispositions of animals, though it is natural to suppose that the attachment of the mother to her young is the last affection that would be changed by this means.

This African species makes a much nearer approach to the baboons than any of the Asiatic ones do; and though there are still differences, both in appearance and in manners, it might perhaps, with as much propriety, be classed with the baboons as with the monkeys. After it, the next African link, leading to the more typical and ferocious baboons, is the pig-tailed baboon, of which some notice will be found under the title BABOON, in its place in the alphabet.

With the present species, therefore, we close our brief notice of the monkeys of the eastern continent. Altogether they are a numerous, a noisy, and a mischievous race, though the singularity of their forms, their great strength in proportion to their size, and their lively motions, will always render them animals to which a certain degree of interest attaches. To man they may be said to be of little or no use other than the mere gratification of curiosity; but, though to our feelings there is something repulsive in the idea of eating a monkey, from its imagined resemblance to a dwarf of the human race, it is highly probable that most, if not all of them, would make wholesome food; and they are so numerous that vast numbers of them could easily be procured for this purpose. Those vast numbers bespeak a corresponding extent of use in the economy of wild nature; but what that use is, is not so easily determined, the more so that the economy of the forests which they inhabit is but imperfectly known, and cannot be studied with safety, as a tropical forest is always unhealthy in proportion to its closeness, and the vigour of its vegetation.

II. MONKEYS OF AMERICA.—The monkeys of the western continent, which differ much more from all those of the east than the Asiatic and the African differ from each other. In America there are neither apes nor baboons, nor any animals resembling them; but the monkeys are exceedingly numerous in the extensive forests of tropical America, and they are equally remarkable for their structure and their manners. Some of the handed animals of the east are noisy enough, and the voices of the whole order are screaming and disagreeable; but the eastern ones are nothing to some of the western in this respect, for the latter really make the woods dismal with their howlings, for the performance of which they have a peculiar organisation, which we shall afterwards notice. Many of the eastern animals are remarkable for the quickness of their motions, and their dexterity in springing to the branches of trees, and so from branch to branch till they traverse the forest faster than any ground animal can follow them, interrupted as it is by the undergrowth below. Their motions are, however, really nothing compared to those of the American species, many of which resemble swift birds in their motions, much more than animals which have no wings. In the general characters upon which animals are classified, there may be said to be a strong resemblance between the handed animals of the two continents; but in every case it is a similarity without the least approximation to sameness. The American species have the three kinds of teeth in like manner as those of the eastern continent, but the cheek-teeth are sometimes more numerous. The females have all two pectoral mammæ in both continents, and there is much resemblance in the general economy in so far as reproduction is concerned. So also all the four extremities of the Americans are shaped like hands, as is the case with the eastern ones; but their hands are variously formed, and in some of the species they approach to those of the aie-aie, the galago, and some other tree animals of the east, which, though to a certain extent they are quadrumana, cannot be classed with the typical quadrumana, whether apes, baboons, or monkeys. These last have the claws long and pointed, instead of being flat like nails, as they are in the eastern monkeys, and those of America, which approach most nearly to the eastern ones in their general form. It is to the monkeys of the east, rather than to any other of the divisions of the other, that the American ones have the greatest resemblance. They have long tails, and though they are not prehensile, or capable of laying hold, in all the race, yet many of them possess that species of action in so high a degree, as to combine the grasping of a hand with a degree of litheness and flexibility not much inferior to the proboscis of the elephant. It is true that none of them are divided at the extremity, or otherwise capable of laying hold, except by coiling round the substance which they seize; but they do this so readily, so firmly, and in so endless a number of positions, that they are truly wonderful instruments, and there are perhaps not any more wonderful mechanical instruments in the whole animal creation.

As is the case with the handed animals of the eastern continent, those of America are conveniently divided into three great groups. The first of these have been styled *Helopitheci*, which we may translate "tree apes," and, generally speaking, they have the tail prehensile. The second have been termed *Geopitheci*, or "ground apes," which have the tail long, but slightly or not at all prehensile, and they in general have the legs much stouter than the group with prehensile tails, but not so long in proportion. The third group have been called *Arctopitheci*, or "bear apes," because their claws are shaped something like those of the bear. This last group consists of only a single genus, *Ouistiti*, afterwards to be mentioned. Popularly, however, all these groups are called monkeys in this country, and we shall bring the whole of them into this article, because we shall save some room, and thereby be enabled to bring out their characters with more clearness. The three groups have been described under other names than those now mentioned, which are, we believe, those given to them by at least some tribes of the native inhabitants of those countries in which they are found. Those names are *Sapajou*, for the first group; *Sagouin*, for the second; and *Ouistiti*, for the third. We shall take them under these names, pointing out the several genera into which the first and second groups have been arranged, and also noticing the leading species in each.

1. SAPAJOUS. It will be borne in mind that these are the true apes or monkeys of America, properly so called, though of course the other groups, being handed animals, are also climbers. The characters of these are as follow: the partition between the nostrils is much thicker than that of the apes of the eastern continent; and the nostrils opening obliquely

toward the sides, and not downward as in these. There are six grinders in each side of the jaw, both above and below, which is one more than is possessed by any of the handed animals of the east, and consequently they possess four more, or thirty-six in all, while the others have thirty-two, as in man. None of them are furnished with cheek-pouches or with callosities on the buttocks, and all of them have the tails long, very muscular, and prehensile. This last character is the one which more immediately and remarkably distinguishes them from the ground apes, which they resemble in most other respects. In this their distinguishing characteristic there are two sub-divisions or sub-groups of them: one with a tail naked of hairs, and only callous, or partially scaly; and the other having a tail covered with hair to its extremity. On this account the first have been called *Gymnuri*, or naked tails; and the second *Cebus*, which implies that organ is hairy.

The Gymnuri have far more power in the tail than the other; and, if we except the kanguroo and the whale, there are no animals in whose economy this instrument is so serviceable. It is true that some lizards, or at all events saurian reptiles, have prehensile tails; and so have some mammalia which are not handed, as, for instance, the little harvest mouse; the beaver, too, makes use of its tail as a rudder, and even sculls with it in swimming, and also converts it into a kind of third hind leg when building; but the uses of all these are far inferior to that of the naked tail in these American monkeys. It is often very long, considerably longer than the body; and from the number of its joints it can command space on every side, and lay hold backwards or forwards, upwards or downwards, to the one side or to the other, with the same precision as if it were a hand, and guided by the sight of an eye. From the direction of the eyes in these animals it is not possible that the prehensile tail can be guided by sight unless in very particular instances; and therefore they have naturally in it the same exquisite sensibility of touch which blind individuals of the human race acquire by long experience and practice. The firmness of the grasp which the animal can take by means of this tail is much greater than one would readily believe, for if it makes a single coil round a branch it is quite sufficient not only to support the mere weight of the animal, but to enable it to swing in such a manner as to gain a fresh hold with the hand. Not only this, for, if the hands miss, the tail is sure to take hold, and therefore, let the wind blow as it may, these animals are never shaken from the trees. The power of motion is in the tail itself, and in every part of it, and the muscular structure in which it resides is truly wonderful. While the animal, in so far as the body is concerned, is in a state of perfect repose, the tail can, with the rapidity of lightning, feel about till it gets a hold, and also try the stability of that hold; and if sufficiently stable, the animal, from the length and elasticity of its legs, can throw itself upward, or indeed in any direction, the coil of the tail being the only fulcrum required. Some of the eastern monkeys are very expert in their motions among trees; but there is no known species of mammalia nearly so well adapted for being a tree animal as these naked-tailed monkeys of America; and we may add that no forests are so well adapted for being the haunts of expert tree animals as those which these singular creatures inhabit.

Those American monkeys with naked tails are usually divided into four distinct genera. One of those we have already described in the article Ateles, and therefore our present notice may be restricted to the three that remain, which we shall notice as briefly as possible.

Howling Monkeys (*Myctes*). These animals, which have also been called *Stentor*, from the great loudness of their voices, form a very natural and well-defined genus. Their limbs are of mean length, with five divisions on them all, and the thumb on the fore ones about half the length of the second finger. One of the most remarkable parts of their organisation is the structure of the *os hyoides*, or bone of the tongue, and of the instruments of sound with which the remarkable enlargement of this part is connected. This may be regarded as a sort of enlargement of the larynx, which appears externally like a great swelling or goitre, especially when the animal howls. So large is this, indeed, that it gives a singular appearance to the profile, by throwing the muzzle higher up than what appears to be the centre of the face, an aspect presented by no other race of animals. This singular apparatus is so clearly and so popularly described by Humboldt, in his Zoological Observations on the Animals of Central America, that we cannot resist quoting it. "The bony cone of the os hyoides," says Humboldt, "measured by water, gave a size equal to four cubic inches: the larynx was slightly attached by muscular fibres, and communicated by a membranous canal. The larynx consisted of six pouches, of ten lines in length, to from three to five in depth. These pouches resemble those of the small whistling monkeys, squirrels, and some birds. They have an opening above on the same side with that of the glottis, by which the air cannot enter without shutting the epiglottis. Above the pouches there are two others, of which the lips or borders are yellowish. These are the pyramidal sacs which enter into the bony case, and are formed by membranous partitions. The air is driven into these sacs, which are from three to four inches long, and terminate in a point, but come in contact with no part of the large hyoid bone opening below. The fifth pouch is found in the opening of the arythenoid cartilage, and is situated between the pyramidal sacs of the same form, but shorter; and the sixth pouch is formed by the bony drum itself, within which the voice acquires the mournful plaintive tone which characterises these animals." Altogether the organisation of the neck and under jaw of this animal is very peculiar, and offers some instances of singular provision for a vast power of voice without the least chance of injuring the essential parts of the animal. In reality, the muzzle of the howling monkeys is rather elongated, and the facial angle small, though the vast production of the howling apparatus renders this not perceptible. The occipital hole, through which the spinal cord passes from the skull to the vertebræ, is situated as far upwards as the orbits of the eyes, and directed backwards, not downwards, by which means the spinal cord is secured from all injury which could arise from the pressure of violent action carried on in front. The lower jaw is very much developed both in its body and its branches, so that their depth is nearly equal to the entire height of the cranium. Between these extended walls the principal modifications of the os hyoides are placed. The body of that bone is formed into an osseous case or shell, the walls of which are very thin and elastic.

To this there is a large opening backwards, to the sides of which are articulated four small elongated bones, to which the sacs alluded to by Humboldt are attached. This case is in some of the species about two inches from front to rear, and an inch and a half in the cross diameter; and when the animal howls, the os hyoides is depressed below the lower jaw, deep as its branches are. It is not well ascertained in what manner this singular apparatus, an apparatus so different from that of the organ of voice in most animals, acts; but it is unquestionably an instrument of most melancholy music. The animals which possess it, though the largest of the American monkeys, are still not animals of any considerable size, and yet their voices are louder than the roaring of lions, being distinctly audible at the distance of nearly two miles all round. On account of the loudness and harshness of their tones, a stranger would be very apt to suppose that the forests which they inhabit are thickly tenanted by wild beasts of the most formidable description. But the howling monkeys, though they do wage war on such as dare to invade their pastures, wage war of a different sort from that of the formidable beasts of prey; they assail the traveller with rotten sticks, which they break from the trees, and with other less cleanly substances which they themselves supply; so that, when Swift describes the most offensive practices of the yahoos, one would be apt to suppose that the howling monkeys of the American forests had furnished him with the picture. These animals are exceedingly numerous in many parts of South America. Humboldt estimates their numbers in some parts of the forests as being not less than two thousand to the square league. Numerous as they are, however, their value by no means corresponds, at least in the estimation of Europeans. Part of this may be prejudice, for the Indian tribes hunt them with great avidity, shooting them with arrows envenomed with *wourali* poison, shot from the bow, or blown from the tube, according to circumstances. Some travellers in the woods, and Mr. Waterton among others, speak in favourable terms of the flesh of some of the species; but, as they are not much sought after by the hunters among the colonists, it is probable that this eccentric but delightful traveller may have brought no ordinary share of "Spartan sauce" to his monkey feasts. The skins are in some request both in Brazil and the western countries for covering saddles, or being placed on the backs of mules, to prevent their loads from galling them; but the skins used for this purpose are few as compared with the numbers of the animals. Indeed, it is no easy matter to get hold of them. If they are surprised upon the ground, they instantly betake themselves to the trees, and mount so rapidly and so high, that nothing but gun-shot or arrows will reach them; and then, though they are killed, the chance is that their dead bodies shall remain suspended in the tree; for though gun-shot wounds relax all the joints, and even the features of the boldest warriors, it appears that they do not thus affect the prehensile tails of these monkeys, for they hang suspended to the branches after they are dead.

The females of these, and indeed of all the American monkeys, never have any catamenial discharge, and they bring forth only one young one at a time, which they carry on the back. When the mothers are pressed with danger, some writers say that they abandon their young, while Spix gives them a very different character. He says that, even though a female is wounded, it will not quit its young until it tumbles to the earth exhausted and dying.

The food of these animals is chiefly vegetable, consisting of fruits and also of succulent leaves. As is the case with the greater number of the handed animals, they prefer those woods which are nearest the banks of the rivers, or the marshy places where the water stagnates. The reason of this is obvious: the trees in those places furnish the most constant supply of food, either in fruits, or in leaves, and they also abound the most in insects. There are several species, the most common and the most conspicuous of which is

The *Red Howling Monkey* (*M. seniculus*). This is the species to which Humboldt alludes, under the name of *Monocolorado*, and it is commonly termed simply the red monkey. One of its most distinguishing characters is the nakedness of the face, upon which there are only some short hairs under the eyes and between the orbits on the mesial line. The body is bright golden yellow in great part, but passes into bright red on the shoulders, the thighs, and toward the insertion of the tail. The beard, which covers the whole enlargement on the under jaw, is bright maroon red, and the rest of the legs and also the top of the head are deep maroon, inclining to purple. The hair on the fore part of the head is shaded so as to lie outwards and backwards; and there is another whirl or centre of the hair at the lower part of the neck, in consequence of which the hair on the hind part of the head turns and meets that on the fore part, forming a transverse crest of a semicircular form. The hair on the cheeks is turned forwards and downwards; those on the outsides of the legs are directed downwards; while those on the insides are directed upwards. The length of the full-grown individual is at least two feet, and the tail is rather more, so that among monkeys this is a large animal. The red howling monkey is a native of the woods of most parts of tropical America, unless those which are dry and near the mountains, and have no monkeys' food at some seasons of the year. They are particularly abundant in the woods of Guiana, behind the European settlements in that part of the world. These animals, and indeed most, if not all, of the genus, are gregarious, and live in large troops, the members of which appear to agree well with each other. There is still some little confusion in the species, and it is probable that there may be in the vast forests several species which have not yet been observed by Europeans.

The *Bear Howling Monkey* (*M. ursinus*). This animal is also known by its colonial name *Araguato*. It has sometimes been confounded with the former; but they appear to be quite distinct, and this one much more of a mountaineer than the other. Humboldt found them in great numbers at an elevation where the temperature was not only moderate, but even severely cold, and they made a very loud howling, especially before rain, so that they might be turned into a sort of rude indicators of the weather. In their deportment they are grave-looking animals. In their general form they bear a considerable resemblance to the red howling monkeys; but, being exposed to higher temperatures, they are more abundantly clothed, the under part of the body, which is nearly naked in the other, being covered with hair in this, and the face being also hairy. The hair is

very long, of a golden red colour, pretty uniform over the body. The young are brown. Notwithstanding these differences, it is possible that this may be a climatal variety of the former, changed in its covering, and dwarfed in its size by the severe cold to which it is subjected. We are not aware that there is any difference in its habits from those of the preceding species.

Golden-tailed Howling Monkey (*M. chrysurus*) has been confounded with the red howling monkey, but it is different, at least in the colouring. The last half of the tail and the upper part of the body, from near the tail to near the shoulders, are very bright golden yellow; the basal half of the tail is very bright maroon, and the rest of the body, the head, and the legs, are very deep maroon, passing into purple in the legs. It is easily distinguished from the red one by the head and limbs being of nearly the same colour, whereas in the other they are of different colours. In the red one, too, the tail and under-part of the body are coloured alike, whereas in this they are different, and the tail consists of two colours strongly contrasted with each other. There is also some difference in the teeth, they being longer than in the others, and very regularly set, and the *zygomatic* arches are larger than any of the rest. Still it is probable that this may be the same species which is called the araguato, or probably that name may be applied to more species than one; as, in various places both of the east and the west, it is not unusual to call several monkeys by one common name, in like manner as we apply the general name monkey to all the varieties, whether of the eastern continent or of America.

The *Brown Howling Monkey* (*M. fuscus*). This is a Brazilian species, of which little is known, and it appears sometimes to have been confounded with the ursine or bear howler, and at other times with the *Beelzebub* species of ateles. It is indeed so like the former, that it is not easy to distinguish between them. Its general colour is maroon brown, passing into pure maroon on the middle of the back and the head, and having the tips of the hairs golden yellow.

Red-handed Howling Monkey (*M. rufimanus*) is generally of a black colour, with all the legs and the last half of the tail russet. The face and almost the whole under-part of the body are quite naked of hair. It is understood to be subject to considerable varieties of colour, if indeed that which is described under this name is not merely an accidental variety of some of the others. It is said, taking the varieties of colour into the account, to be very numerous in the dense and damp forests of Brazil, and also in those of the extensive valley of the Amazon.

Black and Yellow Tailed Howling Monkey (*M. flavicaudatus*). This is a well-marked species, at least in so far as colour is concerned. Its general covering is blackish brown, with a yellow stripe along the tail; the face yellowish brown, and very slightly covered with hair. The tail is proportionally shorter than any of the others, not equalling the body in length, while in most of the others it exceeds it. It is found chiefly in the forests in the upper provinces on the river Amazon; but in all probability it occurs in other places.

Black Howling Monkey (*M. niger*). The full-grown male of this species is generally black, only a portion of the tail and the lower part of the face are covered with yellow hairs. The face of this one is altogether hairy, but the hairs are thin and short. The females and the young differ considerably from the males in their colouring. They have the face, the under part of the body, the flanks, the head and the limbs, with the exception of the feet, straw-coloured. The back is furnished with black hair with yellow points, which make the general tint a yellowish ash colour. This species is found in Brazil, and it differs from most others of the genus in some well-marked particulars. It is considerably smaller, not exceeding a foot and a half from the muzzle to the tail, while most of the others are two feet or more; and the naked or properly prehensile part of the tail does not extend to more than the last third of the length of that organ. The muzzle is straight, as in the golden-tailed species; and the teeth are large and parallel, as in that. Still it is probable that it may only be a coloured variety.

The species of which we have now given the names, and some notices, include the whole of the principal part of the howling monkeys of America, as they are known to European naturalists. They are a curious race in their numbers, their habits, their appearance, their voices, and, in short, every thing about them; and they are perhaps the most characteristic mammalia of those extensive and deep forests in which they reside. Of their manners in a state of nature we know but little, because the exploring of a forest in the rich parts of tropical America is a hopeless task, unless the traveller could, like the sloths, make his way among the upper branches of the trees During the rainy season all below is either stagnant water of inundation, or quagmire which no foot can pass, covered with withered branches, and divided by natural ditches and pools of water, more offensive to the sense and more injurious to the health than "the reek o' the rotten fens;" while, when the subsoil gets a little finer, so exuberant a vegetation springs up, that the forest is impenetrable, or, when penetrated, it is as dark as midnight. Thus its inhabitants cannot be examined in their strong holds, but merely in those openings which now and then occur, and to which the howling monkeys often resort to bask in the sun. At such times, however, they are very watchful, and, in all probability, some are constantly on the watch; because the instant that a traveller approaches the howl is set up, the whole are instantly on the trees, and begin their cannonade of sticks and other substances, to which we have alluded.

Our next business in regular order would have been to notice the spider monkeys, or the genus *Ateles*, which some naturalists have divided into the two genera of *Ateles*, properly so called, and *Eroides*; the first comprising those in which the thumb is very nearly or altogether wanting, and the second those in which, though the thumb is very short, or even only a tubercle, it can act against the fingers. There is, however, still another genus with the tail prehensile, with the legs very long, as in the spider monkeys, and with the head round, and thumbs on all the extremities, as in the howling monkeys. This is the genus.

Lagothryx.—This genus, which is but a recent addition to the zoology of South America, being first mentioned by Humboldt and Bonpland in their researches in that continent, has received its generic name from the produced hair upon the thorax. The legs are considerably shorter and stouter in proportion than those of the spider monkeys, and thus the ani-

mals are better adapted for walking on the ground. They have four fingers and a thumb on each of the fore feet, the latter capable of acting against the others. Still they are but rudely-formed hands, for the fore finger is so short, that, when the palm is applied to the ground, the foot has very much the resemblance of a paw, and not of a grasping instrument. This paw-like appearance is farther increased by the form of the nails, which, on the fore feet, with the exception of those on the thumbs, are compressed, and slightly resemble claws. The head is rounded, and their fur is much softer to the touch than that of any other of the American monkeys, with the exception, perhaps, of some of the genus *Ateles*. Their facial angle is about fifty degrees, and their ears are very small. Altogether they seem to be animals of soft and quiet disposition, though very little is known of their manners. Humboldt, we believe, saw but one, and that one was in the hut of an Indian in the valley of the Oronooko. It had not, however, been obtained in the forest there, but considerably to the west, on the more dry and elevated grounds, where the forests are not so close. This agrees with the structure of the animal, which is better adapted for walking, and less so for climbing, than that of the species which have the legs longer and more slender. The account given by the Indians is, that this species associate together in large troops, which meet in the openings of the woods, and hold a sort of council, at which the elders of the band stand up on their hind legs and conduct themselves with all the gravity of senators. As is the case among these, however, those monkey assemblies are not uniformly taciturn. They do not howl in the same deep and dismal tones as the howling monkeys, properly so called; but they occasionally set up a violent chattering, something resembling that cheering and counter-cheering which takes place among men in the sound, and very likely in the sense. They are represented as being terrible *gourmands*, or rather *gourmis*, for it is quantity, not quality of food, of which they are said to be so fond. Three species have been named, but it is probable that two of these are one and the same, and possible that all the three may be climatal varieties. The one of these is

Humboldt's Monkey (*L. Humboldtii*). This is the one found by that enterprising and intelligent traveller, with the Indian of the valley of the Orinoco. It was an animal of considerable size, being about two feet three inches in the head and body, and with the tail rather longer. The head large and round, and having a blunt appearance, from the smallness of the ears and the shortness of the hair. The hair on the upper part of the body is whitish, with black tips, producing a greyish shade. The hair on the breast is much longer than the rest, and of a brownish colour; but that on the head is very short, of the same colour as that on the back, only rather brighter. The face is of a black colour, and naked, only there are short stiff bristles surrounding the mouth. A portion of the tip of the tail is naked, and that organ is very prehensile. So far as we know, this animal has not been found in the eastern part of South America, though in all probability it exists there as well as in the central part, eastward of the Andes.

The Grison Monkey (*L. canus*). This species is rather smaller than the last mentioned, and it has been found in Brazil. The upper part of the body and the outsides of the legs are greyish olive; the head, the tail, and all the under part brown, mixed with more or less of ash colour. It is supposed, however, to be subject to considerable varieties of colour, as some specimens, doubtless of the same species, have been met with with the head almost black. Spix, in his splendid work on the animals of Brazil, mentions another species, and also gives a figure of it under the name of the "smoke-coloured monkey" (*Gastromargus infumatus*); gastromargus being the generic name applied by Spix to these monkeys, he being the first to discover their great powers in the gastronomic way. This one is, however, so like the former in every thing, except being more of a smoke-grey colour, that it is highly probable they are one and the same species, of which, as we have mentioned, other coloured varieties have been observed.

Sapajous proper (*Cebus*). The grand distinguishing character of these from the whole of those formerly mentioned is the tail entirely covered with short and thick-set hairs, though it retains the prehensile property, yet not perhaps in such perfection as where it is naked, and may be regarded as posessing directly the properties of an organ of touch, as well as those of an organ of prehension. This subdivision or genus may be regarded as holding a sort of intermediate place between the tree monkeys and the ground monkeys, the spider-monkeys being taken as the most typical genus of the former, or the ones most exclusively adapted to a woodland life. Most of those who have attempted to classify these singular and interesting, but obscurely-known animals, have put the howling monkeys foremost among the tree ones, as if they were the most typical genus. In respect of size and numbers, and especially of the noise which they make in the world, they unquestionably stand foremost; but these are not sufficient grounds of precedence among monkeys any more than among men; and Cuvier, though he perhaps knew less of the details of the individuals, especially in their colouring and other external appearances, than other naturalists of far less philosophic and generalising minds, was yet faithful to the structure in taking, as typical of the tree monkeys of America, those which are most adroit among the branches, and most helpless upon the ground. Viewing them in this way, we have, in those American monkeys, a series which is probably more complete than in any other animals with which we are acquainted; for the spider-monkeys are the best climbers of which we have any knowledge, and the structural series comes regularly down till the hand makes a close approximation to a digging foot; and the four-handed race merge into or pass over the still-continued series to the rodentia, and these again to the toothless animals, till we come to the armadillocs, clad in armour, and digging deeply in the ground.

This series, taking all the three orders in their succession, and carefully comparing each order and each shade of generic difference with the corresponding differences of haunt and habit, would be an exceedingly interesting subject of natural study; and would probably better reward any one who should bring to it the requisite degree of knowledge and talent than any other that could readily be named.

It would, however, be attended with great labour, and not a little difficulty; and much must be observed before it can be attempted with any great probability of success; but still it is a mine which will reward for many ages those who have the means and the

ability of working it with skill. The reason which makes the natural history of this part of the world in its more characteristic animals, and their appropriate habits and haunts, difficult, is a very obvious one. The forests of South America are not only the most extensive and the most difficult to be explored of any that are to be found on the surface of the earth, but they are at the same time the most permanent in their nature. The high mountains, the vast rivers, and the heavy rains of South America, together with the flooding of the ground by those rains, are sure bulwarks to vegetable and animal life against the invasion of the desert. In many instances, too, those munitions of nature are such as to set all the efforts of man at defiance; and thus there is no chance that this portion of the globe shall ever become forestless. In consequence of this we have the animals there in their habitations as they have been, and as they will be, during a lapse of years of which we know neither the beginning nor the end; and thus they will remain a permanent subject for naturalists of successive ages; so that, from the time that the language of natural history became the language of truth grounded upon actual observation, the naturalists of every succeeding age may go on to build upon the labours of their predecessors as a sure foundation, the stability of the fabric being beyond question, and the height to which it may be raised beyond even the fondest hopes which we can entertain in the present state of our practical knowledge on the subject. But to return to the sapajous.

As compared with the former species of American monkeys, the sapajous are agreeable creatures. They are full of life and intelligence; and, though very active in all their motions, they are mild in their dispositions, very docile, susceptible of education, and can show a good deal of attachment to those who are kind to them. They are accordingly more frequent in Europe than almost any other genus of monkeys. In their native forests they live in numerous bands, and are chiefly met with in the higher branches of the lofty trees; but, notwithstanding their gregarious habit, the males are said to be strictly monogamists, and the pair are very much attached to each other. As is the case with the whole order, their principal food is vegetable—fruits when they can obtain them. But when their vegetable food fails they can become miscellaneous in their feeding, and live upon insects, worms, and molluscous animals. They will also, at least in a state of confinement, eat flesh; but it does not appear that they show the slightest disposition to kill any warm-blooded animal. As is the case with the howling monkeys, they produce but one at a birth. This one is carried on the back of the mother as she moves about; but when she rests she attends and fondles it with much apparent affection. It is sometimes said that these animals will not breed in our climates; but this is not the fact, as has been proved by numerous instances. These monkeys have not generally the disagreeable voices of the howlers, or the offensive chattering of the *Lagothrici*. Their usual sound, when in good temper, and not annoyed, is soft and murmuring, and heard at a very short distance. When, however, their passions of any kind are strongly excited (and animals of so much activity and resource are necessarily very excitable), their cries are harsh, sharp, and loud, and heard at a considerable distance. But even then the sound which they utter is a sort of yelping or squeaking, and not howling; and their calls to each other are always made in the soft voice.

Some of the sapajous are known by the name of musk-monkeys, and others by that of weeping monkeys, or rather perhaps those names are given to the same ones at different times. They have always a slight musky smell, which is indeed a smell very general among South American animals; but in the season of heat this smell becomes far stronger than at other times. The weeping does not imply that they shed tears; it merely alludes to the sound which they utter when frightened, which sound bears no inconsiderable resemblance to the crying of a child.

The north and east parts of South America are the localities where the sapajous are most abundant, or at all events where they have been most observed. Many species have been enumerated, but it is doubtful whether some or even the greater part of them may not be merely accidental, as their chief distinctions are those of colour. We shall content ourselves with short notices of a few of those which are best established.

The Weeper Monkey (*C. appella*). This species is well known in Europe, better perhaps than any monkey of this or of any other genus. In so far as beauty can be ascribed to a monkey in its appearance (for all animals are beautiful in their adaptations), this one may be said to be a very pretty little creature, though sober in the colours of its attire. It is only about a foot in length from the nose to the tail, and the tail is rather more than a foot. The upper part is of a pleasing and rather bright brown colour, though it does not always show very well in this country, because, though nobody would feel disposed to ill use a creature which is perhaps the most inoffensive of all its order, and certainly one of the most playful, an animal of tropical climates cannot always be made to feel at home in temperate countries; and, when animals are not in good condition, the falling off tells first in the diminished beauty of the fur. The under part is yellowish, and the upper part of the head, with a line down each side of the face, the tail, and the extremities of the feet, are black. It is, however, subject to very considerable varieties of colour, and is understood to alter, with difference of climate, even in the same individual. With us it is much more healthy, and can stand the weather better than almost any other species of monkey. It is usually brought to Europe from Guiana, which appears to be its head-quarters, and it is found there in considerable troops.

The White-fronted Sapajou (*C. albifrons*) is about the same size as the weeper monkey last described, but differently coloured; the forehead and a portion round the eyes are pure white, and hence the name that it has received. The general colour of the body is greyish-olive, rather paler on the middle of the back and on the under part, and having a slight yellowish tinge there. Humboldt found this species in great abundance in the forests of the Upper Orinoco and the adjoining parts. Numerous individuals live in the same troop. They are by no means alarmed at the approach of man; and both the Indians and the Europeans, and their descendants, are fond of keeping them in their houses as pets. In their dispositions they are said to be more gentle than even the weeper monkeys, and also more playful. *Ouvapavi* is the name given to this species by

the Indians of the Upper Orinoco, though what this name implies in their language is not correctly known. It is a curious fact that there are very few animals of which the names can, in any language, be so interpreted as to have even as much meaning as to point out any one quality of the animal expressible by a more primitive word. From this it should seem that, in the rude stages of society, animals were among the first subjects which mankind called by conventional names, calculated for bringing the subject before the mind of the hearer when it was absent from his bodily observation. This comes very nearly to the account of Adam's first labour, which was that of naming the beasts; and it is satisfactory to find that, even in so trivial a matter as this, the declaration of Holy Writ is in strict accordance with those conclusions to which we are led by personal observation.

Those Indians are very partial to this little animal, and generally keep it in their houses, and their example is followed by the missionaries, and other persons from Europe, or the European settlements, who take up their abode in that wild and remote part of the country. It seems that the animal is particularly fond of riding; for Humboldt mentions one belonging to the Maypuri Indians, which regularly mounted a pig every morning, and sat quietly on its back during great part of the day, while the pig, apparently quite unannoyed by the burden of its little rider, collected its food in the savannah with perfect unconcern. Another, belonging to a missionary, is described as making a cat a substitute for a charger, and that even this animal did not show much resentment. Whether the old fable, of taking the cat's paw to get the burning chestnuts out of the fire, may have been practised by any of these animals, we cannot say (only it is not unlikely); but certainly these little gentle sapajous take great liberties with other domestic animals, and, generally speaking, with the greatest impunity.

The horned Sapajou (*C. fatuellus*). This species is a little, but only a very little, larger than the two which have been mentioned. Its colour is blackish maroon on the back, bighter maroon on the sides, and bright red on the belly, with the head, the legs, and the tail brownish. It is, however, subject to considerable varieties in the general colouring, no two describers exactly agreeing as to the tint of any one part of it. The fact is, that very many animals, tropical animals especially, appear of different shades of colour according to the different lights in which they are seen, and therefore considerable allowance must be made for those diversities which we meet with in the published descriptions. There is another source of apparent difference in many of the monkeys, and in this one in particular. The skin is generally coloured, and not unfrequently of a bright colour, so that it shines through the hair where that is thin, and imparts a colour which the hair does not possess. The skin of this one is purplish red, and the hair on the under part of the body very thin; hence the apparent brightness of the colour of that part. One of the greatest peculiarities in this species is the direction of the dark hairs on the forehead. These rise from a little above the eyes, and stand up higher than the top of the head, which is round, and appears smooth from the shortness of the hair. Seen in front, those hairs of the forehead are parted in the middle, and end in two stiff and pointed tufts, to which the name of horns has been absurdly given, though "tufted sapajou" would have been a far more appropriate name. Seen in profile, the aspect of those produced hairs of the forehead is very different; and, in this situation, the animal altogether bears some slight resemblance to a mailed warrior, with the visor of his helmet up; and the resemblance would be nearly complete, if the naked ear of the animal did not make its appearance. From the angles of the erected hairs on the forehead, the hair on the cheeks turns downwards, and then forwards on the chin, but with an intermediate white patch, bordered by a black one on the side of the cheek. The black might pass for a whisker, and the white for a cowl under the helmet, while the erected part shows as if it could be turned down, and exactly cover and protect the face. All these resemblances are of course purely imaginary, but they belong to that class of imaginary appearances which are well calculated to fix the real appearances in the memory.

The robust Sapajou (*C. robustus*). This is described as a Brazilian species; but it approaches so nearly to the weeper monkey, that it is probably only an accidental variety of that, the chief difference being, that it is a little larger and a little brighter in the colouring. *Cebus libidinosus* is another Brazilian species, mentioned by Spix, as indicating an approximation to the baboons in some of the more repulsive habits of these ugly animals. The account was given, however, from an animal in a state of confinement; and it is so contrary to the general conduct of the whole genus, that we must regard the habit as individual, and probably artificial, and not as belonging to, or in any way entitled to become, the name and the discriminating character of a species. The description of this one was given as follows:—The tuft on the head blackish brown; the beard curling in a circle round the face; the back, breast, throat, beard, under side of the tail, and limbs, with exception of the arms and thighs, rusty red; the fore part of the throat deep reddish brown; and the cheeks, chin, and fingers, bright brown.

The large-headed Sapajou (*C. marriachus*). Few individuals of this species have been met with. Such as have been examined have been obtained from some part of South America, though from what particular part is not known. The forehead is rounded, and the eye-balls prominent; the breast, the belly, the cheeks, the sides of the face, and outsides of the arms, pale yellowish orange, passing into white at the fore part on the face, and at the hind part on the arms; the head black on the upper part, and whitish on the sides, with a black band down each side of the face, showing some white between it and the naked part; the legs on the outside, and also the tail, are black; the insides of the legs reddish, but produced more by the colour of the skin than by that of the covering, which is very scanty in these parts. Though the country of this species is not perfectly ascertained, there is little doubt that it is a distinct species, because several have been found agreeing so much with each other, and differing so much from any of the other described species, as to leave little doubt that they are distinct.

Golden-footed Sapajou (*C. chryospus*). This is a handsome species, though very little is known concerning it, and it seems to bear a considerable resemblance to the white-fronted one already described, like which it is a western animal, being found in

Columbia. Its covering consists of a number of colours, of which the distribution is similar to that in some of the rest, but the colours themselves are very different.

There are various other species of sapajous, which have been described from their colours, and figured, and recorded in systematic classifications; but, upon careful examination, we are disposed to conclude that the greater number, if not all of them, are accidental varieties, or varieties arising from differences of colour, to which these animals are subject in the different sexes and at different stages of their existence. These differences of colour are very considerable, and in some instances extend as far as absolute albinoism, specimens of a perfectly white colour being occasionally met with. In all these, however, there is really no instruction to those who wish to study natural history in a popular manner, or even for useful purposes; because the manners of the sapajous, in all the varieties of their appearance, are so much alike, that, when one is studied, all may be said to be studied; and any one who knows the weeper monkey, which is so very common, can be at no loss to understand all the rest. The sapajous with hairy tails, or the genus *Cebus* of the systematic naturalists, may be regarded as holding the same place in the zoology of America as the monkeys hold in that of the east. Like these, they are by far the most numerous in their locality. There is, however, a remarkable difference between them in the superior gentleness of disposition of the sapajous of America over the monkeys of the other continent, with what genus soever of those monkeys we compare them. The howling and spider monkeys bear a similar resemblance to the climbing apes of the eastern continent; and it is not a little remarkable, that though Africa intervenes between the proper locality of those eastern and western animals, there is nothing in the west approaching so nearly to the *chimpansee* and the baboons of Africa as the naked-tailed monkey of America does to the apes of the east. No satisfactory conclusion can, however, in the present state of our knowledge, be drawn from these discrepancies, and the natural history of America must be worked out upon its own data. This is true, not only of the individual races of animals, but of the succession of races; and in the progress from the most dexterous of the handed animals to the most terrestrial of the rodentia, we have to pass through very different gradations in the one continent from those which we have to pass through in the other. The sapajous with the tails entirely hairy may be considered as the last link in those American monkeys which are chiefly, or almost exclusively, tree animals; and we come next to those which have been termed ground monkeys, though of course even they still continue to possess a considerable degree of the climbing character; and indeed, if this were not the case, hands would be given to them in vain, for the chief and proper action of these hands on animals is climbing.

Sagouins (*Geopitheci*). These are the ground monkeys of America, and, though various naturalists have confounded them with the hairy-tailed sapajous, they are perfectly distinct. The tail, though often proportionally longer than in the others, is never prehensile. No doubt the animals are capable of moving it, because every lengthened tail is capable of motion and flexure in the different parts; but, though some of the sagouins do often coil the long tail round other substances, as well as round their own bodies, they never make use of it as a hand, or suspend themselves by it, as is the case with even the hairy-tailed sapajous. These animals have the body long and slender, bearing a very slight resemblance to that of the marten family; their fur is soft, and the tail entirely covered with it; the nails on the fingers are not formed into absolute claws, but they are narrow, rounded upwards in the middle, and rather pointed, something intermediate, in short, between nails properly so called and claws; the eyes of these animals are also larger in proportion than those of the former genera; and the whole structure indicates a lurking animal, having at least a dash of predatory disposition in it. This appears to correspond with the habit in so far as the habit is known; for, as individuals of this species, when in a state of confinement, are very fond of animal substances, including raw flesh among the rest, we very naturally suppose that they are disposed to kill, in a state of nature, any animal they can master. It is not a little remarkable that, in the handed animals of both continents, the strongest species, and those which are most ferocious in their dispositions, should be the most exclusively vegetable in their feeding; and yet such seems to be the case. The handed animals of the east may be said to merge in the loris, and these, notwithstanding the slowness of their motions, are nocturnal animals which prey upon birds. It is highly probable that birds are also, occasionally at least, made the prey of the American ones, for there are not many mammalia in that country which they could master. Those who reflect upon it will easily perceive that it is not a swift animal, which bustles along, but one moving silently and stealthily, which is best adapted for being a nocturnal bird-catcher. Night is the time of repose with by far the greater number of birds; and a wingless animal which is to capture them at this time must come upon them so softly as not to give them notice of its coming, otherwise they would take to the wing and escape. There are indeed other enemies of the tropical birds, which are most in motion during the day, namely, the snake tribes; but they are animals of very considerable resource, and most of them capable of darting upon their prey with equal rapidity and certainty. The sagouins, and animals of similar habits, on the other hand, come by stealth upon their prey. They are not so much found in the lofty forests as the others, though they are still dexterous as tree animals; and during the day they lurk much among the bushes and in the holes of the rocks, while those of the former families are chiefly found in the trees. It is for this reason that they are called *Geopitheci*, or ground apes; and, though the genera into which they are conveniently divided differ considerably, there are common characters which belong to all the divisions. They have the head rounded, and the brain well developed, both of which circumstances are considered as indicating a corresponding share of intelligence in their possessor. The eyes are fitted for nocturnal vision, and during the day the animals remain in their places of concealment. The facial angle is sixty degrees, but though this is large, the approach in appearance to the human face is not so great as in some species which have the facial angle smaller; for the whole have something of a cat-like look. The nostrils are large and open, and directed towards the sides; the ears are also open, and in some species at least they are

furnished with an additional concha of fur, resembling the feathered one of the owls, and this no doubt improves their hearing, a sense upon which they necessarily depend a great deal in seeking their nightly food. We can know little upon so nice a point; but it is by no means improbable that those nocturnal preyers, which catch birds and other small game, are led to their game by hearing it breathe. The sagouins have six cheek teeth in each side of both jaws.

These are the general characters; but there are others which belong only to the genera into which these animals have been divided. There are four of those genera: *Callithrix*, or the sagouins properly so called; *Nyctipithecus*, or night apes; *Pithecia*, the Sakis; and *Brachiurus*, comprising those American monkeys which have the tails rather short. We shall notice a few of the leading species in each of these.

Callithrix. The type of this genus is the *Saimiri* of Buffon, and the squirrel monkey of common language; but some of the others differ considerably from this typical one, at least in some of their characters. The general characters may be stated as follows:—the head small and round; the muzzle short; facial angle sixty degrees; canines of mean length; the inferior incisives vertical, and not projecting, and coming close up to the canines; the ears long, but unshapely; the tail a little longer than the body, and covered with short hair; the body slender and flexible, so that the animal can make its way easily through small openings. In the squirrel monkey the cranium is remarkably developed; but there are some of the others which have it less so, and these do not exhibit an equal degree of sagacity and resource. The eyes in all the species are of considerable size, and the orbits are completely round. In the squirrel monkey there is a very remarkable development of the external ear; but the others are inferior in this respect, as well as in general intelligence. The colouring of the fur is, generally speaking, finer in these than in any other of the handed animals; and it is worthy of remark, that in this they follow the general law of the mammalia, which is, the more carnivorous the animal is, its fur is the more durable and the more beautifully coloured. It is upon this superior beauty of the covering of these animals that the generic name is founded, for *Callithrix* means "beautiful fur." All the animals of this genus are confined to the tropical parts of America; but, though they are very numerous, their habits in a state of nature are but little known, on account of their spending the day in concealment, and being abroad and active only during the night. We may here again notice, before proceeding to an enumeration of the principal species, a remarkable coincidence between these American animals and those Asiatic ones which appear most nearly to occupy the same place in the economy of nature. They are much more finely coloured, and their fur is also much more glossy than that of diurnal animals which are exposed to the sun in the ordinary economy of their lives. We now proceed to the species.

The Squirrel Monkey (*C. Sciurea*). This is one of the most finely coloured of all the monkey tribe, and hence it has been called by a number of names. It is the aurora sapajou of some writers; and *Saimiri*, which Buffon called it, is understood to be the name given to it by some tribes of the Indians of Guiana. On the banks of the Orinoco Humboldt found the general name *Titi* applied to it; and there have not been wanting some compilers who have taken advantage of these two names, and given descriptions as of two species or varieties of animals.

The squirrel monkey is of very small size, but remarkably active and very pretty. The length of the body is not more than ten inches, but the tail is thirteen or fourteen. The face is a sort of flesh colour, with the exception of the muzzle, which is dusky. The general colour of the upper part is a sort of olive grey, passing into a paler tint on the under part of the body, and the long hairs, which form a concha round the ears. This colour extends as far as the knee and elbow joints on the extremities, but stops there at a regular section round the limb, and all the rest is bright red, which contrasts finely with the grey on the body. The grey is a colour which can hardly be named, it changes so much with the different ways in which the light is reflected from it; but in all the shades which it shows it is very soft and pleasant to the eye. There is another circumstance, in what may be called the personal appearance of this species, which renders it much more pleasing to look at than any of the rest, and more especially than any of the apes and monkeys of the eastern world. It shows no caricature of the human face; and though, philosophically speaking, there is no harm or ground of offence whatever in this caricature, yet it is, to some extent at least, repulsive to our feelings. Now, though the features of the squirrel monkey are arranged in exactly the same manner as those of the monkeys which do offend us by the caricature, yet there is nothing of the caricature in them. The eyes remind one of those of a cat; and the wide septum between the nostrils, together with the lateral opening of these, so completely animalises the expression, that we admire it as an animal without mixing up with it any comparison of mankind. Besides this, the squirrel monkey is a good-natured and playful animal, and one which was kept for some time in the managerie at Paris was decidedly a favourite. It seems, however, that the animal is easily excited, and that with it the transition from the expresion of joy to that of sorrow is as brief as in a child. When affected by strong passion its eyes fill with tears; and it does not appear that with any ordinary treatment it is ever angry. In a state of nature these animals live in numerous troops, and feed in great part upon insects, though they also eat fruits and small birds. To larger animals they are

perfectly innoxious; and this, together with their beauty and their liveliness, makes them much sought after as pet animals by the European settlers on the coasts of their native country. In the capture of insects they show a wonderful adroitness; and so well are they acquainted with the appearance of this their favourite prey, that Humboldt says they are capital judges of the portraits of insects even in black engravings, and will clutch at them although the same paper contains other representations of nearly the same size as the insects. This is not to be wondered at, because all animals which prey in great part by sight, and especially nocturnal ones, have a strong magnifying power in the eyes, and consequently they can see objects with great distinctness. The squirrel monkeys seize their food indiscriminately with the mouth or with the hand, though most frequently with the latter; and it is not a little remarkable to witness the extreme dexterity with which so small a hand seizes an insect in the act of flying rapidly past, nor is there perhaps any other animal capable of catching flies on the wing so cleverly by means of a single prehensile instrument. There are some coloured varieties of these animals; and in the same individual the colour is understood to deepen with age; it does not appear, however, that there is any thing upon which we should be warranted in founding a specific difference.

The Widow Monkey (*C. lugens*). This species inhabits nearly the same localities as the former; but it is far more rare, or at all events more rarely seen. The covering is very soft and shining, and uniformly black, except the front of the breast and the anterior hands, which are white. The face is whitish, slightly tinged with blue, and traversed by two deeper lines, which strongly mark the eyes. The produced hair on the top of the head has the black glossed with purple reflections; but the back, the tail, and the hind feet and legs, are entirely black, without any reflection, but by no means destitute of lustre. The manners of an animal belonging to a tribe which dwell in obscurity, and being the most obscure of all that tribe, cannot of course be much known to Europeans. Humboldt, to whom we are indebted for some of the best accounts of the animals of the northern parts of South America, and whose judicious manners recommended him to the most kindly attentions from the Indians, met only with a single living specimen in the hands of those people. They assured him, however, that animals of this species do not, like those of the preceding, or indeed like most of the American monkeys, assemble in troops, and conduct themselves in a sportive manner. They live in pairs, and are of exceedingly sad and melancholy aspect, dozing away their time, and shunning every other animal of the same family. All this sadness and retirement are not, however, indications of simplicity of life; for the widow monkey is perhaps the most carnivorous of all the handed animals of the American continent. It lies in wait, and springs upon its prey like a little tiger; indeed, the bound which it can make, when hungry and excited, by the sight of what will afford it a meal, is more than ten times greater, in proportion to its size, than the spring of the tiger. Birds excite it the most, and therefore we may naturally conclude that they are its chief and favourite food. It is not only more carnivorous than the squirrel monkey, but it is also a more powerful animal. Its body is about a fifth longer, and all its parts are longer and stronger in nearly the same proportion.

The masked Monkey (*C. personatus*), is a Brazilian species, and found chiefly in the forests on the banks of the large rivers. It is of larger size than either of those already mentioned, the total length being about two feet and a half, which is almost equally divided between the body and the head and the tail. Its general covering is yellowish grey, but the face, the top of the head, the cheeks, and the tips of the ears, are deep black in the male, and dark brown on the female, and it is from this marking that it has received the name of the masked monkey. The hairs on the back and the limbs, which show the grey colour, are annulated with dark colour and sandy white, and the under part of the body gradually passes into a greyish sand colour. The tail is rather bushy in its covering, and of a reddish yellow; the hind feet, with the exception of the nails, are deep black.

The ruffed Monkey (*C. amictus*). This also is a Brazilian species, but occurs in the interior of the countries more to the west. It is still larger than the former, being about double the size of the squirrel monkey. The body, the fore-arms, and the legs, are black, mottled with brown; the lower part of the neck and the upper part of the breast white; the feet sandy yellow, and the tail entirely black, and not nearly so woolly as in most of the genus.

Some naturalists are of opinion that the three last mentioned are only coloured varieties of the widow monkey. There appears not to be any structural difference between them which would lead us to infer that there is even the slightest difference in habit; but still the sizes and markings of the colour vary much more than they do in any wild animals which the systematists usually consider as belonging to the same species. We have therefore described them as represented by authors, and we shall do the same with the species that remain, although they also may, in some instances at least, be coloured varieties. This is perhaps the most interesting genus of all the handed animals of America, inasmuch as it appears to form a link between the more typical handed animals and the smaller ones, which are more decidedly predatory, and, as such, referrible to the order *Carnassier;* but, as is very often the case in natural history, the study of these animals is difficult in proportion as it is interesting.

The collared Monkey (*C. torquatus*). This is understood to be a Brazilian species, but nothing is known of it in the living state. The only account that we have of it is founded upon a single skin in a German collection, and, in so far as colour goes, this skin is different from any of the described species which have been seen alive. The general colour is chestnut brown, passing into yellow on the under part, and the anterior part of the neck is marked with a half collar of white.

The Moloch Monkey (*C. Moloch*) is a Brazilian species, but exceedingly rare. It is about twice the size of the squirrel monkey. The general colour of the fur is ash; but as the hairs are annulated, a varied and varying colour appears on the back and external parts of the legs. The insides of the legs are bright ash-colour, and the hands and point of the tail pass into pale grey, and indeed, almost into white. The face is brown, and, generally speaking, naked; though there are some straggling rough hairs on the cheeks and chin. The under part of the body and

the insides of the legs upwards are bright reddish yellow, which does not pass into the grey, but contrasts strongly with it at the line of meeting. The hair on the basal part of the tail is very long, that toward the extremity is shorter, and annulated with blackish-brown and sandy-white.

Black-handed Monkey (*C. melanochir*). This is also a Brazilian species, or, at least, known only to European naturalists as a native of that part of America, and we owe the first account of it to Prince Maximilian of Wied Neu-wied, to whom we are indebted for many particulars respecting the native productions and native inhabitants of that extensive and most interesting portion of the world. It is a large species, measures about three feet in length, of which, however, the tail occupies more than twenty inches. Its fur is long, soft, and woolly; generally speaking, of an ashen-grey on most parts of the body, but really consisting of sand-colour and black or brown, annulated alternately upon the individual hairs. On the middle of the back this passes into a bright maroon-brown, and the tail is whitish, often entirely white, and sometimes with a yellowish tinge. The hands and face are entirely black. This species is much better known than many of the others, being very abundant in many of the Brazilian forests, where it does not inhabit so peaceably as most of the others do, whether in Brazil or elsewhere. Its cry is loud and disagreeable, and numerous bands assemble in the woods about sunrise, and make a loud and unpleasant yelping.

The Mitred Monkey (*C. infulatus*) is still another Brazilian species, or rather it is one known to us as Brazilian, and not as coming from any other part of South America, though it by no means follows that an animal of tropical America thus described as coming from one locality, may not be equally numerous in other localities. Hence, in countries so extensive, and so nearly alike in their physical character, there is always danger of error when we venture to call a species after any particular locality; because this not only gives an erroneous impression with regard to the individual animal, but limits the labours of those who afterwards seek for it to that locality after which it is named, and this may be the one in which it is least abundant. It is understood, however, that this is a very rare species in Brazil, and it has not been met with anywhere else. Its prevailing colour on the upper part is grey, and on the under part yellowish-red, or reddish-yellow; and the tail is of the colour of the under part toward the base, and black toward the extremity, a large spot of white surrounded with a black border, is situated over the eyes, and forms what is called the mitre. Very little is known of the manners of this species, whether it belong to the more silent and retiring, or to the more noisy; but the probability is that it belongs more to the former, because social animals not only make themselves better known, but are in general more numerous than solitary ones. We shall now proceed to a short enumeration of the night monkeys, or night apes of America, properly so called.

Nyctipithecus.—We have mentioned the preceding genus as being, in a great measure, formed upon the nocturnal model; but, notwithstanding this, they are not absolutely nocturnal animals, but rather crepuscular or twilight ones. We mentioned that the black-faced species assemble and howl at sunrise; and this appears to be the signal call from the labours of the morning to bring the stragglers in, so that they may betake themselves to their hiding places, and not become a sacrifice to diurnal foes. The present genus are more decidedly nocturnal; and their covering, their appearance, and all circumstances connected with them, are adapted to accord with this habit. Their aspect is soft, and their hair long and curled, or rather waved, and the fur of the head completely concealing the ears, at least in some of the species. This concealment led Illiger to give them the generic name of *Aotus*, which is usually translated "earless," and, as such, it is by no means descriptive of the animals; for they not only have ears, but hear remarkably well, which is indeed a sense upon which nocturnal animals are particularly dependent, and which, consequently, they possess in a very eminent degree, whatever may be the appearance of their external organs of hearing. The word has, however, a different meaning, and one which is descriptive of the animals; for Ἀῶτος means silk or wool, and by application, that which is silky or woolly; and this is exactly the character of the fur of these animals. But even taking Illiger's generic name in this sense, it is inferior to the other, which is descriptive of the nocturnal habit; whereas a name founded on the mere texture of the covering is of inferior value. The only objection to the literal Greek of night ape is the rugged sound of the word, and on this account F. Cuvier has softened it down to *Nocthorus*. Names, however, are of little consequence, except in so far as they lead us to the right animal, and prevent us from confounding one with another.

The characters of this genus are peculiar and remarkable. In the system of their teeth they agree exactly with the last-mentioned genus. They have the muzzle blunt, the face naked, no cheek pouches, very large eyes, no apparent external ears appearing through the fur; the tail long, the fur woolly, and partially formed into locks; five toes on all the feet; no callosities on the buttocks, and two pectoral mammæ on the females. They bear a remarkable resemblance to the loris in their large eyes, their round head, their nocturnal habit, and their reluctance to move during the day. For a long time there was only one species of the genus known, and the best description of that was given by Humboldt, who had an opportunity of examining it in its native country, and ascertaining its nocturnal habits, so far as the habits of so obscure an animal can be ascertained. More recently, however, other two species have been enumerated; the first, and we believe the only account of which is given by Spix, where they occupy plates eighteen and nineteen of his "New Species of Brazilian Bats and Monkeys," published at Munich in 1820. The manners of these two species are, however, comparatively little known, though, perhaps, they do not differ much from this one, and therefore one may serve for all. We shall consequently make it the chief subject of description, and place it in order before the others.

The *Douroucouli Night Ape* (*N. trivirgata*. Cuvier). This is unquestionably the most singular of all the quadrumanous animals of tropical America, or indeed of any other part of the world, both in the form of its body and in the colour and texture of its covering. Its entire length is about two feet; all its covering on the upper parts of the body is of a peculiar grey colour, the hairs being annulated with black and

white. The under-part, from the chin to the origin of the tail, is orange, a portion of which extends up each side of the neck; the tail is black for the terminal third of its length, and yellowish grey the remaining two-thirds; there is a white eyebrow extending over both eyes, and divided off at each end by a black line extending up upon the forehead, just as far out as the external canthus of the eye; a third dark bar proceeds from the junction of the white eyebrow up the middle of the forehead, or rather of the long hair with which the forehead is beset. These three dark bars which are strongly marked, give a character to the head of the animal, which, if attended to, will effectually prevent its being mistaken for any other. It is from this circumstance that it gets the specific name of *Trivirgata*, the three bars appearing like three rods or "verges," erected coronet-wise on the forehead. This disposition of the line on the forehead is so remarkable, as to have attracted the attention of the missionaries in those parts of the great valley of the Orinoco, where the animals have been observed. They call it "cararayada," though it does not appear to be very eminently deserving of the first part of that name. Though the profile of this species is still the profile of a quadrumanous animal; and though the form of its teeth gives this character to the mouth when open, or when shut, if seen in profile, yet the front view of the face and head altogether, with the exception of no ears being apparent, bears no inconsiderable resemblance to that of a cat. The eyes are very large, and we believe that the pupils contract to a sort of oval, though certainly not upon a line, as in some other nocturnal animals. The nose is indeed much broader than that of a cat, and it is further from the extremity of the upper lip; the chin, also, from the size and vertical position of the incisive teeth, is larger in proportion than that in the cat, and the mouth, taken laterally, is wider. There is, however, a sort of partial division in the upper lip very much resembling that in the cat; and there are stiff whiskers on the upper lip, which, though they are not so long in proportion as a cat's whiskers, no doubt answer a similar purpose, that of enabling the animal to feel its way in the dark. The importance of those appendages to such nocturnal animals as seek their prey among bushes, is much greater than one would be apt to suppose. They enable the animal to steal upon its prey without giving the least alarm, for though stiff, they are very elastic, so that the least touch against any obstacle bends them; and as this is instantly communicated to the sentient bulbs, they are, perhaps, the most delicate of all organs of touch. It is well known that a common domestic cat is incapable of hunting if its whiskers are destroyed; and there is no other way of accounting for the fact, but on the supposition that, in consequence of the want of the whiskers as organs of touch, the animal runs against objects, and makes so much noise as to alarm its delicate-eared prey. The inner surface of the hands and that of the ears is naked and flesh-coloured; but the face, though equally naked, is smoke-coloured in the general tint. The feet, or hands as they are usually called, do not differ greatly from those of the former genus; but those on the anterior ones are but little extensile, or capable of what may be considered as the proper finger-motion. The claws are a still farther departure from the flat nails of the typical hand than in any of the preceding genera, they are narrow, pointed at the tips, furrowed on the under sides, provided with trenchant edges, a little crooked, and altogether partake fully as much of the character of absolute weapons, as of mere defences to give firmness to the extremities of grasping fingers. The tail, though not prehensile, is capable of a great deal of motion, and no doubt, assists in guiding the course of the animal very much in the same way as the tail of the cat does. The ears, though concealed externally by the fur of the animal, are remarkably well made out, and the eyes are prominent, and of that yellowish-brown colour which we have described. The nose cannot be said to terminate in a decided muzzle as it does in the last genus; and the septum between the nostrils is much thinner, and the nostrils in themselves more oblong. The hair over the whole body is remarkably soft and silky; and the animal is well calculated for making its way among bushes with the least possible degree of noise.

These animals are ill able to endure either the light or the heat of the day, and therefore they pass that portion of their time in a state of almost complete repose. Their mode of reposing is peculiar, and admirably fitted for preserving the elasticity of the spinal structure, which appears to be most essential to these animals in the performance of their nocturnal labours. When reposing, the tarsi of the hind paws are brought under the belly of the animal, and the fore paws resting also on the tarsi, are placed immediately in front of them, the head being at the same time hung down between the fore legs, to the utmost relaxation of which the joints of the neck will admit. The long tail is not, generally speaking, coiled in any manner, but left lying in easy flexures.

In our common notion of reposing by lying on the side, there is something to which the position of repose in this animal is so very different, that we would be inclined, at first sight, to conclude that it is most uncomfortable. When we come to examine it, however, we soon discover that it is one of the easiest positions which an animal can have, and that there are certain points of mutual support in it, to which we can hardly find any thing equal in any other animal's repose. The four palms form a broad base, and the wrists of the fore ones, and toes of the hind ones, bear against each other. About the middle of the height, the elbow and the knee come in contact, and mutually support each other; while the bones of the arm and thigh form a sort of diagonal strut, reaching from the scapular to the insertion of the tail, which insertion is also a point of support to the base of the animal. The way in which the head declines, presses the elbow joints backwards and the fore feet downwards; and, in short, if we examine carefully the relative positions of the different parts of the animal, and their bearings, we shall find in this singular creature's position of repose one of the most beautiful applications of the principles of statics that is anywhere to be met with.

The diurnal repose is taken in the holes of trees, or any other cavities which it can conveniently reach. It does not dig its own burrow, or form it in the wood; but in the trees of tropical forests there are usually plenty of holes ready made by the various genera of wood-consuming insects. When in confinement, this animal will eat bread, fruits, and milk; and, in a state of nature, it is also partial to succulent fruits and sweet vegetables; though there it is, at

least according to Humboldt, a great destroyer of birds; and it is mainly for the capture of these that it preserves the elasticity of its back by the curve which that assumes when it is reposing. It is not a silent animal, but utters several sounds, the different affections accompanying which are not very clearly understood. Its ordinary cry has been expressed by the syllables *muh-muh*, louder than the size of the animal would lead one to suppose, and resembling a sort of miniature of the nightly cry of the jaguar. The jaguar is the tiger of Europeans and their descendants in that part of America; and, accordingly, the creoles on the Upper Orinoco call the douroucouli, the "tite-tiger." It has also a mewing cry—(e-i-aou), which will be readily perceived to bear some resemblance to the mewing of a cat; and it has also a very disagreeable guttural growl which it utters when irritated, and which describers have endeavoured to express by a repetition of the snarling syllables *quer-quer*. This animal is exceedingly difficult to tame, even in its native country, and the whole of the nocturnal quadrumana of America are so delicate, that they cannot be preserved alive out of their native habitat without the greatest difficulty. As their cries would lead one to suppose, they are snarling and irritable animals; and when they are exasperated, the skin of the throat becomes inflated, and the hair stands on end. Such are a few particulars respecting the best known of this very singular genus of animals; and we must content ourselves with merely mentioning the names of the other two species.

Cat-faced Night Monkey (*N. felinus*). All the three species may be regarded as being a good deal cat-faced; and we are not aware that this is more so than any of the rest. Its covering is described as being greyish-brown on the upper part and reddish on the under, with the last half of the tail black, and a space round the eyes white. The rays or bars which so distinctly mark the forehead of the other species, do not appear to exist in this or in the following.

Howling Night Monkey (*N. vociferans*). This is named from its nocturnal din, in which, as we have seen, the species first mentioned also takes no inconsiderable share. The colour of the upper part of this one is more inclining to red than that of the former; and it is uniform over the whole body and head, and only a third, and not a half of the tail toward the point is black; still they may be both differently coloured varieties of one and the same species. Hitherto they have been found in Brazil only; and little has been recorded of them even there.

Pithecia—the Sakis. This genus, like the others, was long blended in the common class of South American quadrumana; and some naturalists have proposed to apply to it the generic name of *Cebus*; but as that name is more appropriately applied to the hairy-tailed sapajous, as marking their chief distinction from the naked-tailed ones, it is rather objectionable. The vulgar name of this genus is fox-tailed monkeys, because the tails are, generally speaking, formed into a sort of brush, with the hair much longer in the middle part than at the root. They are night monkeys as well as the former. They admit of subdivision into two genera, though the chief distinctions of these consist in the length of the tails; the other structures and the habits being very much alike in both. Though called night apes as well as the former genus, they are much less so in reality, and are to be considered rather as dawn and twilight animals than animals of the darkness of night. In this respect they resemble the common fox, with whom the early morning is the busy time, at least in paying his attentions to the farm-yard, though, where foxes are numerous, they may be heard barking for the greater part of the night, at least in certain states of the weather. It is curious to find a correspondence of habit, at least in so far as time is concerned, between animals of which the tails are the only parts that have any traceable resemblance to each other. The sakis make a much nearer approach in some particulars, especially in the form of their bodies, than they do to the genus placed intermediate between them in the system; but the tails not being prehensile at once distinguishes them from the sapajous; and the produced hair, forming a fox-like brush, equally distinguishes them from the sagouins. They have thirty-six teeth in all, and the incisors of the upper jaw are a little peculiar in their form. They are rounded at their cutting edges, sloped on their external surfaces, and hollowed in their internal, so that they bear some resemblance to little goudges. The canines have very sharp points; and of the grinders, those which may be called the false ones are formed into points, while the true grinders have blunt crowns, whereby the animals are distinguished from the ouistitis, and pointed out as living more on vegetables, and less upon insect food. Their claws also differ very much from the demi-talons of the ouistitis, which last may be regarded as to some extent prehensile instruments. The external characters are: the head round, the muzzle short, the facial angle nearly sixty degrees, the ears of mean size and bordered, the tail shorter than the body and furnished with long puffy hair, and all the feet with five toes, having short claws a little crooked. The sakis inhabit the very depths of the American forests, and spend the greater part of the day, and always the hot time of it, in repose. They are social, but their communities seldom consist of more than seven or eight individuals. They are great destroyers both of wild bees and of their honey; and it is said that some of the more powerful species follow them to share this description of food, or to take it altogether from the sakis. There are several species which we shall very briefly notice.

Red-bellied Saki (*P. rufiventer*). This is the fox-tailed monkey, and the night ape of Buffon. It has a round face, and a short muzzle, without any beard; its nostrils are oblique and large, and its eyes very large. It is covered over with very long hair, which is as much as three inches long about the middle part of the tail. Its colour is brown mottled with reddish on the upper part, and passing into red on the belly. The individual hairs are brown at the roots, and annulated with red and brown toward the extremity; the forehead is furnished with a sort of toupee of diverging hairs; the hair on the hands and feet is very short; and that of the face is thin, soft, and fine, and of a tawny colour. This species is very common in the forests of the interior of Guiana.

The Yarke Saki (*P. leucocephala*) has sometimes been confounded with the former, though the external appearances are different. The head and body are about ten or eleven inches in length, covered with brown fur, very long on the upper part, but much shorter on the under, while that on the head is very short. The forehead, the cheeks, and the lower jaw,

are of a pale yellowish sand colour, from which the animal has received the name of *Leucocephala* or white headed. A small space round the eyes, the point of the nose, and the lips, are the only naked parts of the face, and they are of a brown colour. This species in habits the forests of Guiana, or rather the brush-wood on their margins, and in their openings, where the ground is moderately dry; and its chief employment when active consists in hunting for the nests of wild bees, upon whose honey it feeds with great eagerness.

The Monk Saki (*P. monachus*) is a native of Brazil, at least it has been found only in that country. It is of rather smaller size than the other; and its fur is mottled in rather a peculiar manner, with large spots of brown and dull white. The hairs in the spots are brown at their origin, and golden near the tips. The hair from the occiput is reflected forwards, forming a sort of cowl over the top of the head, from which circumstance it has received the name of monk. The tail is rather longer than the body, and very thick and long in the hair toward the middle part.

The Yellow-headed Saki (*P. ocrocephala*) is found in nearly the same country with the white-headed one, and is about the same size, so that it may perhaps be nothing but a coloured variety, as not more than one or two specimens of it have been observed. Its colours are maroon on the upper part, reddish-ash with a trace of yellow on the under; and the hands and feet blackish-brown, with the hair on the front, and that surrounding the face, ochre-yellow.

Red-whiskered Saki (*P. rufibarba*). This species is also described from a museum specimen, ascertained to have come from the neighbourhood of Surinam. Its body is blackish-brown above, and pale red below; the hair becomes very short toward the extremity of the tail, which gives that organ a peculiarly pointed appearance. There is no light colour upon this species, except a small spot over each eye.

The Miriquouina Saki (*P. Miriquouina*). This is a species from a more southerly part of America than those which we have hitherto noticed, and it is also of far larger size. The only notice that we have of it is in D'Azzara's Natural History of Paraguay; but as the descriptions of that author have been always verified where subsequent observation has been practicable, we have no reason to doubt them where this has not been the case. It is described as being two-and-thirty inches long, exclusive of the tail, and capable of being tamed, and docile when in that state. Its chief habitat is described as being in the province of Choca to the westward of the river Paraguay. It has a very short tail, but very thickly beset with hair; its head is small and rounded; and its eyes large, with irides of a pale yellowish-brown. The face is naked, except the cheeks, which are lightly covered with white hairs; the ears are very large around it, and covered with short soft hair, and the hair on the body is very long, thick, and woolly. All the upper part of the body is of a pretty uniform greyish-brown, formed by hairs which are annulated with white and blackish-brown; the under part of the body is a very bright cinnamon colour; the tail is black, with the exception of a portion of the under side, which is bright maroon. There is a white spot over each eye, pointed upwards, something in the shape of a little flame; and altogether the markings, as well as the size of the animal, point it out as a well defined species. Those which we have enumerated comprise all the species of this genus which are known with any thing like distinctness; and, as we hinted in our enumeration of them, it is by no means improbable that several of those which we have enumerated as distinct ought really to be looked upon as nothing but coloured varieties. We shall now consider the other genus which has sometimes been mixed up with this, but which perhaps deserves in strict propriety to be separated.

Brachiurus. This genus does not differ very much from the former in its essential particulars; but there are some few differences which may be marked. Of these, perhaps the most characteristic is the muzzle more produced than in the others, and the short tail. Some of them are also particularly ugly in their forms.

The Devil Monkey or Couxis (*B. Satanus*). This animal was first discovered in Brazil, and in appearance it is unquestionably the most peculiar of the race. Its total length, including that of the tail, which is considerably shorter than the body, though longer than the tails of the rest of the genus, is about two feet nine inches. The colour is nearly uniform sooty-brown, with a light trace of purple in it, and altogether as grim a colour as can well be imagined. Its face is naked, and of a dull brown. Its gape is ample, and its canine teeth very powerful. The hair on the body is rather shaggy, and that on the breast thin; but when the animal sits on its tarsi and its hands, a long beard depending from the whole length of the under-jaw completely covers it. The hands and feet are naked for a considerable way; and from the length of the hair upon the clothed parts, the extreme length and tenderness of the tarsi, the long and skinny hands, and the narrow pointed nails, they seem fit appendages to what fancy pictures of a hag or a harpy. Many well preserved specimens of this curious species have been brought to Europe, but very little is known respecting its manners. Its aspect bespeaks an animal of rather a savage disposition; but appearances of this description are not always to be relied on, though the appearance of large canine teeth very seldom fails. This animal has been obtained from Guiana as well as from Brazil, and it is said to frequent the borders of the deserts rather than the woods; but some caution is requisite in every thing that can be said concerning it.

The Capuchin Monkey (*B. chiroptis*). This species has also been called the hard-drinking monkey; and in doing this it seems particularly careful not to wet its beard, which it holds to one side while it carries water to the mouth with the other hand. In its dimensions and also in its form it is not unlike the last-mentioned species, but its colours are different; and the hair on the head is turned up in a large tuft upon each temple; the face and forehead are naked; and the beard is of immense length. The colour is brownish-red, the beard darker; the eyes are large, and very deeply set in the head; and the nails on all the fingers are bent, but they are not so on the thumbs.

The Black-headed Monkey or Cacagoa (*B. melanocephalus*) is a very curious species, and differs greatly from the other two. It is comparatively a small species, and the contrast of its colours is remarkable. In the body it is not more than six inches long, and the tail does not exceed two inches; and it appears as if clothed up to the neck, and down to the wrists and ankles, in a close garment bearing some resemblance to a yellowish and dirty sheep skin. The real colour of this, the principal portion of the body

and limbs is a clear brownish-yellow; but the length of it, and its curling into tufts, give it a mottled appearance. The head is wholly black, with a tinge of purple. The portion covered with hair rather darker than the naked part, and showing the ears with a bold relief. The hair, which is turned forward on the cheeks, is a little grisly at the points, and appears like whiskers just beginning to turn grey; while the deep-set yellow eyes give it a very peculiar appearance. The extremities are long and very slender; and the animal altogether has an expression of feebleness. It is a native of the interior of Guiana, where it is gregarious, living in troops; and, like the rest, it is a crepuscular animal. It is represented as being particularly fond of bananas, guavas, and other sweet fruits; and as it is much more feeble in its body, and mild in its aspect than the other members of the genus, so it is represented as being far more gentle in its disposition and quiet in its manners.

Some other species of the genus *Brachiurus* have been mentioned as occurring in the woods behind Demerara, and some of these have been described as very abundant in that part of America. One, the *Jacketed Monkey* (*B. sagulata*), has been mentioned as having a long club-shaped black tail, a black beard, and the upper part of the body ochre-yellow. Other markings, beside these, have been mentioned as occurring in the cases of other individuals; but we are not inclined to set much value on those mere differences of colour as being grounds of any thing of importance in natural history. It is highly probable that there may be many species still in the forests, of which we are utterly ignorant; but much research will be required before their history can be cleared up in a satisfactory manner. We therefore proceed to the last division of the handed animals of America, namely, those which have the fingers or toes armed with strong nails.

Arctopitheci, or handed animals, which have the nails resembling the claws of bears. Animals of this description were formerly classed with the last-mentioned division, which have a slight approximation to the present one in the form of the claws. They have also been often described as a single genus by those who have found enough of peculiarity in them to warrant their separation from the rest. They have acquired various names, of which jacchus or jacko monkeys, is perhaps one of the most common; but in strict propriety they admit of division into two genera, the *Ouistitis*, properly so called, the (*Jacchus*) and the *Tamarin* (*Midas*).

The leading characters of the whole, taken as one little group of handed animals, are as follows: the head rounded, the face flat; the nostrils lateral; no callosities; the tail not in the least prehensile; only five grinders in each side of each jaw, as the apes and monkeys of the eastern continent have, and not six, like the rest of the American ones. With the exception of the inner toes on the hind feet, which have short and rather flat nails, the nails on all the others are compressed, sharp pointed, considerably crooked, and strong, so as to be capable of serving either for climbing or for catching the prey, as may be necessary. The thumbs or inner toes on the fore feet are so little parted from the others, that this group cannot with strict propriety be termed handed animals. They climb by grasping with the foot, but then that foot approaches the form of the feet of squirrels, and holds on, in part at least, by means of the claws. But while the inner toe on the fore feet is thus nearly as long as the rest, that of the hind foot is very short, so as to be of little use for any purpose except that of preserving their balance. The hind legs are in all the species larger than the fore legs, a structure which invariably indicates an animal having great dexterity and power of leaping. Their tails are always longer than the body, completely covered with hair, and serving no known purpose save that of regulating their motions or prolonging their leaps. The ears are large, membranous, and nearly naked; the nostrils are placed as in the other American groups; the hair on the body, which generally consists of good colours, well contrasted with each other, is generally long and exceedingly soft. It covers all parts of the body except the head and the feet, upon both of which the hair is very short and close.

They live mostly in trees, as is the case with the more characteristic quadrumana; but they are without the resources of the others, or, at least, most of them, whether of the eastern continent or of the western. They are incapable of using the tail as a fifth hand, in the same manner as the typical tree monkeys of America; and they are also without the resource which the quadrumana of the east derive from the callosities on their buttocks. These callosities are curious appendages. To common observation they seem no better than excrescences, which actually disfigure the animals; but nothing can be more erroneous than any conclusion of this kind respecting them. They are points of support, composed of matter exactly similar to those pads on the feet of hoofless animals, which contribute so much, both to the safety and the stability of the owners; and therefore, though the prehensile tails of the western quadrumana make a more showy appearance, it is not a very easy matter to settle the question as to the real advantage of them and the callosities of the eastern races compared with each other. The prehensile tail is a fifth hand certainly; but then, for stability, if not for motion, the callosities of the others are equivalent to two feet.

The little group under consideration are, as we have said, destitute of both of these supplements to the hands in other tree animals; but they have their compensation in the claws, and the extreme lightness of their bodies, and thus they are enabled very speedily and very safely to find their way to the tops of the most lofty trees. In their action among the branches, in the lightness of their bodies, the length of their tails, and in various other respects, they resemble the squirrels much more than any other group of animals; and both groups are perhaps lighter in proportion to the length of their volume measured to the extremities than any other of the mammalia. Of their manners in the wild forests we know not much, but several individuals have been kept alive in European collections. That their mode of living is different from that of the squirrels there is no doubt; and they appear to be animals of greater observation and resource than these animals, lively as they are. The food of the tame ones consists both of animal and vegetable matter; of the former they prefer insects and very small birds, and of the latter sweet fruits. They were fond of looking at themselves in glasses; and they seemed readily to distinguish between friends and foes, even when only their representations in the glass appeared. Of the appearance of a cat they were very unfond. This might have been expected, because the tree cats of America are, in all probability, the most formidable

enemies they have in their native forests; but there was another animal of which they were even more afraid, and that was a wasp, from which they endeavoured to conceal their heads with their hands, in a state of the utmost excitement. We must, however, close this general view, and very briefly notice the two genera into which they have been divided. The first genus is,

Hapales, consisting of the *Ouistitis*, properly so called. The generic characters are, the head round, the muzzle short, the hind head prominent, tail very long and hairy, the upper incisors in the middle larger than the lateral ones, the lower cutting teeth long and narrow, the upper canines conical, and the lower of small size, and the cheek-teeth beset with sharp-pointed tubercles.

The Striated Monkey, or Common Ouistiti. This is by no means a rare animal; and although peculiar, it is rather pretty, and agrees well with confinement. It is pretty generally known and also liked. It is a very small animal, being only about eight inches long in the body, with eleven inches of a tail appended, and very slender, though the fur makes it appear much thicker than it is in reality. All the upper part of the body is covered with very long hairs, annulated with black at the roots, and yellow, and then black, and alternately white again; so that while the mixture of colours makes a general tint of greyish olive, the whole of the upper part and the tail, and also the external parts of the hind legs especially, are marked with cross bars of darker and lighter shades, which contrast very pleasingly with each other. Those markings are finest on the tail, where twenty black bands and as many white ones occur. The neck and head, with the exception of the face and ears, are covered with blackish-brown hair, without any markings. The paws are covered with very short hair, which is pale brown in some individuals, and pale grey in others. The inside of the legs and the belly are brown, a little mottled with white; the face is also brown, with the exception of a large spot above the eyes, and a line on the lips. They are, however, subject to considerable changes of colour. We had almost forgotten to mention one very remarkable trait in their appearance, which is a tuft of brownish hairs, varying in the individuals from very light brown to pure white.

This species, which, though called the striated monkey, has very few characters in common with the typical monkeys, is very common in all the tropical parts of America; and, considering the temperature of its native haunts, it breeds pretty freely in Europe. The number of young varies, being sometimes only one and at other times as many as three. Some that bred in the French Museum, gave F. Cuvier an opportunity of observing their manners with his usual exactness, and reporting them with his usual fidelity. When the female produced three, she very soon after eat the head of one of them, but the other two began to suck, and her disposition soon became changed to tenderness for them. They were borne indiscriminately on the back or under the belly of the mother, though the last was of course, more strictly speaking, the suckling position. When fatigued with carrying the two young ones, she used to apply to the male for assistance, intimating her necessity for it by a peculiar cry not uttered upon any other occasion; and when she had recourse to this cry, the male took upon himself the burden of the young. In confinement these little animals are not only very indiscriminate in their eating, but very rapacious. They will contrive to catch gold fishes which are kept in ornamental jars; and Edwards mentions one that acquired some dexterity in killing and eating small eels.

The tufted Jacchus (*H. penicillatus*), is a Brazilian species, bearing a considerable resemblance to the common one, but differing in a sufficient number of respects for entitling it to rank as a distinct species. The breast and belly are red and not brown; the white spot on the front is larger, the cross bars on the back are brighter, and the light-coloured hairs do not spread like a fan over the ear, but form a tuft in front of it, while a margin of produced hairs from the nape stands up behind the ear. The manners of this species are but little known.

The white-headed Jacchus (*H. leucocephalus*), is another Brazilian species, resembling the former one, but yet with well-marked external characters. It is rather larger than either of the two preceding ones, and has the lower part of the back of a deep black colour. This species has the head and throat entirely white, and the ear tuft black. It is usually found in the copses of the mining districts of Brazil.

The eared Jacchus (*H. auritus*), still resembles the common one in form and size, but is very different in the markings of the colours. The hairs on the back are only black and russet alternately. The throat, the belly, and the flanks are black; the feet have short hairs, a mixture of black and grey; the face and chin are white, and the nape of the head yellowish red. There is a tuft of white hairs in front of each ear, but shorter in proportion than the black hairs on the tufted species. The young have the back more striated than the adults, and they want the yellowish red on the top of the head. This species is also Brazilian.

The white-shouldered Jacchus (*H. humeralifer*,) also Brazilian, smaller than the common one, and perhaps only a variety, but very different in the colours. The arms, the upper part of the back, the neck, and all the under parts of the body, are white; and so also are the ear-tufts, the hairs of which are very long. The top of the head is dusky, the thighs are brown mottled with white, and the cross bars of the tail are black and white, but very indistinct. The tail is longer in proportion than that of the common species; and though this, as well as many of the preceding ones, has often been regarded as belonging to that species, and being only coloured varieties, yet the departure in the case of this one is so great, independently altogether of colour, that one would require the evidence of absolute descent before confidently referring them to the same species.

The black-tailed Jacchus (*H. melanurus*). In this species the tail is entirely black with a brownish tinge, and without any cross bars of alternating colours. The body and legs are generally bright brown, except the under parts and insides of the legs, which are reddish white. The feet are brown, and the size of the animal is nearly the same as that of the common species. Like the others it has hitherto been found chiefly in Brazil.

The Mico (*H. argentatus*), is still a native of the same countries, or nearly so. It is about the size of the common one, but very differently coloured from any of the rest, being generally of a white colour, with the exception of the tail, which is black. It is possible, however, that it may be a partial albino of

the black-tailed species; and so also may be the other variety with a white tail, which has been described. One of the chief reasons for supposing that this one is an albino is the colour of those places where the skin is naked, that is the face and the feet, which are red, as much as to say that the usual colouring membrane of the skin is wanting. Still this has been described as a species under the name of the mico, or fair monkey, for a long time.

Various other coloured varieties of this genus might be mentioned; but the enumeration of them would be only ringing the changes, which colours extend no further than the single individuals in which they are found, and thus they would only burden the memory without informing the judgment. We shall therefore proceed to the last and concluding genus, of this very numerous group of animals.

Midas (*Tamarin*). One of the most common names of this genus is eared jacchus or eared monkey; and it is in consequence of the great production of the ears that the name midas has been applied to them. They are not unfrequently included in the same genus with ouistitis, or jacchus properly so called; but besides the greater size of the ears, there are some other differences which are worthy of notice. They have the lower incisors much more trenchant than those of the preceding genus, placed in a more uniform line, and shorter than the canines. Their tails are also much thicker than those of the other genus, and they are never annulated. Very generally they are furnished with long hair on the head and neck, and sometimes the haunches also have the hair on them a good deal produced. It is not very easy to determine which ought to be considered the typical species of this genus, because the species differ much more from each other than those of the former genus do.

The Pinche (*M. œdipus*). It appears that this species is much more numerous in the northern parts of Colombia, than in the countries farther to the east. It is a small animal (which is indeed the character of the genus), being only about seven inches long in the body, but having at least twelve inches of tail. One of the most remarkable traits in the appearance of the pinche is the very long white hair on the top of the head, which, falling backwards and laterally, forms a complete hood. All the under parts of the body and the insides of the legs are also white. The outsides of the legs, the buttocks, and the basal half of the tail, are bright rusty red; and the terminal half of the tail is black. The back is covered with black hairs having yellowish olive points; and these are so arranged as to produce a transverse barred appearance, but the bars are by no means distinct. The length of the body and head is from seven and a half to eight and a half inches, and that of the tail from eight to twelve.

Common Tamarin (*M. rufimanus*) is the typical species of tamarin. It is generally of a black colour, with the feet of a golden red, and the back faintly cross-barred with yellowish-grey. In the northern parts of South America the common tamarin is very abundant where it is gregarious, and large troops are found together in the forests; the usual length when full-grown is about eight inches in the head and body, and rather more than a foot in the tail.

The Black Tamarin (*M. ursulus*) differs but little from the common one, except in colour. It has the hands black, as well as the other parts of the body, but the back is slightly cross-barred with red. It is understood to be very common in Para, or the country on the left bank of the Amazon, extending south-ward to the point where Paraguay commences. Specimens have not unfrequently been brought to Europe. They are exceedingly irritable in their dispositions; and snarl and bite if any one attempts to touch them, which is a disposition not possessed by the common tamarin, or indeed by the genus generally; but whether, in a state of nature, they display equal pugnacity has not been ascertained. In all the race indeed, and it may be said in all very small mammalia without exception, there is a certain degree of irritability, and disposition to exercise upon slight occasions such weapons as they possess, which is not found among animals of greater size and strength. This is generally true, not merely of different species, but of different individuals or varieties of the same species, of which the little ones are constantly showing their puny fight, while the large ones scorn to take the field, "nisi dignus vindice nodus."

The Silky Tamarin (*M. rosalia*) is one of prettiest of these animals; and it is the one which is vulgarly denominated the lion monkey, though the same name is also given to another one which has the body, and also the tail, a little more resembling those of a lion than the present one. The hair upon this species is very fine and silky, and that upon the head, the cheeks, the back part of the lower jaw, and the breast, is long, forming a sort of mane which fancy can imagine to resemble the mane of a lion. The colour is pretty uniform, being a very delicate golden yellow when the animal is in good health; but it should seem that this healthy state and beauty of colour are both very intimately connected with the warmth and drought of the animal's native country. It has been brought to Europe, and kept there for some time; but it requires to be protected from the damp with the utmost care; and in spite of all the care which can be bestowed upon it in this respect, the bright yellow very speedily fades off, the colour becomes dull white, and the animal puts on a heavy and languid appearance. This species is understood to be very decidedly a tree animal, and very closely to resemble the squirrels in all its motions.

The Lioncito or Lion Tamarin (*M. leoninus*). This is in some respects the most interesting of all the tamarins, and it is also one of the smallest; indeed, all things considered, perhaps the smallest of the whole monkey race. It is a native of the dry countries on the eastern slopes of the Andes; but it never ascends to such a height as that the place of its habitation is ever temperate. It is about seven inches and a half long in the body, and eight or nine in the tail; and both body and tail are very slender in proportion to their length, at least with the exception of the point where there is a little tuft, still further increasing the lion-like aspect; the tail of this one is covered with shorter hair than that of most of its congeners. The general covering is olive brown, not very unlike the colour of the darker lions. The mane, which is very much produced, is the same colour; and the back is slightly marked with short cross-bars of yellowish-white. The tail is black above and brown on the under part; the feet are altogether deep black; and the claws are also black. The annexed cut will give some idea of the general form.

Humboldt, to whom we owe the best description of this animal, because he visited the interior, and it

is seldom seen on the coast, describes it as one of the smallest, and at the same time the most elegant, of all the monkey race. The Indians of that part of the country where it is to be met with are very partial to

it, and fond of keeping it in their cabins whenever they can procure it. Humboldt, however, saw but two individuals in the course of his travels; and one of these had been carried alive from the western side of the eastmost or innermost Cordillera of Andes. These little animals, when kept in a cage, are continually in motion, like squirrels, and their motions are equally rapid. They are very gay and playful, but remarkably short tempered; and when they are irritated they put on a most formidable appearance, considering their trifling size: their manes bristle up, their throats are distended, their eyes glisten, their teeth are shown, they lash themselves with their tails; and not Bottom himself, in the Midsummer Nights' Dream, could play the lion to better perfection than it is played by these small animals. They agree more, however, with Bottom's emended or *piano* lionising than with his original *forte*, which was in danger of frightening the ladies; for "they roar you an it were any sucking turtle." In a word, they are exceedingly interesting little animals, and so familiar in their manners that they breed in confinement; but they are very delicate, so that it would be difficult to preserve them alive for any length of time in cold climates. In the upper valley of the Amazon, and those of its effluents, they are by no means rare; but we are not aware that they have been observed either in Guiana or Brazil. Those which Humboldt saw alive in cages were so constantly in motion that it was scarcely possible to make drawings of them; and therefore the figures which are given in the books are not to be implicitly depended on, more especially those which have passed through the hands of ignorant copyists, and have been got up at a cheap rate more for show than for use.

The White-lipped Tamarin (*M. labiatus*). This species is very remarkable for its colours. The back and the outsides of the fore-arms and thighs are brown, dotted with reddish white; the feet, the head, and the tail, are blackish; the inner surface of the legs, the under part of the body, and the under side of the tail near its origin, are bright reddish; the nape is reddish-yellow; and the lips are surrounded with a border of short white hairs, forming a striking contrast with the dark colour of the surrounding parts. This is a small species, and hitherto it has been found only in Brazil.

The Golden-yellow and Black Tamarine (*M. chrysomelas*). This species has its colours very strongly marked. Generally speaking, it is black, with the front and the lower side of the tail golden-yellow, and the fore-arms, the knees, the breast, and the sides of the head, maroon-red. It is found in the thick forests of Brazil, and also in all the country to the south of the Amazon. The face and throat are surrounded with very long hairs, generally of a golden-yellow colour, but often with more or less of maroon-red. This species differs considerably from most of the others in the tail, which is not above one-fourth part the length of the body; and the body itself is only between seven and eight inches.

The Golden-buttocked Tamarin (*M. chrysopygus*). The general covering of this species is also black; but the inner parts of the thighs and the buttocks are golden-yellow; the forehead is yellowish; and there is a long mane of black hairs which descends from the head, neck, and throat, and falls so low down as completely to cover the arms and a considerable portion of the shoulders and back. This species, which is well marked, is larger than some of the rest, being about ten inches and a half in length, with the tail half the length of the body.

Such is a general list of the monkeys in all their leading species and varieties, both in the eastern world and in the western. Taking them individually, they are not animals of a very high degree of interest, and they may be said to be of no value to man in an economical point of view; but they are far more numerous than any other family of tropical mammalia, and therefore highly characteristic of wild nature in those countries to which they belong. The American ones are unquestionably the most singular of the whole, and therefore we have described them with the greatest minuteness.

There is another reason why this should be done: South America is at this moment the portion of the world where natural history is least known to Europeans, because of the jealousy both of the Spaniards and Portuguese, while they held the greater part of it as colonies. Their sway is, however, now at an end; the country is equally open and inviting to inquirers; and there is no doubt that the many enterprising and scientific travellers who are at present engaged in exploring it will make valuable additions to natural knowledge.

MONOCEROS (Lamarck; Buccinum, Linnæus). The Linnæan genus *Buccinum* included the *Purpuræ* of the modern school, and this was separated from them by Lamarck, in consequence of its constantly possessing a thin, conical, somewhat curved tooth-like appendage at the base of the right side of the aperture: we may also add that in some species of this mollusc the spire is more elevated than in others; the exterior surface of the whorls is carinated and angular, smooth, or with small imbricated scales in transverse rows; the aperture internally grooved, and we possess a species from the South Seas, whose right side of the opening near the edge presents one or more rows of small tubercles in addition to the tooth; from the growth of the tooth an internal rib is formed, which generally causes a corresponding groove on the exterior. Lamarck's type of this genus, *M. cingulatum*, possesses some singularities: its columella is not smooth, but irregularly plaited or wrinkled, and the tooth does not extend within the interior of the whorls, as in most of the

other species, but appears affixed only at the edge of the lip. De Blainville has made this genus a subdivision of the genus *Purpura.*

MONOCULUS (Linnæus) One-eyed. Under this generic name Linnæus comprised a variety of crustaceous *Entomostraca*, varying very greatly in their structure, composing, in fact, in the modern systems, the order *Branchiopoda* (which see), to which all the Linnæan *Monoculi* belong, with the exception of his largest species, *Monoculus Polyphemus*, or the *Limulus Polyphemus*, Latreille, serving as the type of the sub-order *Xyphosura*, belonging to the *Pœcilopoda*, which was the first species in the genus *Monoculus*, according to Linnæus. Under these circumstances the Linnæan name *Monoculus* has entirely sunk, being neither employed generically nor specifically. The name is, however, so appropriate for some of the species which possess but a single eye, and more especially for the Linnæan *Monoculus pediculus* (*Polyphemus oculus*, Müller, the head of which is distinct, and entirely occupied by a large eye), that we would suggest the propriety of retaining it for the last-named insect, rather than suffer a good old Linnæan name to fall into disuse.

MONODONTA (Lamarck; Turbo, Trochus, Linnæus). In constituting this genus of molluscs, Lamarck appears to consider it an intermediate link between the *Trochus* and the *Turbo*, with both of which some of its species had been confounded by Linnæus; he was in this principally guided by the aperture being rounder and scarcely at all depressed as in the *Trochus*, and from the *Turbo* by a thickened callosity running round the columella, forming a projecting angle at the base of the aperture; we cannot, however, consent to call this a tooth-like appendage, as it is, when best defined, nothing more than a notch occasioned by a continuous sulcated groove running uniformly from the spire to the base. There are, however, other remarkable distinctions which may authorise its being distinguished and classed as a division of the genus *Turbo*, to which we are disposed to assign it; these are the rounded entire aperture, the margin disunited at the upper part, and close by an operculum; in some the margin appears double, or rather it is grooved in its thickness. The animal is also organised precisely similar to that of the *Turbo;* it is phytophagous; some breathe air, but the greater number of aquatic species are marine molluscs. The name of this genus appears to us unhappy, as the characters are not sufficiently strong to warrant its application, and it would have applied more appropriately to the *Monoceros*, which more resembles a tooth than a horn.

MONODORA (Dunal). An ornamental shrub called in Jamaica the American nutmeg. The flowers are polyandrious, and the plant belongs to the natural order *Anonaceæ*. Gærtner called this plant *Anona myristica.* Generic character: calyx in three parts; petals six, in two series, outer ones acutely lanceolate, interior ones ovate, short and thick; stamens bearing subsessile anthers crowded; style none; stigma sitting; berry large, globular, one-celled, and many seeded. The plant thrives in our stoves, when planted in loam and moor-earth, and is increased by cuttings.

MONOPHORA (Quoy and Gaimard). A species of mollusc arranged by De Blainville as a division of the genus *Salpa;* it possesses no testaceous covering, and its singular structure will be more fully explained under *Salpa.*

MONOPLEUROBRANCHIATA is De Blainville's third order of the second class *Paracephalophora:* it includes the families *Subaplysiacea*, which contains the genera *Berthella, Pleurobranchus*, and *Pleurobranchidium, Aplysiacea, Dolabella, Bursatella, Notarchus, Elysia, Patelloidea, Oombrella, Siphonaria, Tylodina, Akera, Bulla, Bellerophus, Bullea, Lobaria, Sormotus, Gasteroptera, Atlas*, each of which will be explained under their respective heads.

MONOTOCA (Dr. R. Brown). A genus of evergreen shrubs, introduced from Australia, and belonging to *Epacrideæ*. Generic character: calyx five-cleft; corolla funnel-shaped, with a five-cleft limb, throat beardless; disk surrounding the germen, cup-shaped and lobed; stamens with filaments inserted into the tube of corolla, anthers incumbent, two-valved, and somewhat protruding; style simple, stigma headed; drupe, a one-seeded berry. These are greenhouse plants, and succeed and are increased by the ordinary management.

MONOTREMATA. A small group of marsupial mammalia of New Holland, agreeing with the ground edentata among placental mammalia in some particulars, but being so peculiar in others, that they stand alone in the system as distinct from the other marsupial animals as they are from the placental. The character upon which the name of the group is founded is that of having only a single posterior opening to the body, as in birds. On this account many naturalists were long of opinion that these animals are oviparous; but observation has shown that they are mammalia There are only two known genera, the Echidna and Ornithorhynchus, each forming a separate genus. See these articles, and also the general article Mammalia, in this work.

MONSONIA (Linnæus, Jun.). A genus of greenhouse perennials, natives of the Cape of Good Hope. The flowers are monadelphous, and the genus ranges among the *Geraniaceæ*. Generic character: calyx of five sepals, mucronate and awned at the top; petals five, large, bitten into teeth; urceolus bearing stamens; anthers oblong; style awl-shaped; stigmas five; urceoli five-seeded; seeds with twisted tails. Propagated by cuttings or from pieces of the root.

MONSTER. Any production of nature which, in the form of its organs, or any of them, deviates from the usual type of its species. The word is not applied to unusual colour, or to a deficiency of the usual number of parts. Thus, for instance, an albino is not accounted a monster; neither is an animal which comes into the world without one or more of its limbs. If, however, there is a part which deviates completely from its type, or one which is doubled, or has a portion of a similar or a different part adhering to it, or growing out of the same structure with it, then it is considered a monster, and the monstrosity is considered as being greater in proportion as the part thus produced is larger and more important.

There is nothing in the name monster, considered in its general meaning, which conveys anything more than that the subject to which the term is applied is calculated, *monstrari*, to show itself, or cause itself to be taken especial notice of; and then it may be with propriety, and it is in fact, applied to a remarkable showing of any kind, whether natural or moral, good or bad.

Natural monsters have attracted a good deal of attention, more especially in the ages of ignorance, and much has been written on their physiology with-

out throwing any great or useful light upon the subject. When we calmly reflect, we can easily see that all such speculations must be vain, as incapable of leading to any satisfactory result. Before we are even in a condition for entering upon the inquiry, why, in certain cases, the animal should deviate from its type, we should be in possession of a satisfactory answer to the previous question, namely, why it should follow that type in the majority of instances to which the monstrous cases form the rare exceptions? and, as we have no means of getting correctly at this cause of the general uniformity of nature's productions, it would be in vain for us to endeavour to settle the physiology in the case of monsters, notwithstanding the superstitious associations which the ignorant are so prone to couple with them. Indeed it is chiefly with the view of pointing out the useless and unsatisfactory nature of such inquiries that we have introduced the article MONSTER even in this brief notice.

Monsters are looked upon by the ignorant very much in the same light as miracles, and, like these, they are deviations from the ordinary course of nature. So far all is well; but there is an association borrowed from the miracle which mixes up with the popular notion of the monstrous production, and which is really of mischievous tendency, as giving a most erroneous turn to the thought. The miracle is always supposed to be the result of some supernatural agency external of the common laws of nature, and in opposition to them; and, such being the case, the real miracle is looked upon as a special and immediate act of the Divinity, for the purpose of accomplishing some end which could not be arrived at by the common laws of nature. Historically we know but one subject to which there was the slightest necessity for the application of miracles, namely, the establishment of those doctrines of Divine Revelation, which, being above the utmost extent of the human powers in their peculiar and mysterious parts, do not admit of the same kind of demonstration as facts or deductions in ordinary philosophy. Miracles of this kind were required for only a very limited time. That time has long since gone by; and every supposed miracle which has been mentioned since has been a mere imposture, and abuse of the credulity of mankind, resorted to for the purpose of accomplishing some end which could not be accomplished by fair and philosophical means.

As the production of a monster is a deviation from the ordinary course of nature as well as a miracle, the one is very apt to be confounded with the other; and weak, though well-meaning persons, are very apt to suppose that the monstrous production is the result of a special interference on the part of the Almighty, as well as the true miracle. If, for instance, one of a family shall have the misfortune to be born with any monstrosity, the vulgar conclusion is, that some sin of the parent is thereby visited upon the child; and, even if it should happen in the case of a domestic animal, there is a tendency to look upon it as the punishment of some transgression committed by the master of that animal.

These are errors which struggle with great stubbornness against all the enlightenment of the present times; and, although unintentional errors, they are very mischievous ones, as tending to lay the axe to the roots both of sound thinking and of correct moral feeling, it becomes every one's duty to assist in the exploding of them.

The previous question, upon which we must remain for ever ignorant, ought to keep us right here. We do not, as has been hinted, know why species are, generally speaking, true to their types; but we do know that artificial treatment can, without breaking down the type so as to render it monstrous, change it to a very great extent. These changes are not, however, produced by simple volition on the part of man; for a man may wish and will long enough before he can change a Shetland pony into a dray horse, or a cart horse to a racer. Means must be employed, and persevered in, proportional to the change which is desired; and, if the means have been properly tried by former experience, they never fail of success. But the deviation from the type of the species as to form is merely a physical result, as well as the change of all the parts without deviation in any one of them; and therefore it must depend on physical causes just as much as they do. Consequently, when we speak of a monster as a deviation from the laws of nature, we speak incorrectly. The truth is, that the deviation is not *from* the law, but *of* the law; and unless there were a specific cause in the individual case, adequate to the production of the monstrosity, the monster would not be produced. It is true that this new law, which produces a result different from the ordinary one, is a law of which we do not possess, and possibly cannot acquire, the knowledge; but, notwithstanding this, we have no more right to say that there is a special interference of the Divinity required to produce the deviation from the type in the one instance, than we have to say that there is a similar interference for the purpose of preserving the type in every case where it is not departed from. Deviation or no deviation, the laws which God has from the beginning established for the world's economy are perfectly adequate to carry on that economy; and true to those laws physical nature works, and every modification of the law, whether it be known to us or not as a cause, is as necessarily followed by a corresponding modification of the result as effect follows cause, and expresses the measure of its nature and efficiency in any other case.

MONTEZUMA (Mocino and Sessi). A genus containing as yet only one highly-ornamental tree, a native of Mexico, belonging to *Bombaceæ*. Generic character: calyx hemispherical and truncate, the rim sinuated; petals five, and large; stamens spirally twisted round the style, stigma club-shaped; berry globate, four or five-celled, each with many seeds.

MOON SEED is the *Menispermum Canadense* of Linnæus, a climbing shrub commonly planted for covering bowers, and increased by dividing the roots.

MOON TREFOIL is the *Medicago arborea* of Linnæus, an evergreen shrub, a native of Italy, long introduced into our gardens. It is usually kept in greenhouses, but will bear the open air with but a slight protection from frost. Seeds or cuttings.

MORÆA (Linnæus). A genus of bulbous plants, chiefly natives of the Cape of Good Hope, and belonging to the splendid order *Irideæ*. Generic character: spathe elongated, and somewhat scaled; corolla six-parted, interior petals smallest; stamens opposite the gashes of the pistil, filaments partly united; pistillum in three petal-like divisions; capsule three-celled and many-seeded. These bulbs require the same treatment with other Cape sorts; that is, potted in light sandy loam and leaf mould, kept dry while dormant, but duly supplied with water

when growing. They should be fresh potted every autumn, and when they have made roots they may be removed from the cold frame into the greenhouse to flower. They are increased, like other bulbs, by offsets; or they may be raised from their seeds.

MORDELLIDÆ (Leach). A family of coleopterous insects, belonging to the section *Heteromera*, and sub-section *Trachelides*, Latreille, having the body of an elevated and arched form, the head inserted very low, the thorax semicircular, the elytra narrowed towards the tips, or very short, and the abdomen sometimes produced into a point. In the form of the antennæ many of these insects approach the *Pyrochroidæ;* whilst others in the form of the maxillæ, tarsal claws, and parasitical habits, are allied to some of the *Cantharidæ*. They differ from these, however, in the solid consistence of the body, and especially in their great activity. The species are generally of small size, and occasionally variegated in their colours; they frequent flowers, especially those of the whitethorn, in the imago state, and fly and run very quickly. The British genera are *Anaspis*, *Mordella* and *Ripiphorus*. The first has the wing-covers entire, and the abdomen not pointed; whilst the second differs from the preceding, in having the abdomen terminated in an acute point; the tarsal claws are also here denticulated, and the antennæ filiform and serrated. There are seventeen British species of *Anaspis* and eight of *Mordella*, the type of the latter being the *Mordella aculeata*, Linnæus.

The genus *Ripiphorus*, Bosc, is distinguished by having the elytra narrowed at the tips, so as not to be able to meet in a straight line down the back, nor to cover the wings; the antennæ of the males are deeply pectinated, and serrated in the females. There is only one British species, *Mordella paradoxa*, Linnæus, a remarkable insect, which resides in the nests of a wasp (*Vespa rufa*), and respecting which Mr. Kirby has given the following notice in the second volume of his Bridgewater Treatise.

"Connected with the subject of parasites is a singular history communicated to me by the Rev. F. W. Hope, one of the most eminent entomologists of the present day. In the month of August, 1824, in the nest of the above mentioned species of wasp, he found more than fifty specimens of a singular little beetle, which may be called the wasp-beetle, long known to frequent wasps' nests. From their being found in cells which were closed by a kind of operculum; he conjectures that they lay their eggs in the grub of the wasp, upon which they doubtless feed subsequent to this; upon opening some of the cells, he was surprised to find, instead of beetles, several specimens of an *Ichneumon* belonging to Jurine's genus *Anomalon*. Upon another examination, some days after this, no more of these last insects appearing, he discovered that they had been pierced in their chrysalis state by a minute species belonging to the family of the *Chalcidians*, of which he found no less than twenty specimens flying about in search of their prey. From the above facts, Mr. Hope remarks, we have a convincing proof, if such were wanted, of a *superintending power* which ordains checks and counter checks to remedy the superfecundity of the insect world. First the wasp, a great destroyer of flies and various other insects, and often a troublesome pest and annoyance to man himself, is prevented from becoming too numerous, amongst other means, by the wasp-beetle; then, lest it should reduce their numbers so as to interfere with their efficiency, this last is kept in check by the *Anomalon*, which, in its turn, that it may obey the law, 'thus far shalt thou come, and no further,' becomes the prey of another devourer. Mr. Hope observed, and the fact is curious, that the specimens of the wasp-beetle obtained from the female wasps were about one-third larger than the others."

MORINGA (Decandolle). A Malayan tree, of rather an ornamental character, belonging to *Leguminosæ*. In India it is called the horse-radish tree, because the roots are so acrid that they are used instead thereof. It is a stove plant, and may be increased by cuttings.

MORMOLYCE (Hagenbach). A very curious genus of coleopterous beetles from Java, belonging to the family *Carabidæ*, and apparently to the subdivision *Brachinidæ*, having the body flattened and dilated, scarcely exceeding in thickness a sheet of paper; the antennæ are as long as the body; the head very greatly elongated behind the eyes; the sides of the thorax dilated and notched; and the elytra furnished with a broad lateral leaf-like appendage, extending far beyond the extremity of the body, giving the insect much more the appearance of a *Mantis* or *Phasma* than that of a carabideous insect; the legs are long and slender. We know nothing of the habits of this remarkable creature, which is specifically named *M. phyllodes*, from its resemblance to a leaf. The length of our fine specimen is not less than three inches and a half. A good figure is given in the title-page of Mr. Shuckard's Manual of Entomology.

MORSE (*Trichecus*). A very singular genus of mammalia, belonging to Cuvier's tribe of amphibious animals, and one of the largest and most remarkable of that singular tribe. There is only one known species of this genus; but the singularity of its appearance has procured for it a great number of names. It is called "the walrus," "the sea-cow," "the sea-horse," and some other names, but they all refer to one and the same species of animal. It has often (see MAMMALIA) been classed with the herbivorous cetaceæ; but in this a double error has been committed, for it is not a cetaceous animal at all; neither is it, generally speaking, herbivorous, if we judge of it from its alimentary system, though it is alleged that it occasionally feeds on the more succulent kinds of sea-weed. The only animals with which it agrees in its general structure are the seals; and, although there are very wide differences between them, some of the most essential points are very much alike in both. The hind legs, for instance, though imperfectly developed, and in great part united with the tail by means of the membranes, still exist, while in the cetacea they are entirely wanting.

When, however, we come to examine the teeth, we find a remarkable difference between the teeth of this animal and those of the seals. The teeth of the seals approximate to those of the carnivora; while in the morse there is an approach toward the elephant, though not sufficiently great to bring the animals within the same class, even in their dentition. The most remarkable character of the mouth of the morse is the immense canine teeth with which the upper jaw is furnished. Those teeth are curved downwards and slightly forwards; they are rounded on their external surfaces, and furrowed on their internal.—They form an article of commerce, as ivory; but their texture is not formed of curves of different

colours intersecting each other, like that of the tusks of the elephant; it is of uniform texture throughout its internal substance. They have neither incisive nor canine teeth in the lower jaw; and that jaw is compressed to give scope for the vast canines of the upper, which descend from the sides of the mouth to the distance of fully two feet, and are thick and strong in proportion. The vast sockets required in the upper jaw for supporting those great teeth swell that part out into a large blunt muzzle; and the nostrils, as if pushed out of the way to make room for the great teeth, are turned upwards. Over the sockets of the canines there are placed two tufts of coarse whalebone looking hairs, having the form of great mustachoes which spread beyond the sides of the head. The central part of the mouth, the only part which the animal can use in feeding, is much compressed laterally; and the lower part of the nose, which divides the mustachios from each other, is also very narrow. The shape of the nose is curious, as the extremity of it consists in two loop-like appendages, having their broad ends uppermost, and each surrounding a nostril. The upper jaw contains two incisors, which are very small, and resemble grinding teeth more than cutting ones; and between these again the young specimens have pointed teeth still smaller, which drop out before they arrive at full maturity. The cheek teeth are four on each side of the upper jaw, which are cylindrical in their sections and obliquely truncated on their crowns. In the adult animal these stand at some distance apart from each other, because in the young there are smaller ones between them which drop out like the small one in front of the canines. In the lower jaw there are only four cheek teeth in each side, which in their forms resemble those in the upper jaw. It does not appear that the canines can be used for conducting the food to the mouth, or preparing it for the stomach; but it is highly probable that they are very efficient against enemies; and the animals also use them as hooks in climbing up those steep rocks and masses of ice, the summits of which they could not otherwise reach. The head is rounded; there are no external ears; and the body is tapered away in the rear, like that of the seals. The anterior extremities are developed to pretty nearly the same extent as those of the seals; and they are used as oars or fins in swimming, and as claspers, and partially as a sort of clumsy feet; but the posterior extremities are so united with the tail that they have very little separate motion. The tail is short, in its developed part; but as the whole body, from the internal cavity backwards, acts a good deal after the fashion of a tail, these animals get through the water with more celerity than their appearance would lead one to suppose. The posterior part of their bodies indeed has but a feeble swimming power compared with that of the whales. It has, however, a little twisting motion of a peculiar kind; because the extremities of the hind feet are capable of being, partially at least, elevated or depressed above the mesial line of the tail; and thus the sort of sculling blade, formed by the three, can act either horizontally or slightly twisted to the one side or to the other. From the high latitudes to which these animals are chiefly confined, the danger of following them near the rocks where the weather is so very inconstant as it is in the high northern latitudes, even during summer, there is much less known of the habits of these animals than could be desired. We do not even know distinctly upon what they feed. The internal portion of the alimentary system is, as we have said, similar to that of the seals; and the seals are known to feed exclusively upon fish, and not by any chance upon marine vegetables. It is probable that the principal food of the morses is also animal; and yet sea-weed is certainly quoted by almost every describer as forming a portion of its subsistence. It is probable, however, that it may only poke among the sea-weed with its long tusks, which can act like a most efficient two-pronged hoe; and thus it may dislodge from the sea-weed about the rocks those animals upon which it feeds. From the absence of both incisors and canine teeth in the lower jaw, the extreme smallness of the incisors in the upper, and the total unfitness of the canines of that jaw, large and strong as they are, for biting, it is evident that the anterior part of the mouth can serve no purpose, except that of a simply prehensile instrument for laying hold of the food; but the curious cup which the under lip and jaw form when the mouth is opened fit it uncommonly well for such a purpose; and from the shortness of the head, and the strength of both jaws, together with the form of the cheek teeth, there is no doubt that these could crush very easily the hardest covering found on any of those crustacea which inhabit the rocks. We are, however, so little acquainted with the actual feeding of the animal, that any conclusions at which we can arrive concerning it are analogies drawn from its external structure rather than facts which have been observed. The animal is confined to the high latitudes, and we believe to the northern hemisphere, at all events no mention is made of it in the southern. There have been instances of its occurrence in the extreme north and north-western isles of Scotland; but they are exceedingly rare, and occur only in severe winters, when the animal is frozen out, or rather in, for a great part of the north. In former times these animals were taken in considerable numbers upon the shores of the Norwegian seas; but such is not the case now, and any which appear even there must be regarded as rare stragglers. There has been a gradual declining toward the north of all the more polar inhabitants of the European seas, in the course of modern history; but whether this is to be mainly attributed to the extent to which they have been captured by the fishers, or to some natural causes, it is not easy to determine.

There is only one species of morse (*Trichechus rosmarus*) to which, of course, the general observations which we have made apply, and indeed necessarily form a part of its particular description. In the extreme north, as, for example, at Spitzbergen, which may be said to be the extreme limit of land in our seas, it is sometimes found about eighteen fee in length, twelve feet in circumference at the thickes part, and with the tusks about two feet. Specimen of this large size are but rare, however; and sixtee feet long, ten feet girth, and twenty inches length o tusks, is reckoned a large animal. A specimen which came on shore on the island of Harris in De cember, 1817, was about ten feet long, and, as th tusks were not above eight inches and a half, it wa supposed to be a young one. It was shot while resing on the top of a rock. It is probable that it wa more abundant on our shores in ancient times, fo Strabo mentions that ivory bits of British manufactre were exported to Rome, and it is probable that te

tusks of this animal supplied the materials, though probably also the tooth of the narwhal—which, though now rare as well as the morse, was perhaps more abundant in former times—may have, in part at least, supplied materials for the same purpose.

The general colour of the morse is brown, pretty much like that of the common seal; and indeed there are many coincidences in the characters of the two animals, though the seal is, generally speaking, the more numerous, the more widely distributed, and the more discursive of the two—ranging over a wide extent of sea, while the morse generally keeps near its northern shores.

Both animals are, however, very similar in their habits. They are social, resorting in great numbers to favourite places of the coast, lying on the rocks or the ice-bergs, basking in the sun, until hunger compels them to resort to the water for a supply of food. The female brings forth her young early in the season, and suckles it in the same manner as the female seal does. As the morse is a much more unwieldy animal than the common seal, or indeed than any of the seals, it is probable that it does not fish in the same bold and dashing style. The seal, though, probably from its more landward form, not so swift a swimmer as the porpoise, is yet able to follow the swift fishes, and seize them in the currents. The morse is also less active on land than the seal, but it is more expert as a bank animal, as its tusks enable it to climb to heights which the seal cannot possibly reach. These differences in the conformation of two animals of the same family, living in the same places, present a good instance of that judicious adaptation in nature which prevents any one animal from coming exactly on the ground of another, but provides, that the one shall take that which, in its kind, or the mode of taking it, the other must leave.

Many accounts have been given of the morses, and also of the mode of capturing them, but we shall content ourselves with a short extract from Zorgdrager. "The seals and morses," says he, "come during the heat of summer into the seas near the Bay of Horisant and that of Klock in troops of eighty, a hundred, and even two hundred, especially the morses, which remain there many days, until hunger forces them back into the main ocean. Many morses are seen towards Spitzberg. On land they are killed with lances. They are hunted for their tusks and fat. Their oil is nearly as much esteemed as that of the whale; their tusks are also very valuable. The interior of these teeth is considered more valuable than ivory, and is of a substance harder and more compact in the larger than in the smaller teeth. A morse will furnish half a ton of oil. When one of these animals is encountered on the ice, or in the water, the hunters strike him with a strong harpoon, made expressly for the purpose, which will often glide harmlessly over his thick and hard skin. When it penetrates, the animal is drawn towards the vessel with a cable, and then killed with a lance peculiarly formed. He is then drawn to the nearest land or flat iceberg. They then flay him, throw away the skin, separate the two tusks from the head, or simply cut the head off, cut out the fat, and carry it to the vessel."

The seals consist of many species, and are scattered over almost all seas, sometimes in numbers which defy all counting; and those which inhabit parts of the world remote from each other, generally have corresponding differences of appearance. The morses on the other hand, are limited to a single species, and confined to the polar regions of the north. Hence we are led to conclude, that the use of them is very limited, as compared with that of the seals. Nor can we fail in being struck with another remarkable fact which presents itself, with regard to the mammalia of the Arctic Polar Sea. The great black whale of Greenland, which is the whale by way of eminence, though in powers of locomotion it is vastly superior to the morse, is yet confined, not only in its locality, but to very nearly the same locality as that animal. The morse is the largest animal of its group, and its mouth is armed in a very peculiar manner; and the Greenland whale is also the largest animal of its group, that is of the toothless whales, and it also has the mouth peculiarly armed, by having the baleen or whalebone much more developed and perfect than any of the rest. This is a curious coincidence, and one which is well worthy the attention of inquirers.

MORUS (Linnæus). A genus of deciduous trees and shrubs, natives of Asia and Europe, a majority of which are cultivated. Class and order *Monœcia Tetrandria*, and natural order *Urticeæ*. The *M. nigra*, common mulberry, is well known. The mild acidity of this fruit is exceedingly grateful, especially to persons labouring under fever. It is slightly laxative, and, like the raspberry and strawberry, is said not to undergo the acetous fermentation in the stomach; and hence it may more safely be eaten by gouty patients than many other fruits which have not the same anti-fermentative properties.

The white mulberry is chiefly cultivated for the value of its leaves, its fruit being insipid and very inferior to that of the common species, the leaves of which are equally good with those of the white, and in some parts of Spain and Persia preferred to them as the food of silk-worms. It is likewise a more hardy tree, having, according to the fable, become callous when it changed the colour of its fruit from white to dark red, on absorbing the blood of Pyramus and Thisbe self-slain beneath its shade.

Mulberry trees are easily propagated by layers, or large truncheons of the branches. The story of a gate-post, made of a mulberry trunk, becoming and now remaining a fruitful tree is well authenticated.

MOTACILLA, the generic name of the wagtails. See WAGTAIL.

MOTH. The ordinary English name given to the lepidopterous insects comprising the Linnæan genera *Sphinx* and *Phalæna*, the remaining insects of that order being diurnal, and known by the name of butterflies (*Papilio*, Linnæus). Moths are at once distinguished not only by their being seldom observed on the wing during the day, but also by their antennæ not being terminated by a club, as in the butterflies. There is very great diversity in the structure of these insects, of which a vast number of species are inhabitants of moderate climates. In this country we possess nearly 1800 species, and many more are known on the continent. It is true, that of the exotic species our knowledge is but slight, there being very few entomologists indeed who attempt to make collections of the tropical or extra-European species; the consequence whereof is, that the classification of these insects has been very greatly neglected by most authors, and little beyond the establishing certain great typical forms effected. Indeed, it is perhaps a natural consequence of the peculiarities of our climate

that we possess such an extensive series of these insects. Our vegetation is sufficiently varied and luxuriant to support a great number of species, whilst the great duration of twilight in our latitudes calls for a greater supply of species, which appear only during its continuance, than is probably to be found in tropical climates, where the twilight is but of very short duration. In our country, for instance, the functions of these insects appear to be twofold; first, as plant-feeders; and, second, as serving for food to the bats and other nocturnal vertebrata; but in the tropical climates, where the butterflies so far exceed both in number and size our few diurnal lepidoptera, there exists but little necessity for the former, whilst in the latter respect they are still less needed; because, as stated in the article Bat, the tropical species of this tribe of animals come abroad by day at all hours, their ravages extending to fruits, flowers, the juices of trees, animal substances of all kinds, and, in short, to everything consumable. Hence we may perhaps look upon the temperate parts of the globe as the metropolis of this tribe of insects, as well as of the *Brachelytra*, &c.

As may be supposed, from the great extent of this tribe of insects, there is very great diversity in their size, structure, habits, colours, &c. From the gigantic *Erebus strix* of South America, which measures very nearly a foot across the wings, and the Death's-head moth, capable of instilling terror into an ignorant and superstitious multitude, down to the pigmy gilded creature which revels upon the parenchyma of a rose-leaf, finding between its upper and lower surfaces room "enough and to spare" for its abode, we have every gradation of size. The structure of many of these insects in the perfect state is very interesting and diversified. In some, formed for rapid and long-continued flight, the body is robust and conical, and the wing-nerves of great strength; whilst in the feeble *Geometræ*, which flit around the hedge-rows occasionally by day, the whole structure is light; but it is to the *Alucitæ* and *Pterophori* that we may best apply the term "as light as a feather," because their wings are slit from the tip almost to the base into distinct fringed pieces, which have all the appearance

Bombyx (Saturnia) Promethea, male.

of separate feathers. In many moths we find the mouth completely obsolete, there being not the least vestige of the spiral tongue, which forms so conspicuous a character of the order. But it is in the diversity of the sexes that we often find the greatest variation, the males being generally of smaller size and brighter colours than the females; their antennæ are also often very beautifully ornamented with lateral branches, so as to resemble a double comb (an example of which may be given in the *Saturnia Promethea*, the early history of which we have given in our article Caterpillar), whilst those of the females are comparatively simple; but a still greater diversity exists between the sexes of certain species, the females of which are completely wingless, and their bodies misshapen; so that it is impossible, except by direct observation, to suppose that the male and female can belong to one and the same species. This, however, is the case with but very few species; but in almost every instance the males of these species are furnished with beautifully pectinated antennæ. Of the habits of these insects we can here say but little; they are so exceedingly various, that they have already formed, and will continue to form, the subjects of various articles wherein the different groups are treated upon in detail. We may, however, here remark, that whilst the majority of the species fly by twilight, or during the night, there are some which delight in the hottest sunshine, as the humming-bird hawk moth, the *Sesiæ*, &c. Many species delight to hover, during the twilight, over the long-tubed flowers, from which, whilst on the wing, they extract the nectar with their long spiral tongue, whilst others are very sluggish, scarcely showing any animation except during the short period of their coupling. Of course, we need hardly mention that all these moths have proceeded from larvæ hatched from eggs deposited by parent insects; but it may perhaps be necessary to remind some of our readers, who have paid but little attention to these subjects, that such is the fact. The writer had, for example, much difficulty, a short time ago, in making a non-natural-history reader comprehend that "the moth" had got into his wardrobe. He saw no moths flying about, it was true, but the little woollen cases formed by the caterpillars of this particular group of moths (of which there are many species, *Tinea vestianella, pellionella, tapetzella*, &c.) were plentiful enough; but we could scarcely make our friend comprehend how these could possibly be "the moths." And this brings us to speak of the different habits of the larvæ or caterpillars of these insects; but we have need only to refer to our article Caterpillar, where we have given ample details upon this part of the subject, as well as to the articles Chrysalis and Cocoon, considering it necessary in this place merely to state, that amongst lepidopterous insects, which form cocoons, the far greater, and almost entire number, are moths, a few exceptions only occurring in the butterflies; and that the form of the chrysalis, owing to its being enclosed in a cocoon, is necessarily conical, and not armed with those angulated points observable in the crysalides of butterflies, and which would be troublesome to a chrysalis enclosed in a cocoon.

Of the colours of this group of insects, it may be in general said that they are obscure, and but slightly varied, exhibiting none of that splendid appearance which is seen with so much delight in the butterfly; exceptions, however, occur, as we have stated in the article Catocala.

There is a circumstance connected with these

insects which every one must have noticed, namely, their habit of entering lighted apartments during the summer evenings, and flying around the candles until their wings are burnt. We are at a loss how to account for this peculiarity in insects whose ordinary habit it is to avoid the light, and to remain inactive until the twilight has commenced. Is it an extatic kind of bewilderment which compels the creature, even at the risk of its own life, to whirl round a light at the particular period of time when it ought to be upon the wing? It would be a curious experiment to ascertain whether a noctua, for instance, would act thus, if introduced into a darkened room in the middle of the day, into which a light were afterwards to be brought. This may seem an absurd experiment; but we have so much to learn of the economy of insect life, that it might possibly tend to other and more advantageous experiments. This habit of flying towards a light is made use of by collectors of moths, who hang a bull's-eye lantern round their necks, and, with the assistance of a flap-net, are enabled to make very extensive captures during an evening's walk.

For the classification of these insects, and for many other particulars which it is unnecessary here to repeat, we must refer to the articles LEPIDOPTERA, HAWK-MOTH, BOMBYX, GEOMETRIDÆ, &c.

MOTHERWORT is the *Leonurus cardiaca* of Linnæus, a British herbaceous perennial, found on gravelly banks, bearing spikes of labeate flowers.

MOUNTAIN ASH is the *Pyrus aucuparia* of Gærtner, a British ornamental tree, found in moist woods. It is cultivated for the beauty of its form and foilage, and for the splendour of its bunches of scarlet berries, so conspicuous in autumn and winter.

MOUSE. See ARVICOLA for some of the species of this exceedingly numerous and curious group; and RAT, for the rest of them, and the general relations.

MOUTAN is the Chinese name of the *Pæonia suffruticosa*, and applied as a specific name in botanical lists. This is a highly-valued plant in China, as well as in this country, ever since its introduction. There are several varieties of it, and all hardy enough to bear the open air, with slight protection in winter; but they flower much finer under glass. They succeed in any kind of garden soil, and are increased by layers or cuttings. The *Ixora coccinea* is called the *Canton moutan* by the gardeners of that city. The Chinese have many varieties of peony not yet introduced into this country.

MOVING PLANT. This is the *Desmodium gyrans* of Decandolle, and the *Hedysarum movens*, or *gyrans*, of Linnæus. The latter described this plant as "wonderful on account of its singular motion, which is not occasioned by any touch or irritation, or movement in the air, as in *Mimosa*, *Oxalis*, and *Dionæa*; nor is it so evanescent as in *Amorpha*. No sooner (continues he) had the plants raised from seed acquired their ternate leaves, than they began to be in motion in every direction. This movement did not cease during the whole course of their vegetation, nor were they observant of any time, order, or direction; one leaflet frequently revolved, while the other, on the same petiole, remained quiescent; sometimes a few leaflets only were in motion, then almost all of them would be in movement at once; the whole plant was but seldom agitated, and that only during the first year. It continued to move in the stove during the second year of its growth, and was not at rest even in the winter. The irritability of this *Desmodium* is never so great, even in our best hothouses, as it is said to be in Bengal, and its motions here are seldom so lively as those described by Linnæus; though the two upper and opposite leaflets are often observed to rise and fall alternately, provided the temperature be as high as 70° of Fahrenheit, and the plant be placed in shade. The motion is most evident when the stove is closed, and the air perfectly still. These movements have more the semblance of spontaneity than any others that have been observed in the more perfect plants; for the leaflets, if held quiet between the fingers for a short time, and these movements thus prevented, are said, immediately on their release, to revolve with accelerated speed, as if to make up for the time lost during the forcible interruption."

MUCUNA (Adanson). A genus of tropical climbers belonging to *Leguminosæ*, separated from, and including some plants of, the genera *Dolichos*, *Stizolobium*, and *Carpopogon*. Some of the species are remarkable for their stinging properties. Their seeds are imported under the name of "bulls'-eyes," and may be used as beads. The flowers are showy, and the plants easy of cultivation in stoves.

MUGILOIDÆ—the Mullet family. The eleventh of those families into which Cuvier divides the spinous-finned fishes, but which must not be confounded with the surmullets, which are sometimes popularly called mullets, but which belong to the perch family, and have not the labyrinths in the pharynx which characterise that division of fishes to which the mullets belong. The whole of this division of fishes are capable of retaining a portion of water for some time in the pharynx, by means of which they can keep their gills moist for a longer or shorter time, and thus live out of the water. The mullets get the name *Mugil*, because, when out of the water, the escape of the small portion of air which is expelled from the lungs murmurs (*mugit*) as if the fish had voice.

The mullet family consists of three divisions, *Mugil*, *Tetrogonurus*, and *Atherina*, which will, however, be better considered separately; and the mullets themselves, which differ considerably in the several species, shortly noticed in this article by themselves as a little sub-group. Taking them in this point of view, they are pretty distinct, and offer the following characters:—Their body is nearly cylindrical, or about equal in depth and breadth; their scales large; two dorsal fins distinctly apart from each other, with four spinous rays in the first one; the ventral fins abdominal, but placed farther forward than the first dorsal, and only a little behind the pectorals; the middle of the under jaw with a compressed, elevated and angular point, which fits into a corresponding groove in the upper jaw; the teeth small, and six rays in the gills; the head is rather depressed, and covered with large scales; their teeth are often so exceedingly small as hardly to be visible to the naked eye; the bones of the pharynx are very much produced, and give the entrance of the gullet nearly the same form as that of the mouth, so that nothing can enter the stomach but liquids or very small substances; the stomach terminates in a sort of muscular gizzard, bearing some resemblance to the gizzards of birds; the pyloric appendages to the stomach are few, but the intestinal canal is long and of ample diameter. The mullets

are handsome fishes, and highly esteemed. They swim near the surface, ascend the estuaries of rivers, and are remarkable for the extensive leaps which they can take out of the water. The species are rather numerous, and there is some confusion in the foreign ones; we shall therefore confine our notices to those species which are found at one part or other of the European shores.

The Grey Mullet (*Mugil capito*). This is by much the most common of the British species, though it is one respecting which there have been mistakes. It appears, from the *Fauna Italica*, now publishing by the Prince of Musignano, that there are five species of grey mullet found in the Mediterranean, while there are not so many in our seas. *M. cephalus* is one of the species found in the Mediterranean, and not hitherto at least, in the British seas, though *M. capito* is not only found in those seas, but as far to the north as the coast of Norway, and in the Baltic. By some means or other, the trivial name *Cephalus* was for a long time applied indiscriminately to all the grey mullets of Europe; and thus it was made to appear that a fish, which is in reality confined to the warmer seas, is generally distributed. Mr. Yarrell, in his excellent work on British Fishes, thus clearly points out the difference of these two species:—"*Mugil cephalus* is distinguished by having its eyes partly covered with a semi-transparent membrane adhering to the anterior and posterior part of the orbit, and also by a large elongated triangular scale pointing backwards, placed just over the origin of the pectoral fin on each side. A dried specimen of this fish from the Mediterranean, now before me, exhibits both these peculiarities, which *M. capito* does not possess. The appearance of the pectoral fin, and the superposed triangular scale of *M. cephalus*, supply the means of comparison with our own grey mullet, in which the pectoral fin scale is short and blunt."

It should seem from this, and from various other collateral circumstances, that the grey mullet is the *Ramado* of Nice, the *M. capito* of Cuvier; and Cuvier himself seems to have been perfectly aware of the confusion which had been introduced into the history of this fish. He says distinctly, in a note to the last edition of the Règne Animal, that "Linnæus, and many of his successors, have confounded all the European mullets under one single species (their *Mugil cephalus*)."

This is perhaps not to be wondered at. Linnæus found a description of mullets in the Mediterranean, and he observed in the North Seas one not essentially different, and thus he fell into the mistake. There is no question, however, that the common mullet, which is not a rare fish on many parts of our coasts, is *capito*, not *cephalus*. They are remarkably lively fishes, particularly fond of fresh water, and very dexterous in managing themselves. On the south and south-east of England thdy are very common; and they occur both on the south and the north of Ireland, and on some parts of the Scottish coasts, though there they are not so general or so numerous. These fishes are in fact a sort of scavengers of the water, and come near the shores, equally partial to the scum and the dregs. Greasy substances, and also animal matters in a semi-putrid state, are not rejected by them; and they may be seen at one time skimming the surface for what floats, and at another time poking with their noses in the mud for whatever is to be found there suitable to their very peculiar sort of palate. They are also particularly fond of flies, which appears to be one of their inducements for ascending so far up the estuaries of the rivers, though it does not appear that they get above the tide-way, or even remain till a second tide overtake them at the top of their excursion. They are very familiar, and can be kept in ponds, where they soon become so domesticated that they assemble at their accustomed hour in order to be fed. In their natural rambles they are liable to be entangled by shallows, and among reeds and other obstacles. They have great powers of leaping, and when enclosed, even in a net, it is difficult to prevent them from springing over the head line, and making their escape. Indeed, the over-leaping of obstacles appears to be instinctive with them; and, as compared with many fishes, a grey-mullet pond would require lofty banks, in the same manner as a deer-park requires lofty walls. This fish rises freely to artificial flies; and during the flood tide, in those rivers which they visit abundantly, they afford excellent sport. Bait-fishing is not so successful with the grey mullet, because its mouth is not accustomed to receive any substance so large as a baited hook. Contrary to the opinion sometimes stated, that mullets never seize living food, it may, however, be urged that they rise to the fly. It is usually said that the river Arun, which enters the English Channel at Arundel, furnishes the best grey mullets of any in England, and that they ascend the river as far as twenty miles, and thus afford excellent angling, especially toward the upper part of their range. The size of fishes is not a very definite matter, but that of the common grey mullet may be estimated at about a foot and a half. Mullets spawn in the warm weather about Midsummer, and in the course of about six weeks, or two months, the young are about an inch in length. They then keep much in the salt water, but alternate between it and the fresh. Indeed it appears, from experiments which have actually been made, that if mullets, in this early stage, are placed in fresh-water ponds of sufficient size, they succeed as well in gathering flesh and fat as if left to their natural habits, and their usual alternation of salt and fresh water.

The short Grey Mullet (*M. curtus*). For the knowlege of this species we are indebted to Mr. Yarrell. Its body is much shorter and deeper than that of the former species, and its head wider, and also more pointed. The only species which Mr. Yarrell met with was about two inches in length.

Thick-lipped Grey Mullet (*M. chelo*). This species has been long known as a native of the Mediterranean, but it has only recently been added to the list of British fishes. The characters are:—The head of moderate size; the upper lip thick, the lower one less so; and the maxillary bone curved. This species of grey mullet comes to the estuaries of rivers, in the south of England at least, during the winter months, and the best account of them is by Mr. Couch, whose observations on the fishes of the Channel, as published in Mr. Yarrell's work, are highly valuable.

"This grey mullet," says Mr. Couch, "is gregarious, frequenting harbours and the mouths of rivers in the winter months in large numbers, all of which are just of one size; but the fish which I shall here describe was taken, with about four hundred others, as they were left in a pool of our river, forsaken by the tide. This species has, like the other, the habit of escaping from a net by leaping over the head lines.

The length of the specimen was ten inches; the head wide, depressed; the eyes one inch apart, and three-eighths of an inch from the angle of the mouth, not connected with any membrane; nostrils close together, and, while the fish is alive, moveable on each contraction of the mouth; a prominent superior maxillary bone, minutely notched at its lower posterior edge; upper lip protuberant and fleshy, with a thin margin minutely notched or ciliated; the lip appears behind as projecting under the maxillary; carina of the under jaw prominent and square; edge of the lower lip fine and simple; body solid, round over the back; pectoral fins high on the side, pointed, round below, the first rays short; the first dorsal fin five inches and three-eighths from the snout; the organ of the first three rays approximate, the first ray the longest; the first two rays of the anal fin short; tail broad, concave; scales large; colour of the head and back greenish; all besides silvery, with six or seven parallel lines along the sides of the same colour as the back."

There are two or three other species of mullet in the Mediterranean, of which the golden mullet and the jumping mullet are mentioned by Risso. The first of these partakes of the characters both of *Capito* and *Cephalus*, and the second more resembles the former of these. There is still another small species in the Mediterranean (*M. labeo*), with the lips very thick in proportion, and crenulated at their margins. The Indian seas, and the seas of some parts of America and of New Holland, also have their mullets, but it does not appear that any of them are of very predominating importance. Of the seas of Europe, the Mediterranean is by far the most abundant in this genus of fishes, and vast numbers of them are taken about the Balearic Islands and on the east coast of Spain. As is the case with most fishes that throng toward the shores at particular seasons of the year, those mullets are taken in much greater abundance than can be used in a recent state at the time, and therefore they are stored up, after being salted—thus affording a seasonable supply to people whose religion enjoins them to feed on fish very frequently.

MUGWORT is the *Artemisia vulgaris* of Linnæus, a common British weed found everywhere.

MULBERRY. See Morus.

MULLEIN is the *Verbascum thapsus* of Linnæus, a well-known British plant, usually called "shepherd's club."

MULLUS—Red Mullet, or, in some of the species, Surmullet. A very celebrated genus of spinous-finned fishes, belonging to the perch family. Two species have been well known as inhabiting the Mediterranean ever since the time when the Romans began to carry their luxury in the eating of fish to that remarkable pitch to which it was brought among them. The characters of the genus may be briefly stated as follow: the body thick and oblong; the profile of the forehead from the eyes sloping so rapidly as to be nearly perpendicular. The body covered with large scales, which very readily come off, and are understood to be shed annually. Two distinct dorsal fins on the back; the first with spinous rays, about seven in number, and with a short free spine immediately in advance, and the second with flexible rays. There are teeth in the lower jaw and the palate only; two well-produced cirri or beards at the symphysis of the lower jaw, and the gill-flap with four rays. All the mullets are remarkable for the beauty of their colours, which are red and yellow of greater brilliancy than are to be found in most fishes.

It is probable that the striped red mullet was the most celebrated one in the time of the Romans; though perhaps in those days the distinction between it and the plain one was not attended to. The grand object of the Roman epicure was to get a red mullet, and the larger the better, which shows that the eye was more attended to than the palate in the matter of those very costly fishes. This held true also in those cases of the *Coryphene* (we believe), which, passing through the prismatic colours in the agonies of death, was first displayed to the guests expiring, and then cooked in their presence, in order that they might make sure that the fish seen and the fish tasted were one and the same. The mullet also passes through various colours in dying; and it is a very beautifully coloured fish, whether dead or alive. The common account is, that the name mullus is derived from the red slippers or sandals worn by the Roman consuls during the republic, and continued by the emperors afterwards. Those sandals were marks of distinction, not worn by any but those dignitaries; and thus the name of these fishes after them shows that mullets were not fare for every man, or indeed any man's every-day fare. The striped red mullet, or surmullet, is by much the more plentiful of the two which are found in the Mediterranean; it also grows to a much larger size than any of the others, which indeed is rarely, if ever, found so heavy as the most esteemed weights mentioned by the Romans. When luxury was at its height, a mullet of three pounds' weight brought an ample reward to the fisherman who caught it; and if it reached four pounds and a half, it was quite a fortune—fifty, sixty, and even eighty pounds a piece were given for mullets to set out a Roman feast; but it may be possible that those costly ones may have been the plain red mullet, which, though a smaller fish than the other, is more richly coloured; for there is so much confounding of one species with another in the Roman accounts that one can come to no absolute decision. We believe the fact to be that the surmullet, or striped red mullet, is a very palatable fish when in proper condition, and that the plain red mullet is still better.

On the southern shores of Britain, where the striped mullet, though not one of the most abundant of fish, certainly is not rare, the size is seldom more than a foot long, and in no instance above fourteen inches. Three pounds and a half is about the weight of one of the largest in the best condition, which falls far short of the Roman fish. This mullet is found in the London market, at almost all seasons of the year; and therefore it cannot be looked upon as a migratory fish. The following passage from Mr. Yarrell throws so much light upon the management of this fish, as a market commodity, that we shall quote it at length: "The striped red mullet has been considered migratory, but it appears in the shops of the London fishmongers throughout the year, though in much greater plenty during May and June, at which time their colours are more vivid, and the fish, as food, in the best condition. If closely examined, it will be observed that, where the scales happen not to have been removed, the natural colour is little more than a pale pink, passing into white on the belly, the lower part of the sides having two or three longitudinal stripes; but that the mixture of purple and bright red, which

ornaments various parts of the fish, is the consequence of violence; every scale removed by force (and but little is necessary) increases this colour; it is produced by extravasated blood lying under the transparent cuticle, but above the true skin."

The spring is the spawning time with these mullets, and when they come into their best condition, in summer, it is immediately after recovering their flesh subsequent to the labours of that operation. The young surmullets grow pretty fast, so that by the end of October in the first year they have acquired about half the length and one-eighth of the weight of the average ones found on our coast. Mullet appear to be chiefly ground feeders; and the beards, as they are called, are no doubt intimately connected with the finding of their food, as they are in other ground fishes that possess them. The usual supposition is, that those appendages are very delicate organs of touch, though how they act it is not easy to say. The fish that possess them have very frequently the eyes directed upwards, in a different direction altogether from the mouth; but whether the beards of the mullet act simply as feelers under the fish, or assist in raising it up (for they are very muscular), it is not easy to say. It is certain, however, that mullet do feed chiefly at the bottom of the water; for though a good many are taken in the surface nets, it is probable that this takes place chiefly when they are shifting their ground from one locality to another; for the greatest number, and those in the best condition, are got by trawl nets, worked at the bottom. What the food may be is not very well known; but, from the smallness of the teeth, it cannot be of a very obstinate nature.

The striped mullet is liable to some differences of colour, being of a brighter red not only at different seasons, but in different individuals at the same season; and altogether this is one of the most interesting of our fishes.

Plain Red Mullet (*M. barbatus*). *Barbatus*, or bearded, is by no means happily applied to this species, because the striped one is as completely bearded as the present species. This one does not attain so large a size as the former; but its colour is finer, at least in those specimens which are in high condition. The back and sides are a very delicate pure red, of very nearly what is called the fundamental colour, and this passes very gradually and softly into silvery white on the under part. The frontal line in this one is still more perpendicular than in the striped species. The scales are smaller, the first dorsal fin is more elevated, and the second one differently shaped; so that, independently of the colours, the specific difference is well made out.

It is probable, however, that either this last species is subject to some varieties of colouring, or that there are variations in the colours of the former one; for Mr. Couch mentions that in two specimens which he obtained in the Channel, answering of course in form to the plain red mullet, the sides and part of the belly were dark red, and there was a longitudinal stripe of yellow below the lateral line, while the back, in both specimens we believe, was of a paler red than it is even in the striped mullet. But the typical red mullet are described as having the back very clear carmine red, without any yellow between it and the silvery colour on the belly. If, therefore, colour is to be depended on in these fishes, Mr. Couch's two specimens appear to have belonged to a species different from either the common striped, which is so well known on our coast, or from the plain red as described from the specimens found in the Mediterranean and in the Black Sea, in which it appears the red species is also known. These circumstances tend to continue the confusion which certainly at one time existed respecting the species of these much-celebrated fishes, and we must regard it as still a doubtful question, whether a red mullet, identified with the plain red mullet of the south of Europe, has ever yet been actually met with in the British seas. The notice by Pennant of one found on the Scottish shores is only a hearsay notice; and as the striped mullet is a mere straggler, if known at all on those shores, and as no drawing was made of that to which Pennant alludes, it is at least possible that it may have been a straggler of the striped kind; and, as a new fish, it was not unnatural to refer it to that species which is regarded as having the greatest celebrity.

The mullet most common on the south coasts of England, though it does not altogether quit those coasts at any season, is a little capricious even at those times when it is most abundant; for, after the fishermen have had a successful fishing for some time, they occasionally find that not a single fish remains upon the ground, even long before the proper season is over. When this occurs they have to try for the shoal of fish eastward or westward, according to circumstances, but seldom much further out to sea in one situation than in another, unless there is a great difference of depth of water and character of the bottom in-shore. This shifting of the fish makes the price very fluctuating; so that in the same season, and within a few days, a mullet shall be so many pence at the one time, and as many shillings at the other.

MUNDIA (Kunth). A genus of greenhouse shrubs, belonging to *Polygaleæ*; formerly the *Polygala spinosa* and *viminea* of botanical authors. Both flowers and fruit are beautiful, and the plants are easily cultivated.

MURACUIA (Jussieu). Beautiful ornamental climbers from tropical America, belonging to *Passifloreæ*. *M. ocellata* is one of the most desirable climbers for a hothouse, as it grows freely and flowers abundantly. The flowers are crimson, and extremely showy. It requires a rich light soil, and may be increased by cuttings.

MURALTIA (Necker). A genus of evergreen shrubs, natives of the Cape of Good Hope, belonging to *Polygaleæ*. They are pretty greenhouse shrubs, and easily kept and propagated.

MURRAYA (Konig). Evergreen shrubs, natives of China and the East Indies. The flowers are decandrious, and belong to the natural order *Aurantiaceæ*. They may be kept in the greenhouse, but flower best in the stove; they affect a light turfy loam, and are readily increased by cuttings.

MUSA (Linnæus). A genus of the largest herbaceous plants known. Their organisation and inflorescence are so peculiar that the genus gives a title to a natural order, viz.:—

MUSACEÆ. This, though a small natural order, contains some of the most conspicuous plants in the world. There are only four genera, viz., *Musa*, *Urania*, *Strelitzia*, and *Heliconia*. Of these there are already twenty-eight species described. The most stately, as well as the most useful of these plants, is the *Musa paradisiaca* and *sapientum*, extensively cultivated in the East and West Indies for their fruit.

These have been long in Britain, and frequently fruited in hothouses lofty enough to allow their full growth. In the West Indies the banana is indispensable; shady walks of them are on every plantation, and attached to every house and cottage in Jamaica. As the banana is perennial, and ever throwing up a succession of young stems, some one or other of the plants are yielding fruit the whole year round, and this is very often the chief part of the food of the owner and family. Three dozens of the fruit are sufficient to serve one man a whole week instead of bread, and will support him in warm countries much better. When boiled or roasted they are used in the place of bread, and eaten with fish or salt meat. When ripe, tarts are made of them, or the fruit is sliced and fried with butter, or dried and preserved as a sweetmeat, or converted into an excellent marmalade. The young shoots are eaten as a delicate vegetable, and the old stems, when shredded or chopped up, are excellent manger-food for cattle.

The fruits of some species of *Heliconia* and *Urania* are also eatable, but they are inferior to the bananas. *Musa textilis* affords a very valuable flax-like fibre, from which some of the finest India muslins are made. The *Strelitzia regina*, named in honour of queen Charlotte of England, is a beautiful flowering plant, and much valued. The flowers of all the genera are pentandrious, except *Urania*, which belongs to the sixth class of Linnæan botany.

MUSCA (Linnæus). Under this name Linnæus comprehended a great variety of dipterous insects, which, from the vast accession made to their numbers by modern entomologists, and by the more precise investigation of their characters, it has been found necessary to separate into several families, and a vast number of genera; of these the greater part compose the family *Muscidæ* of Leach, or the tribe *Muscides* of Latreille, which are characterised by having the proboscis membranaceous, of moderate size, and terminated by two fleshy lips generally furnished with a pair of palpi, and capable of being withdrawn into the oral cavity; the antennæ are terminated by a large, often triangular-shaped, joint, having a bas.l or lateral bristle; the wings are provided with but few nervures. The works of Meigen, Fabricius, Fallen, and especially Macquart and Robineau des Voidy, must be consulted for a knowledge of the great number of species and genera of which this group is composed, and of which some idea may be obtained from the fact that the work of the last-named author extends to about 800 quarto pages, and comprises technical descriptions of a portion only of these insects, and in the work of Meigen, upon the European species alone, the genus *Tachina* comprises 315 species, and that of *Anthomyia* 230.

These insects are best typified by the common domestic fly, the blow-fly, bluebottle-fly, &c. These insects frequent houses, outhouses, woods, hedges, ditches, ways, water-courses: in fact they may be said to be found everywhere. They fly with lightness and rapidity, and make a buzzing noise whilst on the wing. Many species are exceedingly troublesome, especially those which frequent our houses; they are found abundantly throughout the summer, and especially in July and August; they alight upon all sorts of food, especially sugar and sweetened materials, which they much prefer, and which they sip with avidity.

> Busy, curious, thirsty fly,
> Drink with me, and drink as I,

is a distich too well known from childhood to render it necessary for us to remind the reader of the apparent delight which flies have in sipping up a drop of spilled wine; but the fly is equally able to sip up a bit of sugar, which it effects by first moistening it. Many species delight in decaying vegetable or animal matter; indeed they may be considered as commencing the work of scavengers, by depositing their eggs or young upon matter just on the point of "turning" or becoming putrid. Of their powers in this respect some idea may be obtained from the statement of Linnæus, that three flesh-flies will devour a dead carcass as soon as a lion. Of course, the progeny of the flies and their great powers of multiplication must be taken into the consideration.

Amongst these insects the *Musca* (*Anthomyia*) *meteorica* is one of the most annoying; it is this species which appears about the middle of summer flying in swarms about the heads of horses and cows, and endeavouring to creep into their eyes and ears, in order to feast upon the humours secreted by those organs, not only in the quadrupeds above mentioned, but also of man himself. The *M. domestica* is another exceedingly abundant species frequenting our houses, but there are many distinct species which have precisely similar habits, and which it requires some examination to distinguish from the common species. Certain species of house-flies indeed seem to frequent particular localities, for during the present summer and autumn (1836) we have been examining these insects rather attentively, and have not yet seen a single stomoxys in our study, whereas on paying a visit to a friend at the commencement of this month (September), at some distance from the metropolis, we found the stomoxys swarming in his apartments. Our recent investigations have been conducted with a view to clear up an inquiry proposed to us by Dr. Thaddeus W. Harris, librarian of Harwarden University, United States, as to the specific identity of the domestic flies of Europe and America. We have, it is true, not yet been able to ascertain this point; but from observations communicated to us by Mr. R. H. Lewis, M. E. S., relative to the swarms of house-flies on board the vessel in which he sailed recently to New South Wales, which bred in the ship, it is evident that America may have been as practicably tenanted by our domestic fly as by the hive-bee, which is now completely domesticated there. There is, however, scarcely any other insect which could be mentioned which more strikingly exhibits our ignorance of the habits of even the most common insects than the house-fly. We know its general form, and that it is exceedingly abundant, but beyond this our knowledge can scarcely be said to extend.

We have already, in the articles upon the BLUEBOTTLE and BLOW-FLY, given an account of two of the most common, but not the least interesting, species of the present family; and in the article DIPTERA we have noticed the question which has excited so much attention amongst philosophers as to the means whereby the fly is able to walk upon glass in a perpendicular position, or even with its back downwards.

The larvæ of the *Muscidæ* (whereof we have given a representation, in the article INSECT, p. 835, fig. 19) are thick, fleshy, cylindric, attenuated towards the head, and truncated at the other extremity of the

body; the head is soft, with two or three horny points, which serve to pierce the matters upon which they feed; they are also provided with spiracles, whereof the number and figure are variable, some being placed upon the head, resembling eyes, and the others, which are larger, placed at the posterior part of the body. They are destitute of legs, and their progression is effected by the hooks of the mouth, which they affix in the surface of the substance upon which they are placed; having first extended the body as far as possible, they then draw the hind parts of the body towards the head, contracting it as much as possible, when they again push the head forward as before. These larvæ feed upon various matters, both animal and vegetable; amongst the herbivorous species, many devour decaying fungi, boleti, &c., the galls and seeds of plants, and the interior of fruits; amongst the carnivorous species, some prey upon the flesh of animals, of which they cause the more rapid decomposition, whilst others live in excrement, manure heaps, &c., and some are parasitic, living in the bodies of other caterpillars, of which they devour all the inner parts. The curious manner in which these larvæ assume the pupa state, without throwing off the outer skin of the larva, has been described under the article DIPTERA. The pupa state is variable in its duration according to the state of the weather, which may be more or less favourable to the development of the different parts of the enclosed pupa. In order to effect its escape from the pupa, the fly bursts off a small cap at one end of the case or skin-cocoon by beating against it with its head; at first these flies are soft, and may be observed creeping along with their wings crumpled up in a small compass. They soon, however, gain their full size, and the fly acquires its dark colour, and then joins its companions in the air.

Latreille has divided this family into nine primary groups, from various peculiarities of structure; whilst Macquart, availing himself of the researches of M. Robineau des Voidy, has partially adopted the habits of the groups for the establishment of three subfamilies, in which he traces a gradual decrease in the organisation of these insects until his arrival at the confines of insect life.

1. The *Creophila*, characterised especially by the wings, of which the first posterior cell is entirely or partially closed, and by the large size of the alulets. This subfamily comprises those species which are distinguished by their size, colours, robustness of body, strength of flight, &c. They generally deposit their eggs either upon the flesh of dead animals, or are parasitic in the bodies of other larvæ. The chief genera are *Tachinia, Ocyptera, Gymnosoma, Phasia, Dexia, Sarcophaga*, and *Musca*.

2. The *Anthomyzides*, distinguished from the preceding by having the first posterior cell constantly open, and by the moderate or small size of the alulets. They chiefly frequent flowers; and their larvæ reside in decomposed vegetable matters. The chief genera are *Aricia, Lispe, Eriphia, Anthomyia, Cœnosia, &c.*

3. The *Acalyptera*, differing from the *Anthomyzides* by the breadth of the face, in which the eyes of both sexes are separated, and by the want of alulets. Here belong various groups of small size and inferiorly developed structure, which are for the most part exceedingly prolific. The chief genera are *Loxocera, Scatomyza, Ortalis, Tephritis, Sepsis, Lauxania, Sphærocera, Phora*.

The genus *Musca* is now restricted to the domestic fly (*M. domestica*) and a few allied species, instead of comprising, as it did with Linnæus, the entire dipterous order, with the exception of the *Tipulidæ, Tabanidæ, Asilidæ, Bombylïdæ*, and *Empidæ*. We have here the two extremes of classificational nomenclature, evidencing the progressive elaboration of insect investigation, but unfortunately, although necessarily, attended with so great an addition of names as to become far beyond the powers of ordinary memories to retain them throughout the science. Hence the necessity of reverting to the old well-established names in the sense in which they were formerly employed for general purposes, but at the same time of employing the newly-required terms for scientific and particular purposes.

The type of the genus *Musca* (*M. domestica*, Linnæus) is of a cinereous colour; the face black, with buff sides; the forehead yellowish, with a black band; the antennæ black; the thorax with black lines; the abdomen with black markings, pale beneath, the sides of a transparent yellow; the legs black; the wings clear, with the base rather yellowish.

MUSCARI (Desfontaines). A genus of bulbous plants, formerly united with the hyacinths. The flowers are hexandrious, and belong to *Asphodeleæ*. The well-known grape-hyacinths are *Muscari;* and the *Hyacinthus monstrosus* is now *Muscari comosum*. They are flower-border plants, and thrive in light sandy soil.

MUSHROOM is the *Agaricus campestris* of Linnæus, the eatable agaric. Though a cryptogamous plant, and, as such, not coming within the limits of our general botanical notices, yet as a dietetic vegetable, and as a production requiring much skill and attention of the gardener, it may be worth while only to remark, that the mushroom is the only instance of any of its class having been brought into cultivation. The champignon, the truffle, and morel, are three others used in cookery, but these have not been as yet tried to be produced artificially; nor with the two last is cultivation necessary, as they are never used in a fresh state.

MUSK (*Moschus*). A genus of ruminant mammalia, or, more strictly speaking, a small and very peculiar group, made up of two genera; the one consisting of only a single species, and furnishing the substance known by the name of musk; the other consisting of several species, much smaller in size and more elegant in form than the other one, but not provided with the organ which secretes musk, and consequently not supplying that substance. In their general structure the musks do not differ greatly from the other hoofed ruminants, though they still hold a sort of intermediate place between them and the camels. The chief external differences are, the absence of horns, and the very much produced canine teeth in the upper jaws of many of the males. These last project out of the closed mouth, and are usually recurved backwards. In the skeleton the chief difference consists of a fibula applied to the head of the tibia on the hind legs, and extending down nearly to the lower extremity of the bone; and there is no bone of this kind found in any of the other ruminants except the camels. They have farther two small bones, applied one to each end of the canon bone on the fore legs, more developed in proportion than those bones in the horse, and answering in situation, though not in office, to a sort of ulna. As none of these additional bones extend completely from joint

to joint, they do not assist in giving any cross or twisting motions to the joints, which are still susceptible of vigorous motion only in one plane, like the corresponding joints of the other ruminants. Still these bones are by no means without their use in the economy of the animals, for they give a firm insertion and imbedment to the muscles, and also a security against fracture, which could not be secured by any single bone, how much soever it might be beset with processes. The cartilaginous union between those bones and the others, prevents the shock upon the principal bone of the limb from being propagated to the muscles, and jarring and disturbing their action, at the same time that it gives strength and firmness to the muscles and tendons, by means of which they can better bear their part in the motion of the limb.

And when we come to consider the camels, and more especially the musks, and, most of all, the animal which furnishes the perfume, in combination with the peculiar nature of their pastures, we cannot fail to be struck with the admirable resource of nature in furnishing their limbs with means of endurance in proportion to their size, which are not to be met with in any other animals having merely walking feet. It is true that the small bones applied to the canon bones of the horse give great additional stability and power of endurance to that animal; and it is, in a great measure, in consequence of the possession of these small bones, that, as it is beautifully expressed, the horse "paweth in the valley and rejoiceth in his strength." It is in the *valley*, however, that the horse shows off his fine paces—upon the turf, where there is still some elasticity in the covering of the ground, which helps to let him down gently as he dashes along. With the camel and the musk it is different. The march of the camel is in the *desert* and often deep in the sand, so that he is necessitated to lift his feet high, and consequently make a bumping and heavy foot-fall, which would shake the legs of a differently constructed animal to pieces. The musk has still severer pastures; he is on the dry and rocky mountains, where it seldom rains, and where mouthfuls of food are "few and far between," and therefore nature has adapted his limbs to the wilderness of stones as finely as the limbs of the camels are adapted to the wilderness of sand. It is in those creatures which are fitted for what may be regarded as the extremes of locality that we see most forcibly the admirable provision which nature, that is, the Great Author of nature, has made for every creature according to its necessity.

As the animal which produces the musk, and the other animals which nearly agree with it in general structure, are brought into the same group, have different localities, both in latitude and in character of surface, they necessarily have different adaptations, and therefore a description, descending to much minutiæ, could not apply properly to them both. It is true that they are all upland or mountain animals, fitted for bounding along in dry places; and the small ones are admirable in the delicately light appearance of their bodies and limbs, and most graceful in their motions. But they are children of the lands of the sun, and not more than one is found out of the Oriental Archipelago, and even that one is rarely, if at all, found as far north as the central latitude of India. We shall therefore take them separately—the one that has been longest known, under the generic name *Moschus;* and the others under the generic name *Tragulus.*

Moschus. The species of this genus is the common musk (*Moschus moschiferus*), whose head-quarters are in the vast table land of Central Asia, between the sources of the Indian rivers in the south, and those of the great Siberian rivers in the north; and between the sources of the great Chinese rivers on the east, and the rivers which flow to the inland seas of Asia on the west. These rivers do not overlay each other, as is the case with the rivers which rise in single ridges of mountains, or upon successive ridges where much rain falls. The remote sources of some of them, indeed of most of them, are very imperfectly known; for few portions of the earth's surface are more completely a sealed book to the natural geographer than this same portion of Asia; but we are sure that there is in the centre of this extensive region a very large portion from which no river is discharged; and it is this portion which forms the grand abode, and in some respects the fortress, of the musk animal. That animal is thus intimately connected with one of the most interesting questions which remain unsolved respecting the natural history of the earth's surface; and, besides this, the most characteristic animal of such a country is highly interesting on its own account; and the interest is certainly not lessened by the perfume which the animal furnishes, and the great estimation in which this perfume is held, more especially in the East.

The animal is not confined to the absolute centre of this table land, but extends along the mountain ridges which branch out from it. It is not found to the southward of the Himalaya, nor in the central desert which slopes westward to Lake Aral and the Caspian; but it extends south-eastward into the elevated parts of Tonquin, and northward as far as the Altaian ridge. Those nations, speaking many languages, are familiar with it; and there is not, perhaps, throughout the world an undomesticated animal which has more names than the musk.

In such an extent of latitude as it inhabits, it is natural to suppose that it must be affected by some climatal differences; but it does not appear that these are such as to affect the identity of the species. The chief difference is in the odour of the drug, which is more powerful in proportion as the animal inhabits more southerly. In the warm latitude of Tonquin it is exceedingly powerful, while in the extreme north of the animal's habitat it has not more odour than the substance furnished by the beaver in polar climates.

Musk, as a substance, was known in Asia from very remote antiquity; and it was very early introduced into Europe. It was long, however, before any knowledge was attained of the animal producing it, and some of the earliest accounts represented the animal as a deer with horns. Our illustrious countryman Grew, to whom natural history generally, and particularly the physiology of plants, is so much indebted, was the first naturalist who gave anything like a satisfactory description of the animal, and Buffon and Daubenton were the first who obtained a living specimen in Europe, while Professor Pallas had opportunities of examining the animal in its native locality. After this it speedily took its place in the system, as a distinct and very peculiar ruminant animal.

When full grown it is about the size of a roebuck at six months old, being one foot ten inches in height at the shoulder and two feet at the crupper. This superior production of the hind legs indicates a vigorous

leaper; while the disproportion is not so great as to destroy the symmetry and power of its action as an animal of swift motion on its legs. The upper part of its head bears some resemblance to that of a roe-buck; but the character of the mouth is different, arising not so much from the form of the bones as from the large canines which descend from each side of the mouth, and make the upper lip seem broad; and the tufts of produced hair at the bottom of the gape give an appearance of breadth there also. The hair is remarkably coarse and strong, and has almost a spinous appearance. The basal part of it is white; but the extremities are different shades of black, brown, or dun colour, which makes the general tint vary with the position in which the animal is seen. The under part of the body, the insides of the legs, the chin and the lips, are white; and the eyes are reddish brown. The legs, though clean and light, are very firm; and the hoofs are strong and sharp-pointed. The successorial, or supplemental hoofs behind the principal ones, are much longer and firmer in proportion than those of any other ruminating animal; and though they cannot be said to act against the others by an absolute grasp, as a thumb acts against fingers, yet they enable the animal to take a firm hold of the sharp edges of those rocks among which it has so frequently to make its way; and thus furnished in its feet, the animal can ascend and descend with equal rapidity and safety as the chamois. In fact no animal is better adapted for bounding from rock to rock, clearing chasms, mounting precipices, and descending the steepest slopes. It is also an excellent swimmer, and can stem the torrents of the mountain streams with the greatest hardihood.

Inhabiting a country where it is subjected to many privations, it can, during the severe weather, subsist upon lichens, like the rein-deer; and in the summer it is under the necessity of browsing the leaves, and even gnawing the stems of those rhododendrons, which form the principal vegetation of some of its more northerly haunts. In short it is an animal tempered to a hard country, to hard weather, and to hard food. Notwithstanding the comparative sterility of their pastures they become very fat in the autumn; and in proportion as they become fat the musky secretion becomes abundant and odorous. Whatever may be the purpose of this secretion, the matter of it seems to pervade the whole animal; for even the chyme, before it is converted into chyle, has a musky smell; and the flesh of the animal has the same, and the stronger the higher condition it is in. The natives of the country hunt it with considerable avidity as well for the musk as for the flesh of the animal. The little pouch which contains the musk, and the follicle by which it is secreted, are peculiar to the male, and situated backwards on the abdomen. Various physiological theories of the use of this substance has been propounded, but none of them is altogether satisfactory; and some of them, together with inferences which have been drawn from them, do not admit of satisfactory explanation in a popular manner.

These animals come in season in November; and the fawns are dropped about the end of May. Their colour is at first reddish grey, dappled with whitish spots disposed in lines. In the following winter they become deeper brown, with yellowish spots irregularly disposed on the flanks, and more regular ones on the back. The produced canines of the males are not developed until the animals arrive at maturity.

The time for hunting the musks is chiefly in the rutting season; that is, in November; because then, as we have already hinted, the musk is most abundant and has the most powerful scent. When the animal is seized, which is rarely done without killing it, as they are very timid as well as very fleet, the first care of the hunter is to secure the musk-bag, which is done by cutting it out and rolling it up like a little purse; the quantity contained in one is very small, however; and therefore it is generally understood that even the best musk of commerce is adulterated by being mixed with other substances. Some differences of species as to size and colour, and the form of the ears, have been mentioned; but probably these are merely climatal; and they do not appear, from the accounts given of them, to be accompanied by any differences in the economy of the animals.

The musk animal never descends into the plains, or approaches the habitation of man. It is decidedly an animal of wild nature, endeavouring to escape to its fastnesses when seen, and incapable of anything like domestication.

Tragulus. This name, taken literally, means "little goat," or, in fact, any small animal with a rough or shaggy coat, which browses hard plants, and gnaws the twigs or the bark of trees; and it has been sometimes applied to one section of the antelopes, which are remarkable for the length, height, and fleetness of their leaps.

The generic characters of the small animals to which this name is applied differ very little from those of the musk animal properly so called, only they are all without the musk-bag and follicle, and thus are not musk animals in any other sense than as they belong, in their general structure, to the same group with the animal that furnishes the drug. All the animals which are included in this genus or sub-genus are inhabitants of the mountain forests, or, at all events, of the forests upon elevated places; but their haunts are too difficult to be explored for enabling us to speak positively as to the species. There may be distinct species which are not at present known; and some of those which are now described as species may be only varieties; we must, however, take them according to the accounts given by those who have seen them on the spot.

Memina (*T. memina*). This animal is about the size of a rabbit, that is to say, sixteen or seventeen inches long, with a very short tail; the covering on the upper part is olive-ash; and the throat, breast, and belly, white; the neck, sides, and horns, are also peculiarly, but not unhandsomely, marked with lines and bars of white; there are two longitudinal ones upon each side; one near the back, which terminates in a turned-up point at the hinder part of the loins; the other is broader, farther down, and more irregular; but whether these are uniform in all individuals, or at all ages, is not ascertained; the ears are rather large, and the muzzle produced and slender; the canines in the male are large for the size of the animal, and much recurved backwards.

The memina is the species of these little musks which has been longest known. It was first mentioned by Knox, in his account of Ceylon, as a native of that island; and it has since been found in the southern part of continental India. In the account of the mammalia of the Deccan, laid before the

Zoological Society of London in 1831, this animal is represented as being numerous in the woods of the Western Ghauts, but it does not descend into the low country toward the coast. The Mahrattas call it *Peesoreh*. So far as has hitherto been observed, it is the only one that occurs on the continent of Asia, and it is not found far to the north. The others have been met with chiefly in Java, but they in all probability inhabit the adjacent islands.

The Napu (*T. napu*) is the largest of the Javanese species. It is about twenty inches long and rather more than a foot in height, standing higher at the rump than the shoulder. The upper part is mottled red colour; the sides grey, marked with white, and the under part and insides of the legs altogether white; the tail is about two inches and a half, white on the under side and at the end, which is furnished with a small tuft of produced hairs; it is also variously striped with white and grey; the legs are very slender, and the body rather heavy, which gives the whole an air of feebleness and incapacity for violent exertion. It inhabits lower down than the memina, being met with in the low thickets, and not in the elevated woods.

The Kanchil (*T. Javanicus*) has some general resemblance to the *Napu* in the form of its body, but it is more lightly and handsomely made, much smaller in size, and very different in colour. It is only from fourteen to fifteen inches in length, and about nine in the average height. On the middle of the back it is very dark brown, approaching to black, but this passes gradually into bright bay on the sides, while the belly and insides of the legs are white. Like the *Napu*, this species is marked with white streaks on the breast, but they are differently disposed. The variations of colour and size are constant, and moreover the habits and manners of the two animals do not agree. These, together with the different names given to them by the natives, are sufficient grounds for regarding them as distinct species. The *Kanchil* is an inhabitant of the dense forests, and much more mild in its disposition than the *Napu*. If taken young, the *Napu* can be tamed without much difficulty; but the *Kanchil*, though not a vicious animal, cannot be tamed, and escapes to the forest whenever it can find an opportunity. Living in the forests, which are infested with powerful carnivorous animals, this active little creature has occasion for no slight degree of cunning and resource in order that it may preserve itself from them. Nor is this animal found without sufficient means of self-protection in proportion to the danger in which it is placed. It is very quick, and equally cunning. If it is free, so that it can avail itself of its active powers of escaping, and is hard pressed in the chase, it is said to make a vigorous bound upward, catch a branch with its strong and hooked canines, hang suspended there while the enemy passes underneath, and, as soon as the ground is clear, jerk itself down, and make off in the opposite direction. If it has no active means of escape, its passive cunning is equally great. It is well known that many animals attempt to follow the pattern of the "passive stout," mentioned by Butler, and

> "Run away from death by dying."

Foxes have been known to do this when surprised in a poultry-house from which they could not make their escape; and the dead fox, after being taken by the hind legs and tossed out as lumber, until there should be time for making him pay the forfeit of his skin, has been known to start instantly, and bear his brush triumphantly to his cover. The *Kanchil* is said to practise a similar *ruse* when caught in nooses. It lies stretched, and looking as if strangled; but if the hunter undoes the noose, the *Kanchil* vanishes in an instant.

The Pelandok (*T. pelandok*) is described as being lower on the legs and heavier in the body than the *Kanchil*, and, though resembling the *Napu*, a more sluggish animal in appearance than even that. Its colour on the upper part is light rusty grey; the canines were very small in the specimens seen, which renders it probable that they were immature animals, in all probability, of the *Napu*, or, at all events, closely allied to it. The habits are said to be exactly the same as that animal, brushwood, in the neighbourhood of houses where predatory animals are comparatively few, being preferred to the wild woods, in which the lighter but more energetic and spirited *Kanchil* invariably takes up its residence. Information is, however, still wanted respecting these animals.

MUSQUITO. The name of one of the most tormenting of our insect enemies, which, from the attacks of its countless multitudes upon sleeping persons, is the subject of more consternation and alarm than can well be imagined by persons who have never encountered them. In our country the bite of the gnat is regarded as an evil, but in the sultry climates of Brazil, India, &c., where, from the exhaustion attendant upon the daily heat, the body has need of sound nightly rest, the attacks of the musquito become a real plague, and one of the greatest luxuries that can be imagined is a musquito-proof curtained bed. Like the gnat, the musquito announces its approach by a buzzing hum; and it is one of the most particular duties of the attendants of the inhabitants of these countries to whisk away the musquitoes which, during the day, have taken shelter within the bed-curtains, by means of a flapper, and then suddenly to let fall the curtains, which are provided with weights at the edges; and the ceremony of lifting up the curtains and jumping into bed must be performed as quickly and as carefully as possible, to prevent the ingress of the fearful plague. The gnats and musquitoes belong to the same natural group, *Culicidæ*, and as they breed in stagnant water and damp situations, it does not seem improbable that the last-named insects were the species of flies which were employed as one of the ten plagues of Egypt to punish the rebellious Egyptians. In the article Bat there is the following passage, which especially bears upon the subject: "The banks of the Nile, in Egypt, where they (the bats) dwell in the palaces and sepulchres of forgotten kings, and the temples of forgotten gods, are particularly replenished with them, because *the swelling and subsiding of the Nile cause a vast production of insect life*." Mr. Kirby, indeed, adopts another opinion, suggested to him by an eminent and learned prelate, that the Egyptian plague of flies, which is usually supposed to have been either a mixture of different species, or a fly then called the dog-fly (κυνομυια), but which is not now known, was a cock-roach, the Hebrew name of the latter, which is the same by which the raven is also distinguished, furnishing no slight argument in favour of it, the same word also signifying the evening. Hence, as the cock-roach of Egypt is black, and appears only in the evening, Mr. Kirby

considers the reason sufficient for the name given to it. We are afraid of being charged with presumption in venturing to differ from these learned divines on a point of biblical natural history, but we cannot avoid adopting the opinion that the plague of flies was caused by the musquito. Mr. Kirby evidently appears to have previously adopted the view of the subject given by Bishop Patrick, who says of these flies, that they were "flesh-flies or dog-flies, very bold, troublesome, and venomous. Some think the Hebrew word means a mixture of different insects, all manner of flies;" and Bruce regards it as being probably identical with the insect which he describes under the name of the zimb. We read, on the denunciation of this plague, that Moses was directed to say to Pharaoh, "If thou wilt not let my people go, behold I will send *swarms* of flies upon thee and upon thy servants, and upon thy people, and into thy houses; and the houses of the Egyptians shall be full of swarms of flies, and also the ground whereon they are; and I will sever in that day the Land of Goshen, in which my people dwell, that no swarms of flies shall be there," &c. Now in this passage we are first struck with the expression "*swarms of flies*," and we are sure that every one who has seen "a swarm of gnats at even-tide" will perceive the aptness of the expression, supposing the Egyptian fly be a species of gnat, or, in other words, the musquito. We next read of their making their way into the houses, which shall be full of flies. This is also precisely the habit of the *Culicidæ*. The next passage, that they should also swarm upon the ground, is certainly not in favour of our interpretation, and would apparently apply to some other species; but it is in the last passage quoted that we perceive the fullest corroboration of our view of the subject. Bryant says, "The Land of Goshen was a tongue-like piece of land, where the Nile first divided at a place called Cercasora; Said, or Upper Egypt, lying above, and Mesre, or Lower Egypt, was in a line downward;" and Bruce states, that "the Land of Goshen was a land of pasture, not tilled or sown, *because it was not overflowed by the Nile*. But the land overflowed by the Nile was the black earth of the Valley of Egypt, and it was here that God confined the flies, for He says, it shall be a sign of this separation of the people which He then made, that not one fly should be seen in the sand or pasture-ground of the Land of Goshen; and this kind of soil has ever since been the refuge of all cattle emigrating from the black earth to the lower part of Atbara." These observations appear to the writer almost conclusive upon the question: the sandy pasture soil of the Land of Goshen would have been the spot where the cock-roach would have resorted to naturally, and it is the spot where the musquito would not have been found. Far be it from us to deny the miraculous power of the Almighty in producing this surprising flight of flies, but we know, in our own days, that in certain seasons certain species of insects are multiplied to such an extent as to become a positive evil. We know not, of course, for what end such multiplication is permitted by the Creator; but in the one case, as well as in the other, we must certainly acknowledge the working of an all-wise Providence, which sees and understands what man cannot comprehend.

We are aware that Dr. Hale and Bryant have given calculations, whereby it would appear that this succession of plagues took place between the month of January and the beginning of April, and consequently that the plague of flies, &c., must have been miraculous, occurring at a season when the Nile was at its lowest, and when flies, &c., were not naturally abundant; but there is nothing fully to warrant the adoption of a fixed period of time between the early plagues.

We have said that the musquito is a species of gnat (*Culicidæ*), nearly allied to our common English species, *C. pipiens*. In making this statement we have followed the best authorities. Mr. Kirby says that the musquito from Batavia, whose bite is exceedingly venomous, occasioning a most intolerable itching, which lasts several days, is distinct from the common gnat, and approaches *C. annulata*, but the wings are black, and not spotted. Robineau des Voidy and M. Percheron have described and figured the insect under the name of *Culex musquito*; and Pohl and Kollar have described the Brazilian musquito, as it is termed by the Portuguese, under the name of *Culex molestus*.

Of the attacks of these insects we can obtain, from the accounts of various travellers, the most striking idea; thus Jackson, in his Travels in Morocco, complains that they would not suffer him to rest; that his face and hands appeared, from their bites, as if he was infected with the small-pox in the worst stage. And Captain Steadman, in his Travels in America, states that he and his soldiers were actually compelled to sleep with their heads thrust into holes made in the earth with their bayonets, and their necks wrapped round with their hammocks. But it is in the chronicles of the olden time that we find the most extraordinary account of their powers; thus it is related that a king of Persia was compelled to raise the siege of Nisibis by a plague of gnats, which, attacking his elephants and beasts of burden, caused the rout of his army. And Mouffet has collected many accounts from different authors, in which it is recorded that the inhabitants of various cities have been compelled to desert them owing to the multiplication of this plague, which has become so notorious as to give its name to bays, towns, and even territories of considerable extent. Thus we have Musquito Bay, in St. Christopher's; Musquitos, a town in the island of Cuba; and the Musquito Country, in North America; as stated by Kirby and Spence.

The name musquito, therefore, appears to be applied to any species of *Culicidæ* tormenting to mankind in foreign countries. It has also been applied to some minute midges belonging to the genus *Simulium*, and family *Tipulidæ*, but which are distinguished from the preceding, in North America, as the writer is informed by a competent entomologist, by the name of the black-fly.—See SIMULIUM.

MUSSÆNDA (Linnæus). A genus of evergreen shrubs, natives of both Indies, belonging to *Rubiaceæ*. Generic character:—calyx irregularly five cleft; corolla funnel-shaped, limb spreading, and five-parted; anthers sitting, included in the tube of the corolla; style simple; stigma bifid; capsule two-celled, with transverse dissepiments. These are pretty plants, thrive in loam and moor-earth, and are propagated by cuttings.

MUSTARD is the *Sinapis nigra* of Tournefort, a well-known economical British plant.

MUTILLIDÆ (Latreille). A family of fossorial aculeated *Hymenoptera*, in which the females are generally destitute of wings, the males being winged; hence Latreille has placed this family in the subsection *Heterogyna* with the ants, but their economy

is identical with the fossorial or burrowing sand-wasps, from which they are alone chiefly separated by the apterous condition of the female; the antennæ are filiform or setaceous, vibratile, with the first and third joint elongated; the basal joint is not, however, so long as to form with the following joints an elbow at its extremity. The family is composed of the Linnæan genus *Mutilla*, which has been divided into several modern genera, viz., *Douglus*, *Labidus*, *Apterogyna*, *Psammotherma*, *Myrmosa*, *Myrmecodes*, and *Methoca*. The genus *Mutilla* is distinguished by having the antennæ inserted in the middle of the face; the abdomen ovoid, the thorax continuous in the females, and the antennæ in the males simple. There are many exotic species of this handsome group, two or three of which alone are inhabitants of this country, including the typical species *Mutilla Europæa*, Linnæus, which is of a bluish-black colour, with the thorax red, and with three white bands across the abdomen; the male is winged. The writer of this article has repeatedly taken it in sandy situations in Coombe Wood, the female being found only on the ground, running very quickly, and endeavouring to conceal itself with much cunning on the approach of danger.

MYA (Lamarck, Linnæus). These molluscs are marine bivalves, transverse, not always equivalve, gaping at the two ends, one of which is usually truncated obtusely. The hinge presents a very singular, large, compressed, spoon-shaped appendage, rising perpendicularly from the plane of the left valve, and fitting into the entrance of the primary corresponding cavity on the opposite valve, when both are closed; the ligament is interior, short, thick, and attached to the projecting tooth on one side, and to the cavity on the other. These molluscs lie concealed at various depths on the sandy shores, and protrude a long membranous tube, enveloping two smaller ones, to the surface. Some fossil species have been discovered, but they are by no means common.

MYCETOPHAGUS (Fabricius). A genus of coleopterous insects, belonging to the family *Engidæ*, according to Stephens, but placed by Latreille in his unnatural family *Xylophaga*, having the club of the antennæ composed of five separate joints, the body ovate, sub-depressed, the legs of moderate length, and the tarsi four-jointed, the males having only three joints in the anterior pair; the species are of small size, and frequent fungi, rotten trees, &c. There are six British species, the type being the *Chrysomela 4-pustulata*, Linnæus, which is a quarter of an inch long, of a reddish colour, with the thorax and elytra black, the latter with four red spots.

MYGALE—Musk Rat. A genus of insectivorous mammalia, approaching more nearly to the shrews than to any other family; and yet differing sufficiently from them to warrant its being constituted into a different genus. It differs from them in its dentition, by having three small teeth placed between the two large incisors in the lower jaw, and by having the two incisors in the upper jaw triangular and flat. Behind the incisors there are six or seven small teeth, and four cheek teeth, having their crowns thickly beset with sharp insectivorous points. The muzzle is elongated, a little enlarged at the extremity, and the animal keeps continually moving it. The tail is very long, flattened laterally, and covered with scales; the feet have five toes upon each, all united by membranes; the eyes are exceedingly small; and there are no external ears. The whole structure of the animals indicates an aquatic habit; and they are accordingly found lodging on the banks of streams and stagnant waters, and seeking their food in the water itself, or capturing those insects which are usually found in great numbers by the margins of still waters.

The true character of this animal was for a long time misunderstood, some considering it as belonging to the rats, and others as belonging to the beavers; and it is on account of this early error that it is still popularly called the musk rat. It is not, however, in the least allied either to the rats or the beavers; for both of these are rodent animals; and this is very distinctly a member of the insectivorous division of the carnassiers; and it may be said to hold pretty nearly the same rank among that division as the otter holds among the carnivora, and to regulate the numbers of insects in those places where the otter regulates the numbers of the finny tribes. Though it can travel a little upon land, it is principally organised for motion in the water; and its adaptation to the water, though of course requiring a different modification of structure, puts one in mind of the adaptation of the mole to motion under the earth. The form of the skull and the number of teeth, the absence of external ears, the smallness of the eye, and some other circumstances, produce a considerable resemblance to the mole as well as to the shrews; but when we come to the organs of motion we immediately see an adaptation to a medium different from that in which the mole has to perform its labours: the limbs are, like those of the mole, exceedingly short, and a portion of them is imbedded or concealed within the membranes of the body, as is the case with the swimming paws of the amphibia and the cetacea. The paws turn in a vertical direction with the soles backward, just as in the moles; but then they have more of a rolling motion in the knee and elbow joints; so that the animal can recover or advance them, something after the manner of feathering an oar.

The tail also, from its lateral flattening, its strength and its scales, forms an excellent sculling instrument behind; and altogether the animals are well formed for making their way under water. There are at least two species, one in the north of Europe, and the other in the Pyrenees, and probably also in some other mountainous parts in the south; but as the northern one is the largest, the most interesting, and the best known, we shall direct our few general remarks chiefly to it.

Taking this species as the typical one, it may be said to be the most aquatic of all mammalia which retain the typical form, without any approximation in the posterior part of the body to the form of a fish. It is never found in dry places, nor does it pass from one piece of water to another unless it can find a watercourse, a passage under ground, or one under moist vegetables. It is no lover of turbulent waters or swiftly-flowing streams, but prefers still ponds, the margins of lakes, and especially those places which are subject to periodical inundations. These last are indeed its favourite localities; and one can easily see the reason: when the inundation comes there are many earth-worms and other small animals which seek safety by coming to the surface of the earth; and these form at such times an abundant supply of food for this animal. We can understand from this, by the way, why Russia should be its favourite country above

all other countries in the north of Europe. From the flatness of the surface and the nature of the soil—for flat surfaces which have been several times flooded have their pores so shut up by the deposit of the flood that they become retentive in time, whatever the substratum is.—Russia is more flooded than any other country of the north of Europe; for the other northern countries have diversified surfaces, from which the water runs off. Besides this the winter-fall upon Russia is chiefly snow, not rain. This snow keeps the ground warm as compared with the latitude; and the thaw at the return of the season is rapid, and the water remains on the surface at many places, and where it remains it deposits a new quantity of rich soil. This soil, when the water subsides from it, is highly favourable to the production of worms and ground insects; and consequently Russia becomes, more than any other country, the peculiar pasture of an aquatic feeder upon those worms and other ground animals; and we could name no other region of equal extent on the eastern continent, or indeed anywhere on the surface of the earth, so well adapted for such an animal.

The musk rats, accordingly, choose the margins of such places, where they dig themselves burrows, having the entrance under water, but gradually worked up under ground until they ultimately reach such an elevation as places them above the reach of the highest floodings; for though these floodings, while they last, extend over a considerable breadth of surface, they are never of great depth, in consequence of this very fact of the surface allowing them to run into breadth. These burrows are sometimes worked to the extent of seven or eight yards, including all their windings; but as they are merely lurking-places, and not feeding-grounds like those in which the moles work, heaps of earth are not cast up upon the surface. It is understood that, except in the breeding season, the animals dwell singly in their subterranean abodes; and during that season they are monogamists, or live in single pairs. They do not hybernate in the winter; because, though the land in cold climates is barren at those seasons, the waters are fertile to such animals as can reach the bottom, in consequence of the great numbers of larvæ which they contain: many of the insect tribes, which are exceedingly numerous in those northern latitudes during the summer, being confined to the waters in winter as the only places of safety. There is therefore no necessity for hybernation on the part of the musk rats, which can subsist on those larvæ, any more than there is on the part of the beavers, which at the same season live upon dry sticks. Still there is some occasional inconvenience; for the surface over the burrow, and the surface of the water, sometimes get both so completely frozen over as to be air-tight; and then the animals are in danger of suffocation. If there are any cracks or fissures in the ice they crowd to them, and eagerly thrust their noses upwards to the atmosphere; but it is understood that numbers of them perish every winter from this cause.

At ordinary times they are very peaceable and retiring animals; pursuing their own labours in the waters, without disturbing any creature except those small animals on which they feed. It has been alleged that they feed upon the succulent roots of aquatic plants, as well as upon animal matter; but this mistake appears to have arisen from the conounding of them with rats and other miscellaneous feeding rodentia. The insectivorous division of the carnassiers are as animal in their feeding as the carnivorous ones, if, indeed, they are not more so; and as the pastures of these animals are at all seasons well stored with animal matter, they have no occasion to have recourse to vegetable food: and Pallas, who examined great numbers of them, was never able to detect the least vestige of vegetable matter in their stomachs.

These animals have got the epithet musk attached to their names, not in consequence of their being possessed of any specific apparatus for the secretion of musk, but simply because of the very strong musky smell possessed by all parts of their bodies. This is so very powerful as to render their flesh quite unpalatable; and not only so, but even pike, and other voracious fishes which feed upon them, as they often do, acquire so rank a smell of musk as not to be eatable. We shall now briefly notice the two species.

Russian Musk Rat (*M. Muscovitus*). This species is not very correctly called Russian, because it is found also in Sweden; but Russia is its head-quarters; and the part of Sweden in which it is most abundant has been annexed to Russia since the partition of Europe at the close of the last war. This animal is about the size of the common hedgehog, that is, between eight and nine inches long in the body; and the tail is between six and seven inches. Its covering very much resembles that of the beaver, consisting of long hairs of firm texture and exquisite polish, mixed with close, soft, and delicate fur among the roots which last forms an exceedingly warm covering; and the two together are quite waterproof. The colour on the upper part is brown, paler along the middle of the back, and deepening on the flank; and the under part of the body is silvery white. The skin is very firm, and the fur strong and tenacious, though fine; so that the skin of the animal is held in much esteem by the furriers; and, as the animal is abundant, it is obtained in considerable quantities. The tail is a singular organ. At the base it is compressed laterally; but after a short distance it thickens and becomes cylindrical, beyond which it is again compressed, and the compression increases, while the volume diminishes towards the distal extremity. The compressed parts have of course a very free lateral motion, and but little in the vertical plane, and the cylindrical part has less motion in any one plane, but admits of nearly an equal extent in all. Thus, in consequence of the three parts of which it is made up, the tail of this animal is a very curious working structure. The compressed part at the base acts as a sort of hinge, upon which the whole tail can be moved laterally; while the compressed part nearer the tip can produce lateral motions in any part of its length, and more free and rapid ones toward the extremity, where it becomes thinner in proportion to its breadth. The cylindrical part again admits of the two flat parts being bent at an angle to each other, and also of their being twisted into different planes. In consequence of these compound motions, the tail of the musk rat is one of the most extraordinary mechanical instruments in the whole animal kingdom; and it is one well worthy of being studied by every person who wishes thoroughly to understand mechanical principles.

Though there is a considerable resemblance between the countries in the east of European Russia,

and the adjoining part of Siberia, and also between the west of Russia and the proximate part of Poland, yet Pallas, notwithstanding the zeal and industry of his researches, was never able to meet with the musk rat, either to the east of the Volga, or to the west of the Dnieper. Within these limits in longitude, it does not inhabit very far to the north, not higher than the sixty-sixth degree of latitude, and its chief haunts are upon the river Don and its affluents. The climate of Norway is, however, far milder in high latitudes than that of Russia; and accordingly the animal is there found much farther to the north; not in such numbers, certainly, as in central and southern Russia; but still skins have been imported into Germany by the Swedes; and there is no doubt from some northern part of Sweden.

As this is decidedly the most aquatic of all mammalia which retain in chief part the land type, it is, independently of its mere organs of motion through the water, furnished with additional accommodations, which perhaps no other animal possesses in an equal degree. Its mode of feeding is not to follow its prey through the free waters, and catch it by speed as the otter catches fish, because its food consists of animals so small, that they would not singly repay it for the labour of a chase; and consequently, if it were left to this mode of finding its food, it would have no other alternative but to starve; because an animal even of its moderate size, hunting for insects through a medium of so much resistance as water, could not possibly capture as many insects as would supply the waste occasioned by its labours. Therefore, it is so formed, that it preys at the bottom, and dabbles with its nose in the mud and sludge, something in the same way as a duck. Nor is there any doubt that its produced nose is endowed with very keen senses, both of smelling and of touch. The nostrils, opening like the bells of little French horns, show clearly that it must have a keen sense of smell; and the continual motion of the nose, together with the papillæ with which the naked part of it is beset, show as clearly that it is equally keen in respect of touch. It is perfectly evident, indeed, that these are the only two senses upon which the animal can depend for its food; for the insects in the sludge are of course equally silent and invisible; and therefore, in finding its food, the most essential of all its occupations, it can have little or no dependence upon ears or eyes. It is thus in some sort reduced to the state of the mole; and this is no doubt the reason why, in the form of the cranium, and the general air of the head, it has so much resemblance to that animal, though modified so as to work in a much softer substance.

This habit of the musk rat, in going always to the bottom, in order to find its food, requires a peculiar apparatus; and it is accordingly furnished with one. The subcutaneous muscle is remarkably strong; and it is voluntary over the whole body, in the same manner as it is over the human forehead, and in the skins of various animals, even pachydermatous ones; for the elephant can shake off not only an offending substance, but often a beast of prey, by this means alone. The power of the muscle in the musk rat is not directed to the shaking off of anything from it; for while it is in health the fur prevents all adhesion either of mud or water; but the muscle can expand and contract the whole skin, and thus alter the specific gravity of the body, so that it can ascend or descend in the water by mere changes of gravitation. The naked part of the nose is the portion of its body of which this animal takes the greatest care; and it is said never to allow that to get dry—a state which would no doubt weaken its powers both of sensation and of motion. It is probable, too, that the continual agitation of this organ is intended to keep the muscles in constant readiness for those motions of which they are the organs, and without which the animal would be incapable of feeding, and would of necessity perish. There is an additional means of touch in this very complete organ. The circumference of the nostrils is beset round with short hairs, forming a sort of whiskers, which the animal has the power of projecting forwards or reflecting backwards at pleasure. When it is in a state of repose, they are always reflected; but when it goes to work they are advanced forwards; and as it can no more see the bottom in which it is to work, than it can see the small animals for which it searches there those appendages to the nose in all probability inform it of its arrival at a place fit for beginning its dabbling operations. Notwithstanding its blindness, it is not a nocturnal animal, but sleeps during the night, though it is said to keep up the motion of the nose, and even to change its place, during its sleep. Water is so indispensable to it, that Pallas was unable to keep one alive more than three days without access to it. When it is placed in a small quantity of water, that water is very speedily rendered most offensive to the smell; and when it is communicated to any substance, it remains for a great length of time. When Pallas was making his experiments upon the animal, he applied a thermometer for the purpose of ascertaining its heat which he found to be ninety-eight degrees of Fahrenheit, or nearly that of the human body. The thermometer got impregnated with the offensive odour of the animal, however, and retained it for fourteen years.

We may further mention of this very singular animal, and it is unquestionably the most singular subject of European zoology, and apparently peculiar to Europe, that the nerves which supply the organs of touch and of smelling are remarkably large, and ramified toward the naked part of the nose in a very thickly-netted plexus. The clavicles and the blade-bones are well developed, and bear about the same proportion as those of the mole, having to support both the digging and the swimming motions. There is but little action of the spine, and the habits of the animal do not require much. Of the dorsal vertebræ only the three last ones of thirteen have spinous processes. There are six lumbar vertebræ, five sacral, and twenty-six in the tail. We omitted to mention, in speaking of that instrument, that it is covered with small scales alternately with short scattered hairs. There are also some scales on the naked portion of the upper sides of the toes. Altogether it is a most extraordinary creature, both in its structure and its habits. There is no parallel to it in the whole range of the mammalia, and there is certainly no country possessing the same physical character as that part of Russia in which it is found. That country has a winter almost Siberian, alternating with a summer nearly tropical, and the changes from the one to the other take place without the intervention of any season deserving the name of spring or of autumn. As the name "musk rat" is calculated to mislead, by inducing the ignorant to refer the animal to a wrong order, it would be very desirable to change it

for another popular one. The French call it the *Desman*, which is, we believe, the Swedish name, and there could be no objection to the adopting of the same in this country. The Russian would no doubt be the more appropriate name, but, like many other Russian names, it is a "jaw-breaker"—it runs thus, as nearly as our alphabet will bring out the expression of it—*Wuytchotschol.*

Pyrennean Species (*M. Pyrenaica*). This species is only half the size of the former, and differs much in the structure of the tail, almost sufficiently so in this, and some other respects, to entitle it to rank as a separate genus, or, at all events, to a separate subgenus. The tail is not compressed at the base, nor enlarged at a little distance from it. It is cylindrical, or nearly so, for the greater part of its length, and laterally compressed for only about the last fourth. It is also longer than the body of the animal, and its covering is different. It has no scales, but only a peculiar sort of flat hairs, which, however, adhere to the skin for the greater part of their length. The muzzle is much more produced than in the Russian species, indicating, perhaps, a habit of finding its food in more stubborn mould. The structure of its feet are much less aquatic, the toes of the fore foot not being webbed to the extremities, and the inner toes and the hind ones being entirely free. The covering of the body is the same in its texture as that of the other, but it is very different in its colouring. The upper part is a fine maroon brown, passing into greyish-brown on the flanks, and again into silvery on the belly; the whole of the face is dark coloured, instead of having a white space surrounding the eyes, and the lower side of the under jaw white, as in the other; in the arrangement of the teeth, those of the upper jaw very closely resemble the teeth of the mole; the bristly hairs around the muzzle are almost entirely rudimental. This species has not been long known, and was discovered by M. Dessouais, Professor of Natural History at the Central School of Tarbes, on the French side of the Pyrennees. It was not found in the mountains or in the plain at the base where the current of the water becomes more moderate, and in this it, in so far at least, agrees with the Russian, or more typical species, which is found only on the margins of slow running or stagnant waters. It should seem that this small species is rare, for it has not been met with at the foot of any of the other mountains of southern Europe, and, even in the place where found, it has been but rarely seen. It does not appear to be an animal of nearly so interesting a character as the Russian; but still it is not a little curious that two animals, apparently peculiar to Europe, and differing so much from all the other European mammalia, should be found in regions so widely apart from each other, without any corresponding animal, or any approach to one, in the wide regions which intervene between their localities. There is not a great deal in the physical geography of the country at the foot of the Pyreenes which could assimilate that country to central or southern Russia; and yet there is a violent contrast in the seasons of the one locality as well as in those of the other. The narrowness of the country there, the difference of temperature in the two seas, the height of the mountains, and their continuation from sea to sea, and the consequent play of the atmosphere between the Mediterranean and the Bay of Biscay, certainly make the French side of the Pyrennees a peculiar country; but still there is not much resemblance between it and Russia.

MYGALE (Walckenaer). A genus of spiders comprising the most gigantic species of the tribe, distinguished by having the palpi inserted at the superior extremity of the maxillæ, so that the former organs appear six-jointed, the first joint being narrow and long, with the internal angle at the tip porrected so as to perform the office of the maxillæ. The labium is small and subquadrate; the last joint of the palpi in the males is short, and in form of a button. The two anterior tibiæ have also, in this sex, a strong spur at the inferior extremity.

Latreille, who has paid much attention to this group of spiders, and published a valuable memoir upon them, in the Nouvelles Annales du Muséum, has divided them into two divisions or subgenera, both of which from the interesting particulars connected with them, it will be proper to notice.

In the first, or mygale, the tips of the cheliceræ are not furnished with a series of moveable spines, and the hairs which clothe the underside of the tarsi form a thick and broad cushion extending beyond and concealing the ungues. Here belong the largest species of the family, some of which, in a state of repose, occupy a circular space of six or seven inches in diameter. The type of this genus is the *Aranea avicularia*, Linnæus, respecting the habits of which great incorrectness appears to have prevailed amongst naturalists. We are indebted to Mr. MacLeay for a correction of these errors; the following is an abstract of the communication of this gentleman, published in the first volume of the Transactions of the Zoological Society of London. The story of a spider which catches and devours birds appears to have had its origin with Madame Merian, in her splendid work upon the insects of Surinam. Oviedo, Labat, and Rochefort make no mention of any spider as possessing such habits; the two latter writers going no further than the statement, that in the Bermudas there exists one which makes nets of so strong a construction as to entangle small birds. Madame Merian, however, went the length of asserting that one spider not only caught but devoured small birds, and figured the *Mygale avicularia* in the act of preying upon a humming bird. Now, the *Mygale* does not spin a net [Madame Merian does not assert that it does do so], but resides in holes under ground, and in all its movements keeps close to the earth, while humming birds never perch except on branches. The food of *Mygale* consists of *Juli*, *Porcelliones*, *subterraneau*, *Achetæ*, and *Blattæ*. A *living* humming bird and a small anolis placed in one of its tubes, were not only not eaten by the spider, but the latter quitted its hole, and left it in the possession of the intruders. The largest spider of the West Indies that spins a geometrical web is the *Nephila clavipes* (Leach,) and its net may probably, occasionally, be strong enough to arrest the smaller humming birds, but it is not likely that the spider would eat the birds. A small species of lizard, introduced into one of these webs, was enveloped in the usual manner by the spider, but, as soon as the operation was completed, the spider lost no time in cutting the line, and allowing her prisoner to fall to the ground. Mr. MacLeay consequently disbelieves the existence of any *bird-catching* spider.

The nest of this species is in the form of a tube, narrowed to a point behind, and composed of a whitish

web of very fine texture resembling muslin. The cocoon of the same insect, or rather the egg-case, is of the size and shape of a large nut, the outer envelope being composed of silk of the same kind as its nest, arranged in three layers. It appears that the young are disclosed within this case, and there undergo their first moulting. M. Goudot stated to Latreille that he had extracted as many as a hundred young from one of these cases. There are several species of these insects in Brazil, East India, and the Cape of Good Hope; and M. Dufour has also found one even in the arid deserts of Moxenta, in Spain.

In the second division of the genus *Ctenizа*, (Latreille), the *Cheliceræ* are furnished at the tip with a series of moveable spines, and the tarsi are less strongly cushioned, so that the claws are not hidden.

The type of this division is the *Mygale cæmentaria* (Latreille; *Araignée maçonne* of Sauvages), or the mason or trap-door spider, so named on account of the curious structure of its nest, as observed by Sauvages, Dufour, and more recently by Audouin, who has published an interesting account in the "Annales" of the French Entomological Society. These spiders dig in the dry and mountainous districts of the south of Europe subterraneous galleries, of a cylindrical tortuous form, to the depth of many inches (sometimes two feet); they also construct at the mouth of the burrow, formed of silk and earth, a moveable operculum, or trap-door, which is so attached as to exactly fit the entry to the habitation, and to lift up and down.

These habitations are formed on an argillaceous kind of red earth; the walls are not left just as they are bored, but are first covered with a kind of mortar, which is subsequently coated with finer mortar, as smooth and regular as though a trowel had been passed over it. This coat is very thin and soft to the touch; within this is a tapestry of silk, having the lustre of satin, and almost always of a dazzling whiteness. These coatings render the nest impervious to wet. But the trap-door is the most singular part of the construction, being composed of more than thirty layers of earth and web, emboxed as it were in each other, like a set of weights for small scales, these layers of web terminating in the hinge, so that the greater the volume of the door, the more powerful is the hinge; and by another peculiarity in the construction of this nest, the strength of the hinge, and the thickness of the frame, are always proportioned to the weight of the door. Whenever, therefore, the spider enters her nest, or goes out, the door shuts of itself. Resistance is, however, experienced in endeavouring to open the door from without, and which M. Audouin supposes is caused by the spider within pulling down the door with her claws. Indeed, the inside of the door is remarkable for a semicircle of minute orifices, placed on the side opposed to the hinge, about thirty in number, the object of which M. Audouin considers is to enable the animal to hold the door down, in case of emergency, against external force, by the insertion of its claws into some of them, the claws, as above stated, being furnished at the tip with a series of moveable spines. There are several of these trap-door spiders, one of which is found in the Island of Naxos (*C. ariana*); another in Jamaica (*C. nidulans*); a third at Montpellier (*C. cæmentaria*); a fourth (*C. Sauvagesi*, described by M. Audouin) in Corsica; and a fifth found in various parts of New South Wales, by Mr. Bennet, and described in his Wanderings in that Island (vol. i. p. 328). Mr. Kirby has figured the Jamaica species and its nest in the frontispiece to the second volume of his Bridgewater Treatise, in which he has also copied M. Audouin's figures. M. Dufour is of opinion that it is the females alone which construct these nests, the males being generally found under stones, and their structure not appearing so well adapted for building as those of the females.

MYGALURUS (Lamarck). A genus of European grasses, chiefly annuals, and therefore not in cultivation. In English botany they are called *Festuca*, or mousetail.

MYGINDA (Jacquin). A genus of hothouse shrubs (except one, the *M. myrtifolia*) belonging to *Rhamneæ*. The plants delight in a loamy soil, and are increased by cuttings.

MYLABRIS (Fabricius). A genus of coleopterous insects, belonging to the family *Cantharidæ*, having the antennæ eleven-jointed in both sexes, thickened towards the tips, with the last joint distinct and larger than the preceding; the body is long and sub-cylindric, and the thorax narrow. This is an extensive genus, consisting of handsomely marked species, none of which are inhabitants of this country, although some inhabit the more southern parts of Europe. The type is the *Meloë chicorii*, Linnæus. Several species are employed as vesicants, having powers similar to those of the blister-fly, *Cantharis vesicatoria*.

MYLOCARYUM (Willdenow) is the buckwheat tree of Georgia, belonging to *Ericeæ*, formerly called *Cliftonia ligustrina*.

MYOCONCHA. A genus of molluscs, established by Sowerby in his Manual of Conchology.

MYOPOTAMUS—The Coypou. A genus of rodent mammalia, resembling the beaver in size, in the places of its habitation, and in some other particulars, but differing from it in geographical distribution, and in other respects, being found only in the tropical parts of America, whereas the beaver is found only in the cold regions of the north. This animal is very generally distributed over the warm parts of South America, where it is found on the banks of the streams, and chiefly, indeed, inhabiting the waters where it finds the principal part of its food. The first correct notice which we have of it is in Molina's account of Chili, coypou being its name in that country. It is also mentioned by D'Azzara, in his natural history of Paraguay, under the name of *Quanya;* and it was also observed by Commerson, (after whose death an account of it was found among his papers,) as the type of a new genus, under the name myopotamus. Commerson left a drawing of the animal; and between that and the account given by the natural historian of Paraguay, the characters and relations of this addition to the rodentia of South America were tolerably well made out. Long previous to this, the skin had been by no means an unimportant article of commerce; but it was not until five or six years of the present century had elapsed that the animal itself was known, even to the naturalists of Europe. For a long time the researches of those naturalists were confined to the ransacking of the warehouses of furriers for the purpose of examining the skins; but as no attention is paid in the procuring of such skins, to preserve the characters of the animals to which they belong, the results of those examinations were far from valuable; and a long time elapsed before anything else than the mere external were

known even to the most learned in zoology. The name *myopotamus*, given to the animal by Commerson, is nearly synonymous with *hydromys*, the common name of almost all aquatic rodentia except the beavers; and it was understood to have no inconsiderable resemblance to two Australian species lately discovered in its external characters generally, and especially in the structure of the feet, which are all five-toed, the fore ones with the toes free, and the hind ones with them webbed. In consequence of this it was considered as belonging to the genus hydromys as then established; but when its system of dentition came to be examined, it was found to resemble much more the dentition of the beavers, having four cheek teeth in each side of both jaws, as the beavers have, and not two, as in the genus hydromys, though the number of incisive teeth in both are the same, namely, two in each jaw. This different structure of the mouth indicated a different species of food, more difficult of mastication, and approaching to that on which the beaver subsists; and after this discovery had been made, it was found, upon further examination, that there were great and very characteristic differences between it and those animals of New Holland with which it had at the first been classed. Its body is much less vermiform, that is, slender and flexible, and capable of twining its way among bushes, than the bodies of these. Its claws, also, are much larger, blunter, and not nearly so much arched; and its tail is less hairy than theirs, and more covered with scales. All those differences indicate not only an animal of very different habits, but an animal whose habits are decidedly more aquatic. The lithe bodies, the crooked claws, and the hairy tails of the Australian animals, afford proofs that they seek for some sort of prey, either animal or vegetable, among the tangled herbage on the margins of the streams, whereas the opposite characters of the same structures, in the South American animal, are equally conclusive evidence that the water is the grand theatre of its action. This being ascertained, it became necessary to establish this animal into a new genus, and Commerson's name has been retained, while the name given by Molina has been Latinised as the specific one. At present, however, there is not much need for a specific name, because there is no other known species of the genus, nor is it very probable that another will be found; but the specific name leaves the generic one open in case that such a discovery should be made at any future period.

This is in some respects a curious animal. The beaver, properly so called, is found only in cold countries; and so is the sub-genus *Fiber*, which agrees with the water-rats and field-mice in the structure of its teeth. This animal approaches more nearly to the beaver in dentition, which is the essential character of an animal, than any of the rodentia even of cold countries; and yet it is found only in the warm parts of America. It is therefore a sort of anomaly in the animal world; for it is not a little remarkable to find in the tropical and the polar parts of America two animals resembling each other so nearly in their teeth, and also in the covering of their bodies; while polar and tropical animals are not only in general very different in the coverings, but that the covering of an animal undergoes a decided change when that animal is transferred from the one of these localities to the other. It must be borne in mind, however, that both the coypou and the beaver spend most of their time in the water; and that the difference of temperature of the water in different latitudes is very small, compared with that of the earth or the air. Besides, the streams of South America near the Andes (and it is in these, rather than the broad waters of the plains, that the coypou resides) contain a considerable portion of snow-water all the year round; and thus their temperature is low in proportion to the latitude. The existence of this animal in warm latitudes may be regarded as a proof of the influence which melting snows can exert upon the waters even of a tropical climate. There is, as we have said, only one species of this curious animal; and this species we shall now very shortly notice.

The Coypou (*Myopotamus coypus.*) This animal is among the largest of the rodentia, measuring about one foot nine inches and a half in length, independently of the tail, which is about one foot two inches and a quarter. The legs are rather short, as compared with the size of the animal, being not above four inches and a half in length. The incisive teeth are maroon red on their external surfaces; the claws are black; and the ears, which are small and rounded like those of the genus *Hydromys*, have the convex surfaces thickly covered with short hair. The general colour of the fur on the back is maroon brown, becoming brighter on the flanks, and passing into bright red; while the tint of the belly is reddish sand-colour. These colours are liable to apparent changes, however, being of a different tint when the animal bristles them up, than when they are laid flat. Each hair is brownish ash at the root, and bright red at the point. The felt, or fine fur which is concealed under the long hairs, is brownish ash, rather deep in the tint on the upper part, but paler on the belly. As is the case in all aquatic mammalia, the hairs on the tail are few, short, and stiff; they are of a reddish sand-colour, and interspersed with scales on the naked parts. The circumference of the mouth, the termination of the muzzle, and the mustachios, which are long and stiff, are white, but the mustachios are interspersed with some black hairs. These animals are, however, affected with albinoism in a good many instances; and it is worthy of remark that this affection is so common in some parts of tropical America, that it is not rare among the people of colour. The albinos of the coypou are not, however, entirely white; for in them the maroon on the back is changed to red and the red on the flanks to a very pale tint of the same. It is possible, however, that these supposed albino skins may be merely those of young animals or of females; although D'Azzara says that the female is very like the male.

The skins of these animals have for a long time been imported into Europe in very great numbers; and the soft under-fur has been employed in the manufacture of hats, in exactly the same manner as the under-fur of the beaver.

The manners of this animal are imperfectly known, nor have its geographical limits been settled with that precision which would be desirable. D'Azzara and Molina are still the authors who have published the best and almost the only accounts of this animal, though, from the researches now going on, we may anticipate that before long we shall be better acquainted with this, and with all the other peculiar animals of South America, whose history, could we obtain it fully and satisfactorily from actual observation, would be one of the most interesting chapters

in the book of living nature. The authors alluded to describe the coypou as inhabiting the banks of the rivers, where it digs a burrow with its claws; and it must be admitted that, from their structure, they are well adapted for such a purpose. It is said to be an excellent swimmer, very gentle and inoffensive in its manners, and by no means difficult to tame. In a domesticated state it is also very accommodating in respect of food, eating almost anything that is given to it; and it shows much gratitude and affection to those who are attentive to it and supply its wants. It is rather a fertile animal, the female producing as many as six or seven at a litter; but then its skin is in such request as an article of commerce, that it is sought for and destroyed with nearly the same avidity as the beaver is in North America. It is not a little remarkable that an animal resembling the beaver so much as this does in the system of its teeth, should yet be so very different in the economy of its habitation. The beaver never burrows, even, we believe, in the case of those solitary individuals which, for causes unknown to us, are expelled from the regular communities; and, excepting in the case of those expulsions (and they form the exception, not the rule), the beaver is a social animal. The coypou, on the other hand, burrows, but never builds, though it probably carries leaves and grass into its burrow in the breeding season, as is done by almost all animals which frequent the banks of rivers, or otherwise form their habitations in humid ground. The difference of character in the places which they inhabit may be one cause of the difference in manners between this animal and the beaver. The streams of the northern parts of North America, upon the banks of which the beaver is most abundant, are subject to be flooded for a considerable time during the spring freshes; and thus a burrow so constructed as to allow the animal an outlet under water, and a dwelling in the air at the same time, could not be formed but at an expense of more labour than the beaver requires to exercise in the building of its hut. Where the coypou inhabits, floodings are by no means so common and when they do occur, they are of very short duration. They do not occur in tropical South America, and hardly, indeed, nearer the equator than the thirtieth degree of south latitude; and, though the countries there have their rainy seasons, drought is the prevailing character. Chili, Tucuman, and part of Buenos Ayres, are the places where chiefly this curious animal is found; and they are countries very unlike in their physical geography to the beaver's country in North America. Still it is not uninteresting to find that though the northern part of the American continent is subject to greater vicissitudes of seasons, and more severity of cold in the winter, than any other part of the world, while in the south the seasons are comparatively uniform, and a tropical character is preserved up even to the Strait of Magalhaen; yet that both are fur countries, and fur countries to a very considerable extent. It is true that the furs of the south are not so numerous, and perhaps not so valuable, as the better ones of the north; but a country which furnishes the chinchilla from its dry hills, and the coypou from the banks of its streams near the mountains, must always be regarded as an important fur country. As is the case with the whole of South America, we want information with regard to the peculiar localities of the coypou.

MYOPORINÆ. A small natural order of plants, comprising four genera and eighteen species, already described. They are mostly natives of New Holland and the South Sea Islands. The leaves are simple, alternate, or opposite, with no stipulæ. The flowers are scarlet, white, or blue coloured, axillary, and without bracteæ. This order contains *Myoporum*, *Bontia*, *Avicennia*, and *Stenochilus:* the last being the handsomest of the order. The *Avicennias* are shore plants like the mangroves, shooting their long roots to a great distance among the mud, or on the surface, five or six feet before they turn downwards to fix themselves. All the species may be kept in the stove or greenhouse, and only require ordinary treatment.

MYRIAPODA—hundred legs (Latreille). Under this name Latreille united together the two orders *Chilognatha* and *Chilopoda* of Leach, which it is true possess many characters in common, as stated in the article upon the former of these two orders, but which have been considered as being respectively of equal rank with the orders of winged insects by our English authors, whose classification we have in this respect adopted.

MYRICA (Linnæus). A genus of deciduous and evergreen shrubs found in different parts of the globe, one of which, the *M. gale*, is the sweet gale of Britain, and the *M. cerifera* is the candle-berry myrtle of North America. The flowers are diœcious, and the genus belongs to *Amentaceæ*. The root of *M. cerifera* is a powerful astringent, but it is more prized for the wax it bears than as a medicine; and in some parts of North America, where animal tallow is scarce, its annual crop of wax is collected and made into candles. Our common gale yields wax, but much less abundantly.

MYRIPRISTES. A genus of spinous finned fishes, belonging to the perch family, having the abdominal fins under the pectorals. They are covered with beautiful scales, and have two rows of toothed scales on the gill-lid, but no spine at its angle. One of their most remarkable characters is the form and situation of the air-vessel, which is divided into two lobes anteriorly, and attached to the bones of the cranium in such a manner as to separate entirely the cavity which contains those hard substances which are understood to be the principal organs of hearing in fishes. The intimate connexion between the air-vessel and these organs in this genus of fishes is a singular point in natural history; but it is one the physiology of which is involved in great obscurity. There is a curious connexion between the characters of different latitudes, and those of the fishes most abundant in these latitudes, which cannot be explained,—either by the slight difference of temperature of the sea, or by the different action of the solar beams considered merely as light and heat. The tropical fishes are remarkable above all others for their brilliancy, and for the superior development of those organs which we suppose contribute to the sense of hearing; and it should seem that fishes are far more sensible to, and far more influenced by, the different electric states of the regions which they inhabit, than we would at first suppose. There is also an obvious connexion between the air-bladder in fishes and their susceptibility to electric influence; though what it is, or how it operates, we are unable to tell. There is no question, however, but that, in the case of tropical fishes, which inhabit where the sea is often subject to violent thunder-storms, there is a sort of presentiment, or affection of their systems, by means of which they anticipate the storm and avoid its violence.

We find in our own rivers that brilliant lightning and loud thunder invariably send down the fish; so that, although there is often good fishing in a shower, there is seldom, if ever, good fishing in a thunder shower. Now, if we find this in our latitudes, where the electric action of the atmosphere is so mild and limited, we may be prepared for finding it to a much greater extent in those tropical climates where this action is at a maximum. To what depth the sea may be so much electrified, even in the most violent thunder storms, as to benumb the muscular irritability of fishes, we are unable to say; but there is no doubt that they are possessed of means which give them warning of the approach of such storms, and that they avoid them. The fishes of the present genus are found in the tropical seas of both hemispheres, but not in cold or temperate latitudes. Nothing whatever is known of their manners.

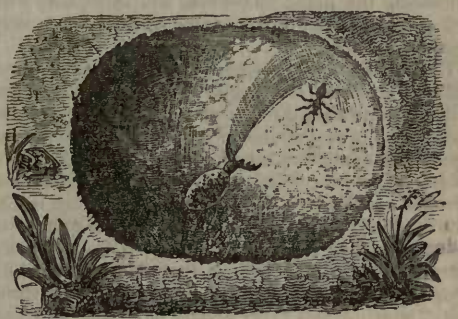
MYRISTICA (Linnæus). A genus of three species of tropical trees and shrubs, one of which is the cultivated *M. moschata*, the true nutmeg, being the type of the order *Myristiceæ*. Generic character:—flowers dioecious; calyx three-toothed; stamens forming a thick column; anthers linear, two-celled, united; style short, pyramidal; stigma of two lobes; drupe one-seeded, nut covered with an arillus; arillus fleshy; albumen firm, veined, and marbled. Of the several species of *Myristica*, the common nutmeg is the most valuable and best known; aromatic fruits are, however, borne by others, such as the *M. otaba*, which is the nutmeg of Santa Fé, and *M. Horsfieldia*, which is a native of Ceylon, where there are several other varieties. The fruit of *M. tomentosa* is often fraudulently mixed with ordinary nutmegs, but it is an inferior spice.

The English residents at Bencoolen, and other settlements in that part of the east, cultivate the nutmeg with success; but they do not seem to thrive in the West Indies. The nutmeg or seed, with its arillus or mace, are powerful carminatives, and in large doses are dangerous, but in proper doses are cordial medicines. The natural order to which this genus gives a title is—

MYRISTICEÆ, which contains only one other genus, viz., *Hernandia*, of both of which there are only six species as yet described, three of each genus. The *Hernandias* are large Indian trees, called by the English Jack in a box, from their fruit being sonorous when shaken. Nutmeg plants are as yet scarce in our collections, but the *Hernandias* are common and easily propagated.

MYRMELIONIDÆ (Leach). A family of neuropterous insects, having the tarsi five-jointed, the body long and slender, the head not produced into a rostrum, the antennæ thickened at the tips, the wings of equal size, and in repose applied against each other above the back, like the roof of a house; the ocelli wanting, and the legs short. These insects are found in warm situations in the meridional coun-

tries of the Old and New World; they fly but little during the day, remaining quiet amongst the leaves of different plants. The habits of the larvæ are, however, quite the reverse of this. In this state the insect is known under the name of the ant-lion (*Myrmeleon formicaleo*, Linnæus), which it has obtained from the great havoc which it makes in destroying ants and other small insects in an exceedingly ingenious manner. The abdomen is very large, in proportion to the rest of the body, and fleshy; the head small, flattened, armed with two long jaws like horns, or rather more like a pair of calliper compasses, but serving as instruments of suction instead of mastication, being channelled on the under side. These organs have indeed been described as perforated and tubular, but such is not the case; the maxillæ, which have been overlooked or considered as a portion of the mandibles, fitting into the channel, and assisting in suction; the body is grey or sand-coloured: although provided with legs, these organs are so unfitted for active motion that the insect is unable to follow its prey, like the larvæ of the *Hemerobiidæ*, which in several respects it very much resembles; indeed its ordinary motions are either backwards or sideways. How then is this slow unwieldy animal to obtain a supply of food, consisting as it does of insects of such activity as the ants? This is effected by means of a snare or pitfall, which it excavates in the sand, at the foot of which, when completed, it takes its station; but, lest its hideous form should alarm its victims, it buries itself at the bottom, leaving only the head exposed.



Pitfall of the Ant-lion.

These pitfalls vary in diameter from one to three inches, according to the size of the larva by which they are constructed. When the insect has fixed upon a spot for its retreat, it first marks out a circle, to which the exterior of its intended pit is to extend: it proceeds working backwards, shovelling or scooping the sand by means of the fore leg on the side which is nearest the centre of the hole, upon the back of its head, and which it then, by a sudden jerk, throws several inches beyond the circle; in this manner it proceeds circle after circle, but alternately reversing its position, so that the opposite leg may alternately be employed as a shovel; and so quickly does it carry on its operations, that in the course of half an hour it has raised a cone of sand equal in diameter to the diameter of its pit. Sometimes, however, it meets with serious obstacles—pieces of stone, &c., interrupt its path, and which require the greatest exertions to remove; sometimes it is able to effect this, which is done by jerking the stone with its jaws beyond its burrow; but, in case the stone is much heavier than itself, it contrives to place the stone upon its back by the alternate motion of the rings of the body, and in this way carries it up to the margin of its cell, when it rolls it away. Sometimes indeed it is unable to perform this, and, after various ineffectual attempts, is compelled to quit the spot and recommence the form-

ing of a fresh pit in another place. When it has completed its work it has now to lead a life of wearisome patience. It takes its station at the foot of the pit, and there waits until an unlucky chance brings some hapless ant down the precipice, which it immediately seizes with its exserted jaws, sucks, and then casts away with a jerk. If the unfortunate insect should happen to struggle, and endeavour to escape, it showers upon it, by means of a jerk with its head, a quantity of sand, which seldom fails in bringing it within its reach. The nutritive matter which it extracts from its prey is not converted into excrement; this insect, as well as various others, having no anal aperture. From its habits it may be imagined that it is enabled to undergo a long-continued fasting. When it is full grown it forms for itself a perfectly round cocoon, of a white shining silky matter, externally covered with sand, within which it is transformed into a short curved inactive pupa. In about fifteen or twenty days the imago bursts forth, in a form quite unlike that in which it had previously appeared, leaving the exuviæ of the pupa sticking in the aperture formed for its exit out of the cocoon. There are many species of this genus, some of very considerable size, being larger than the largest dragon-flies. In all the species the wings are most beautifully reticulated, resembling the finest lace-work, and variegated with dark spots and markings, giving the insect a very elegant appearance.

The other genus belonging to this family is *Ascalaphus* (Fabricius), the species of which constitute one of those interesting groups of animals, which, whilst possessing the real character of one tribe, assume the appearance of another totally distinct, exhibiting what has been termed a relation of analogy in distinction from one of affinity. This kind of relationship is met with in almost every group of animals in a greater or less degree; and from the frequency of its occurrence naturalists are led to believe that in the great and natural distribution of animated nature—that system, in fact, which places every animal in its own situation with reference to the habits and structures of every other animal—these analogies are not casual circumstances, but necessarily attend the higher and more close relations of affinity. If we examine then the essential structure of *Ascalaphus*, we shall find that in its oral apparatus, the structure of its wings, legs, &c., a very close affinity exists between it and the ant-lion flies (*Myrmeleon*). They are therefore placed in the same family, this being an instance of the closest connexion which can exist between two genera. But if a person unused to the examination were to be shown an *Ascalaphus*, he would immediately call it, as some authors have even done, a butterfly—the antennæ between long, slender, and clubbed at the tips, and the wings of moderate size, and ornamented with various colours, although not clothed with scales; this, therefore, is an instance of analogy, or the most distant relationship which can subsist between two genera. The species are chiefly found in the south of Europe. They inhabit hot sandy districts, and fly quickly.

MYROBALAN PLUM is the *Prunus myrobalana* of Linnæus, a fruit tree, of which the fruit is but very inferior in quality.

MYRRHIS (Morison). A common British plant well known as myrrh, esteemed for its pleasant scent, belonging to *Umbellifera*. It has been long in cultivation, and formerly was much more used than at present. Its leaves were used in salads, and its roots were eaten either boiled or made into tarts or sauces, or candied as a sweetmeat. In the North of England the seeds are employed to perfume and polish oaken floors and furniture.

MYRSINEÆ. A natural order, comprising eight genera, and above fifty-two species, all greenhouse and hothouse plants. The plants of this order are nearly allied to *Primulaceæ*, only the former are arborescent, while the latter are herbaceous. The genera here associated are *Mæsa*, *Jacquinia*, *Ardisia*, *Corynocarpus*, *Embelia*, *Myrsine Manglilla*, and *Clavija*. Some of the *Ardisias* are very beautiful; the *Jacquinias* are also highly ornamental, and all of them thrive under the ordinary hothouse management.

MYRTACEÆ. A most important natural order, as well for the number of genera it contains as for the beauty of their flowers and usefulness of many of their fruits. Thirty-seven genera, and nearly three hundred species, are already in our books. The myrtles and their typical allies are trees or shrubs, with often angled branches and simple exstipulate leaves, mostly opposite, but rarely alternate or in whorls, as in some of the *Melaleucæ*. The substance of the leaves is mostly coriaceous, and furnished with numerous dot-like receptacles, containing aromatic essential oils, on which their fragrance depends. The inflorescence is both terminal and axillary, variable in its form, generally aggregate, the blossoms being seldom solitary. The flowers are united and regular, white or red, occasionally yellow, but never blue. The tube of the calyx is adherent to the germen; the limb four to six-cleft, persisting or deciduous. The petals (rarely wanting) are equal in number to the lobes of the calyx, and alternate with them. The stamina are seated round the germen, and are, when not indefinite, two or three times the number of the petals, and often arranged in several series; the filaments are distinct or connate; the anthers are small, oval, two-celled, and open lengthways; the germen is inferior, and one to six-celled; the style is single; and the stigma in general is simple and entire; the fruit is various, either dry or fleshy, sometimes capsular, or baccate, or drupaceous, and many or one-seeded.

MYRTLE is the *Myrtus communis* of Linnæus. Of this favourite plant there are ten garden varieties, differing chiefly in the form of their leaves and manner of growth. There are thirteen other species, mostly natives of warm countries. They are all easy of cultivation.

MYSIS—the opossum shrimp (Latreille). A curious genus of podophthalmous crustacea, forming the type of the order or sub-order *Schizopoda*, so named from the legs being cleft near the base, each composed, as it were, of a pair of legs. The three external pairs of maxillæ, or foot-jaws, which in the shrimps serve for manducation, are here transformed into legs; so that, instead of five pairs of these organs, there are eight; and as each leg is doubled, or bifid, these shrimps may be said to have thirty-two legs. Another peculiarity is, that the females are provided with a pouch on the under side of the body, in which they carry their young for a considerable period after they are hatched. The shell is slender, and none of the legs are cheliferous; the tail is terminated by a swimming apparatus. The type of this genus is the *Mysis Fabrici* (Leach), or the *Cancer oculatus* of Otho Fabricius. Mr. J. V.

Thompson has published a very valuable Memoir upon this genus in his Zoological Researches.

MYTILACEA. De Blainville's fourth family of the third order *Lamellibranchiata:* it includes the genera *Mytilus* and *Pinna*, third class, *Acephalophora.*

MYTILUS. (Lamarck, Linnæus.) The genus *Mytilus*, now consists of such examples of the Linnæan *Mytili* as are regular, equivalve, and longitudinal molluscs, of a solid and not a lamellar structure (as in the oyster): they have pointed apices at the inferior end, nearly straight or slightly curved, and attached to other substances by a byssus of a short thick texture; the cordinal ligament is lateral, and a considerable portion of it internal; by which, as well as the different position of the apices, it is easily distinguished from its congeners. The *Mytilus edules*, or common muscle, is so well known that a more detailed description is needless; it furnishes an abundant and nutritious article of food, in some countries forming nearly the only dependence of the inhabitants, as an article of common food. The immense consumption of this mollusc, in the London markets alone, exceeds all calculation notwithstanding the prejudice existing against them as sometimes possessing a poisonous quality. It is not, however, the only shell-fish which produces bad effects on certain persons; and it is probably occasioned by a peculiar state of disease in the animal. Every known part of the world produces what are familiarly termed muscles, and their abundant distribution indicates their goodness as food for man, since Supreme Wisdom has ordained that everything noxious to life is far less productive than those creatures which are not injurious, and intended to be eaten.

MYXINE — Hag. A genus of *Chondropterygeous*, or cartilaginous fishes, with fixed gills; and standing as it were on the very verge of the vertebrated animals, and forming a sort of link between them and the mollusca. For this reason, though the fishes themselves are of uninteresting appearance and small size, and perfectly useless in an economical point of view, they are highly interesting to the student of nature. They belong to the family of suckers, or *cyclostoma*, following in order the lampreys and the sand-eels, to which they have several points of resemblance. They are, however, so nearly destitute of anything which can be called a skeleton, so destitute of eyes, of jaws, and all the other characteristics of more typical vertebrata, that naturalists were for a long time puzzled where to place them in the system. This puzzle was further increased by the situations in which these fishes are usually found, which is generally in the interior of cod and other voracious fishes, upon which they fasten with their sucking mouth, and consume the substance with no ordinary degree of rapidity. The fact of their being found there, with the uncertainty of their mode of increase, led several naturalists, and among others the justly-celebrated Linnæus, to conclude that they are *Entozoa*, or, as he called them, "intestinal worms" This is not the only mistake which has been committed relating to *entozoa* and fishes; for there is a tolerably large and very peculiarly-shaped parasite, which breeds in the intestines of eels, burying its head between the coats, and extending its body along the canal. Now this species of *entozoa* was long considered as the young of the eel; and, for no other reason than that it is subject to "worms in the belly," the eel was set down as a viviparous animal, or one which brought forth its young alive; nor was it till after Mr. Yarrell had exhibited one sex of the eel with melt and another with roe, again the roe ready for spawning, and yet again the "shotten" eel, flaccid from the newly-discharged spawn, that "the learned" gave up this most singular prejudice. Singular indeed it was, and at violence with every known law of physiology; for though there are recorded instances of extra-uterine gestation, there is no instance whatever of the young of any animal coming to maturity, or at all existing in the intestinal canal. That canal is the avenue of death to every living thing that enters it, or if it is not death to the enterer, it is certainly death to the animal entered. This fact is universal, and applicable to the whole of animated nature; so that, whenever any hypothesis is contrary to it, we require no argument and no investigation to convince us that that hypothesis is utterly without foundation.

The myxine is an animal certainly well calculated to perplex systematists, as it combines some of the characters of the fish with some of those of the *cephalopoda*, or order of mollusca, which, in their general structure, make the nearest approach to the vertebrated animals of any that are to be found among the invertebrated ones. The external appearance indeed resembles a worm more than anything else; but even here the possession of a fin would determine it to be a fish, although there were no more decided characters founded upon its internal structure. Perhaps we shall place this curious subject more clearly before our readers by quoting, from Mr. Yarrell's "History of British Fishes," his very clear and satisfactory description of this singular animal. "The body," says Mr. Yarrell, "is elongated, eel-like in form, cylindrical throughout the greater part of its length, tapering and compressed towards the tail; the whole length from twelve to fifteen inches; the skin perfectly smooth and unctuous; the head obtusely pointed; with a single spiracle connected with the mouth and branchiæ; eyes wanting; eight tentacula, cirri, or feelers, as they are called, are placed about the lips, four near the front, and two on each side; lips soft, extensible, inclining to a circle in their figure; one single-hooked tooth on the palate; the tongue furnished with four rows of small pointed teeth, two rows on each side; at the division between the thoracic and abdominal cavities are two external apertures, each of which is connected by a membranous tube with the six branchiæ of its own side; hence Bloch's name of *Gastrobranchus.* The anal aperture is an elongated fissure, situated about two inches before the end of the tail; along the whole surface of the body are ranged two rows of pores, which afford egress to the secretion of the numerous glands within; the dorsal fin is low and rudimentary, except towards the tail, where the membrane is dilated, and being continued round the end of the tail; and thence upwards to the anal aperture, forms, in addition, a caudal and anal fin, which no doubt materially assist the fish in swimming. In colour the myxine is dark brown along the back, lighter chestnut brown on the sides, and yellowish white underneath."

There are two species of this singular genus of fishes, or perhaps, rather, we ought to say that there are two genera or sub-genera, and that these extraordinary creatures form a group in nature. The most accurate systematists distinguish them by the number of breathing apertures in the sides; and, of the two which are known, one has seven such openings

on each side, and the other only one. For this reason the first has been called *Heptabramatus*, and the second *Gastrobranchus*; thereby implying simply that the first has seven openings to the breathing apparatus on each side, while the second has only one such opening, as if its gills were in its belly. It should seem that those differences are quite sufficient for establishing a generic distinction between the two animals; at least, genera are founded upon slighter differences in many parts of the system of animated nature; and Cuvier, who, notwithstanding the pretended refinements of later and far less experienced authorities, does make a distinction of this kind, although, as his object is to place nature itself before his readers, and not his mere opinion of it, he is by no means dogmatical on this point. Of the two species, or genera, or whatever else we may call it, one belongs to the northern hemisphere, and the other to the southern; and, so far as we have been able to ascertain, they do not meet each other in the middle latitudes; neither is there, so far as is known, any analogous fish to be met with there. The northern one, which is the most peculiar in its structure, is not, we believe, met with in the warmer seas even of Europe; and on the British shores it frequents the comparatively cold waters of the eastern sea, in preference to the warmer tide of the Atlantic. The one belonging to the southern hemisphere has not been so frequently seen, or seen in so high latitudes, as the northern one; but it has not been met with in any of the tropical seas of the southern hemisphere; and thus it is probable that it is also a fish of temperate and even of cold latitudes.

Dombeya's Myxine (*M. Dombeyi*). This species has no dorsal fin; but the anal and the caudal exist, and are united at the extremity. It is blunt at the posterior extremity; and the anterior one is enlarged into something resembling a head, though without the usual organisation of that part even in fishes. It has seven breathing apertures on each side of the body, the same as the lamprey has; but in the form of its mouth, and the perfectly rudimental state of its vertebral column, and, indeed, in its general characters, it more nearly resembles the myxine of the European seas. Hitherto it has been found only on the coast of Chili; but whether it exists on other coasts, in corresponding latitudes of the southern hemisphere, has not of course been ascertained. Besides its curiosity as a subject of natural history, it possesses no manner of interest; for in an economical point of view it is without value, and its services in the economy of nature cannot be very great.

The Hag (*M. glutinosa*). This species gets the name of hag from getting into the interior of fishes, and consuming their substance; and the epithet *glutinosa* is added in consequence of the vast quantity of mucous or gelatinous matter which it secretes from the two rows of pores along the sides of the body. Almost every fish is provided with pores of this description; and the secretion seems to be necessary, both for preserving the flexibility of the skin, and for preventing the water from acting upon it. As the spinal column of this fish is little else than a flexible tube, its muscles have a less stable point of insertion than those of fishes in which the back bone is better developed; and consequently it has more need of the secretion for lubricating the skin, so as to allow the muscles to produce their proper effect. It is indeed a general, though not an absolutely uniform law, that the secretion from the skin in fishes is inversely as the bones of their skeleton; for the cartilaginous fishes have more of it than the bony fishes, and among the latter the soft-finned fishes have more of it than the fishes which have spinous rays to their fins, and harder bones. The fact of this secretion being inversely as the development of the skeleton shows us, that, in proportion as the bones are more flexible, provision is made for greater flexibility in the skin; and, altogether, the fishes with the soft bones are more gelatinous, and, generally speaking, are less provided with regular scales, though many of them have spines, or plates of hard bone, upon the skin, and thus make a slight approach to those molluscous animals which are covered with scales. The hag, though one of the least bony of the whole race, has no hard substance produced by the skin; but that skin bears a considerable resemblance to the cloak of some of the cephalopod mollusca, supporting the muscles at least as much as the rudimental spine does, and therefore require to be lubricated by the glutinous secretion given out by the animal. The quantity of this given out is much greater than one would be disposed to believe. Kalen mentions that, having put one of these fishes into a large pitcher of sea-water, the quantity which it gave out was so great as, in a very short time, to convert the water into a transparent jelly or glue; and that, when he placed it in an additional quantity of sea-water, that also was very speedily reduced to the same state. The communicating of so much of this secretion to the water could not be for the purpose of lubricating the skin of the fish; and hence some have concluded that the myxine, which is totally blind, and appears to have no distinct organs of sense excepting the eight tentacula around the mouth, employs this discharge as a means either of offence or of defence, though which of the two is of course not known.

Considered as a British fish, the hag is not rare on the eastern coast, though little mention is made of it on the western. Pennant says, that it "enters the mouths of other fishes when on the hook, which remain a tide under water, and totally devours the whole except the skin and bones. The Scarborough fishermen often take it in the robbed fish on drawing up their lines." That it is found in the bodies of fish is certain, and it is equally certain that it goes there for no other purpose save that of feeding on the substance of the fish; but how it gets in is another matter, and one upon which the authorities are not exactly agreed. Some say the mouth, others say the very opposite end of the digestive organs; while others, again, allege that it makes an opening for itself, and for this reason it is, upon some parts of the coast, called the "borer." We do not venture to decide on this grave matter, though we are inclined to lean to the third opinion; because it is very uncommon, and also unlikely, that any animal should enter the intestinal canal of another, at either end, for the purpose of eating that other; and besides, the hag, with its two rows of teeth upon each side of the tongue, acting against each other something like a pair of lateral jaws, and its strong crooked tooth on the palate, is pretty well adapted for making an opening for itself. The mode in which it makes its attack is a mystery, however, and one which it may not be very easy to clear up. The attack is, however, not made singly; for Wilson mentions that, on the shores

of Norway, where this fish appears to be more abundant than on any part of the British shores, as many as six have been found in the skin of a single haddock, the flesh of which they had almost entirely consumed. On our coasts it is most generally found on the cod and haddock banks, and we believe more rarely in the deep-water fishings. It seems also to be more abundant the more northerly the situation, provided the bottom is adapted for those fishes upon which it appears chiefly to feed. The breathing apparatus is one of the most curious parts of its structure. There are twelve branchial cells, six arranged on each side, and these communicate singly with the internal canal; but the communications externally are with a common tube on each side, so that there are only two openings outward from the breathing apparatus. There is also only one inwards, or from without, more strictly speaking, namely, the spiracle mentioned in the quotation from Mr. Yarrell. How the breathing of the animal is carried on by means of this singular apparatus is not easily understood; but the probability is that it is very slow, and that the grand labour of the animal consists in the manufacture of that species of glue which it secretes in such abundance. Looking at the simple structure of this animal, its slender form and its soft texture, one would be led to conclude that it is one of the least offensive, and least capable of doing active injury, of any of the race. It is never found above fifteen inches in length, and rarely more than a foot; it is not thicker than the little finger; and it is not only blind, but absolutely without anything that can be positively called a head, or, at all events, a head furnished with jaw-bones, and the other parts which characterise the heads of vertebrated animals; but we should be in error were we to estimate what nature can accomplish by our notions of the means of its accomplishment; and thus the hag, which appears so imperfectly formed and so helpless, can "spoil the spoilers," and feast upon the most voracious fishes, in spite of any effort they may make to the contrary. The common supposition is, that the hag does not attack any fish until that fish is caught on a hook, or fixed by some means or other. But this is very unlikely. We know no means by which a living fish can be fixed in the water except on a fisherman's hook; and dead fishes very speedily float to the surface, and turn up to the air that side at which alone the hag is supposed to enter. To suppose, therefore, that the hag cannot feed except upon fishes which are fast, is supposing, in other words, that it cannot live without the art of man—a supposition which is contrary to every analogy of nature. As found parasitical in the bodies of fish, (and this is the way in which it is usually found), the hag is seasonal on the British coasts, being found only in the end of spring or the beginning of summer, and then only in fine and tranquil weather. Altogether it is an animal of obscure history and habits, and its chief interest lies in the peculiar place which it occupies in the system, as partaking of the characters both of the vertebrated and the invertebrated animals.

There is another fish of a singular character, and nearly allied to this one, which we omitted to notice in its order in the alphabet, and therefore we shall introduce it here, as it forms an appropriate supplement to the species of which we have been speaking. The fish to which we allude is

The Lancelet (*Ampheoxus lanceolatus*). This fish is of very diminutive size, scarcely an inch in length, very slender, and almost entirely transparent. The body is compressed laterally, and there are no pectoral, ventral, anal, or caudal fins, but only a single dorsal fin, extending the whole length of the body, but becoming almost rudimental at the tail, which is very sharp pointed. There are no eyes, and no vestige of any external organ, except a mouth, which is situated on the under side, a little behind what may be regarded as the nose or snout. This mouth is surrounded by small tentacula, and it opens and shuts laterally. It does not appear well adapted for adhering, as the mouths of the typical *Cyclostoma* do; but still the fish more nearly resembles them than it does any others. The surface of this curious little fish is entirely without scales, and the rays which support the dorsal fin are very numerous, though minute. The spinal column is not only cartilaginous, but almost rudimental; and yet the muscles, which are numerous and beautifully arranged, are so placed as to leave no doubt that the animal is a vertebrated one. The filaments, or tentacula, which surround the mouth, and which, like those of the hag, appear to be the only distinct and located organs of sense, are not inserted on the sides of the mouth, but on the os hyoides, or bone of the tongue; and thus the tongue appears to be the essential organ with it as well as with the former.

This singular fish is either very rare, or it is overlooked, only two specimens being mentioned. The first of these was obtained by Pallas; the second was obtained by Mr. Couch, sent to Mr. Yarrell, and by him described in his "British Fishes." Both were procured on the coast of Cornwall, and both, we believe, found accidentally.

NAPELLUS is the *Aconitum napellus* of Linnæus, the common monkshood of gardens, of which there are several varieties. The aconites are among the most powerful vegetable poisons known. The root is the most virulent part of the plant; a single drachm has been known to cause death.

NARAVELIA (Decandolle). A hothouse climber belonging to *Ranunculaceæ*, formerly known as the *Atragene zelanica*. It is propagated by cuttings, and grows well in a mixture of sand, loam, and moor earth.

NARCISSUS (Linnæus). An extensive genus of well-known bulbous flowers, mostly natives of Europe. Several of the species are British, the common daffodil being found wild in many places. The *N. Tazetta* or polyanthus, jonquil, and the poeticus, are among the most esteemed of the tribe. The narcissi belong to *Amaryllideæ*, and are easy of cultivation.

NARTHECIUM (Mohr). A genus of small rush-like plants found on turfy bogs, belonging to the sixth class of sexual botany, and to the natural order *Junceæ*. One species is indigenous to Britain, another is found in North America.

NASTURTIUM (Dr. Brown). A genus of annual and perennial herbs, chiefly aquatics. The flowers are tetradynamous, and consequently belong to *Cruciferæ*. The watercress is the principal one cultivated. The *N. officinale*, the common one, is brought in immense quantities into the metropolis, being collected from the neighbouring streams, and forms an important though humble branch of domestic commerce.

NASTUS (Jussieu). A reed-like plant, found in Cumana, belonging to *Graminceæ*, formerly called

Bambusa latifolia by Humboldt and Bonpland, but made a separate genus by Jussieu.

NAUCLEA (Linnæus). An East Indian genus of trees and shrubs, belonging to *Pentandria* and to the natural order *Rubiaceæ*. Generic character: flowers in a close head; calyx of five teeth persisting; corolla funnel-shaped, elongated; limb five-cleft; anthers almost sitting, and inserted into the sinus of the limb; style long and protruding; stigma headed. Fruit drupaceous, united in a double berry; berries many-seeded. These are store plants, and succeed and are increased in the ordinary way.

NAUCORIS (Geoffroy). A genus of aquatic hemipterous insects belonging to subsection *Hydrocorisa*, and family *Nepidæ*, having the body of an oval subdepressed form, without any terminal filaments; the antennæ minute and four-jointed; the fore legs raptorial, and the four hind legs ciliated and well adapted for swimming; the posterior tarsi two-jointed, and with two ungues. There is but a single British species, *Nepa cimicoides* (Linnæus), which is about half an inch long, of a greenish-brown colour, with the head and thorax brighter coloured. It is of common occurrence in ponds and stagnant waters; is very active, and well fitted for preying upon other aquatic insects, its beak being short and robust.

NAUTILUS (Linnæus, Lamarck). This very elegant mollusc is so generally well known to every collector of shells, that a very detailed description would be superfluous. Its form is spiral, discoid, the whorls contiguous, the last enveloping the others; numerous cells, separated by a thin pearly partition, or transverse septum, concave on one side, and perforated by a syphon running through them all. Some species are umbilicated, but none are known to be mammilated. In the fossil species the divisions of the cells form external ruts, and assume a great variety of sculpture; but in the recent species these divisions are but slightly visible; and when the shell is divested of its exterior coating, and the pearly substance displayed, no trace of these separations can be discovered. The animal inhabiting this mollusc only occupies the last open division of its shell, being attached to it by means of a tendinous or muscular appendage, which passes into the syphon; the mantle is obliquely opened, and prolonged into a kind of hood above the head, which is provided with tentacular appendages, as if digitated, and surrounding the aperture of the mouth. In the fossil genera of the *Nautilacæ* two syphons are found to penetrate the cells, but we do not know of any living species presenting more than one. This mollusc, from its graceful form, and the beautiful prismatic pearly appearance it exhibits when the external coloured coating is carefully taken off, has been known to naturalists from the earliest period. Artists have exercised their graphic skill in ornamenting it with landscapes, historical and mythological engraved subjects; and in the accounts given of some of the costly articles of regal splendour, we read of these shells being mounted, as drinking cups, in gold, bedecked with jewels. In our times specimens of the *Nautilus*, thus exquisitely fashioned, have sold at high prices, and are to be seen in the cabinets of the wealthy amateurs of the fine arts. Much speculation of opinion exists as to the habits of this mollusc, which is described as sailing before the wind like a vessel; and it is by some conjectured that the empty cells contain air or water, which the animal can voluntarily expel, so as to render its habitation sufficiently buoyant to rise to the surface of the waters. Other naturalists are of opinion that the shell is nearly enveloped in the mantle, and the animal carries it on its back in the manner of the snail, crawling habitually at the bottom of the sea, which it only quits from peculiar circumstances of necessity or convenience. The late lamented Mr. Bennet captured one of these animals attached to its shell; and that eminently talented zoologist, Professor Owen, has published a most elaborate and interesting description of its structure, which we will not mutilate by partial extracts. A singular part of its formation is what has been termed the beak, that is, a hard portion resembling the parrot's beak, by means of which this mollusc possesses the faculty of crushing smaller shells, crustacea, &c., indicating its being carnivorous. A transverse section of this shell exhibits one of the most beautiful examples of nature's mathematical symmetry that can be witnessed; and *en passant* we will take this opportunity of suggesting the propriety of sectional specimens of the genera of molluscs, to exhibit more fully their structure. The author of this article has many specimens, but there is no complete series. Where they should be found, the British Museum, they (like many other things necessary to science) are not, and the department of malacology is there an instance of "confusion worse confounded." Under the article AMMONITES, the fossil gigantic species of a former creation are described.

NAVICELLA (Lamarck; NERITA, Chemnitz). These molluscs are nearly allied to the genus *Nerita*, but yet more closely to the *Neritina*. They are fluviatile or fresh-water shells. The summit does not turn in an oblique spiral curve, as in the genera mentioned to which they are allied; it is straight, turned quite to the base, and concave beneath; the left margin flattened, sharp, and straight, forming a flat internal partition resembling a half-decked boat, though this does not ever cover *half* the aperture of the shell; it has an epidermis, and is closed by a solid, flat, thin calcareous operculum, with one lateral and subulate tooth or apophyse. Their habitat is in the Indian Archipelago, and the animal is carefully figured in the Zoological Atlas to the Voyage de l'Uranie. This mollusc is classed in the fourth family *Hemicyclostoma*, second order *Asiphonobranchiata*, second class *Paracephalophora*.

NEBRIA (Latreille). A genus of coleopterous insects belonging to the family *Carabidæ* and subfamily *Carabides*, having the body of an oval-oblong and flattened form; the thorax cordate truncate, the palpi short; the mandibles not dilated externally, as in *Leistus;* the body generally furnished with wings, and the three basal joints of the anterior tarsi dilated in the males. These are handsome terrestrial insects generally found on the sea-coast; the type being the *N. complanata*, of a buff or clay colour, with black markings. Dr. Leach has separated some species under the name of *Helobia*, including the very common *Carabus brevicollis* of Fabricius; whilst Bonelli has detached the apterous species, which he has named *Alpæus*.

NECROBIA (Latreille). A genus of coleopterous insects, belonging to the family *Clerida*, having the antennæ terminated by a three-jointed club, of which the joints are not closely fixed together; the four palpi are terminated by an enlarged triangular

or hatchet-shaped joint, and the thorax has no anterior transverse impression. These are small gaily-coloured beetles, found chiefly in the neighbourhood of decaying heaps of bones: they creep slowly, but fly with agility. There are three British species, including the *N. ruficollis* (Olivier), which is of a violet-blue colour, with the thorax, base of the elytra, and legs red. This insect is widely distributed, being found throughout the Old World from the west of Europe to the East Indies; a peculiarity doubtless attendant upon its natural habits. This insect is especially worthy of the regard of entomologists from its having been the means of saving the valuable life of Latreille. During the sanguinary period of the first French revolution, when "la fanatisme révolutionnaire," as Latreille himself had the boldness to style it, was at its height, this good man, as his writings fully justify us in styling him, was thrown into prison, and doomed to an inevitable death. In his prison he discovered one of these insects, which he sent to a young friend of talent, who made use of this simple circumstance as a proof of his disregard of political feelings, and obtained his release through the medium of M. Dargelas, of whom, as well as the former (M. Bory de Saint Vincent), he has, on many occasions, spoken with gratitude in his various works.

NECRODES (Wilkin). A genus of coleopterous insects, belonging to the section *Pentamera*, and family *Silphidæ*, having the hind legs thickened and bent, especially in the males; the body is oblong-depressed; the thorax sub-orbicular; the antennæ longer than the head, terminated by a five-jointed club. There are several species of this genus found in different parts of the world; one of which is not of uncommon occurrence in this country, feeding on carrion washed on the banks of rivers. It is the *Silpha littoralis* (Fabricius), and is subject to considerable variation in size and in the form of the hind legs. Dr. Leach has named one of these varieties *N. Curtisii*.

NECROPHORUS (Fabricius). A genus of large and handsome coleopterous insects, belonging to the family *Silphidæ*, having the body of an oblong form; the antennæ terminated by a distinct perfoliated mass, not longer than the head; the thorax broadest in front, the elytra truncate behind, and the anterior tarsi dilated in the males. These insects have obtained the name of burying-beetles, from the peculiar

instinct which they exhibit of burying the dead bodies of small animals, such as moles, mice, frogs, &c., as a receptacle for their eggs and larvæ. Their powers of perception are very strong, and it is surprising how soon they discover a dead body fitted for their purpose, round which they may be observed flying with the elytra elevated, their dorsal surfaces being applied together. They soon creep beneath the body, and commence scratching up the earth from the sides and under the animal, which, by degrees, descends into the pit which is thus gradually deepened; when it has reached a sufficient depth the earth is thrown over it, and the insect deposits its egg upon the carcass, so that the larva, when hatched, finds itself in the midst of a repast, disgusting enough, but suited to its taste. The larva is long, of a dirty white colour, with the upper surface of the anterior segments armed with a scaly plate of a brown colour, and with small elevated points upon the hinder segments. They have also six scaly legs, and the jaws are robust. When they have attained their full size they bury themselves still deeper into the earth, where they construct an oval cell, the inner surface of which they coat with a gummy secretion. These insects, like many others which feed upon carrion, have a strong odour like musk. The habits of these insects have been especially studied by M. Gleditsch, and more recently by various persons in France who have written upon the subject of destroying moles, and by whom various points in their economy have been elucidated.

There are a considerable number of species of this genus, some of the largest of which, *N. grandis* (Fabricius), we have received in some numbers from North America. There are seven British species, five of which are distinguished by the golden-coloured bands upon the elytra; these species vary amongst themselves in the form of the thorax, the structure of the hind legs, the markings on the elytra, and the colours of the club of the antennæ. One of the most common species is the *Silpha vespillo* (Linnæus), in which the posterior tibiæ are curved, and the trochanters furnished with a strong spine. The species vary also in length, from half an inch to one inch and a third, which is the length of *N. germanicus*, the largest and rarest of the British species.

NECTARINE is the *Persica lævis* of Decandolle, a subvariety of the common peach; the only difference being that, whereas the skin of the latter is downy, that of the nectarine is smooth. In fact, they are frequently found on the same tree; so that there can be no reason for making those fruits distinct species. They are both cultivated and propagated in the same manner, and are both deservedly esteemed as among the finest of our exotic fruits.

NECTOPODA is De Blainville's first family of the fifth order *Neucleobranchiata*, second order *Polybranchiata*, second class *Paracephalophora*. The animals of this family may generally be described as possessing an abdominal foot, compressed into a rounded swimming appendage. The genera *Pterotrachea* and *Carinaria* constitute the family.

NECYDALIS (Linnæus; Molorchus, Fabricius). A genus of coleopterous insects, belonging to the section *Tetramera*, and family *Cerambycidæ*, in which the elytra are short and truncated at the tips, covering only the base of the abdomen and wings. Linnæus, indeed, introduced into the genus other species, in which the elytra do not meet in a straight suture down the back, but are of an elongated conical form; but, except in this particular, there is no relation between these insects. The antennæ are long, and the femora thickened at the tips. These insects are found upon flowers, and upon the trunks of trees. From the introduction of other species by Linnæus into the genus, some confusion has arisen in the application of the name which is applied by the French to the longicorn species, which Fabricius (followed by English authors) called *Molorchus*, and applied the name of *Necydalis* to the *Œdemeræ* of the French.

NEGUNDO (Moench). A genus of North American trees, belonging to the natural order *Acerineæ*. They were considered by Linnæus as maples, and he

called them *Acer negundo;* but they have been erected into a new genus by Moench. They have been long in our ornamental plantations, and known as the ash-leaved maple, and arrive at considerable bulk in sheltered situations; for if much exposed they are liable to be shattered by the wind.

NELITRIS (Gærtner). A fruit-tree found on one of the Society Islands. It was first named by the younger Linnæus, *Psidium decaspermum*, but now *N. Jambosella.* It belongs to *Myrtaceæ*, and is easily grown and propagated on the stove.

NELUMBIUM (Jussieu). A highly ornamental genus of aquatic plants, natives of warm climates. This and other plants of similar habits form the natural order *Nymphæaceæ*, commonly known by the name of water-lilies. The *N. speciosum* is supposed to be the sacred bean of the Egyptians; though now no longer found in the Nile, that river formerly abounded with it; and, as both its tuberous roots and seeds are edible, was of great use to the inhabitants. It is very common over all the eastern parts of Asia. The numerous canals of China are filled with it, its tubers being universally used as a culinary vegetable. The flowers are splendid; and it is held in high estimation by the Chinese, and in that empire it retains a share of the sacred character it formerly held in Egypt.

NEMATOPODA (De Blainville; Lepas, Linnæus; Cirrhipoda, Lamarck and Cuvier). Lamarck separated this class into two orders; those molluscs which were attached to any object by a peduncle or membranous tube, and such as were permanently affixed from the moment of their birth to rocks or other submarine bodies. This class forms the subtype *Malentozoaria*, or the *Mollusc articulata*, a group which corresponds with the multivalve molluscous worms of Linnæus, and the disciples of his school, separating the *Pholas* and *Teredo* from them, they being true lamellibranch molluscs. Lamarck was doubtful whether to place these animals as the first order of his class *Crustacea*, under the name of sightless crustacea, or to assign them a place at the end of the *Mollusca.* They nearly resemble the former, since we find the *Cirrhipods* furnished with the same system of nerves, with jaws analogous, and their tentacula resembling those of the shrimp. They now, however, stand in the system of modern writers as following the *Mollusca.* The first class includes the first family *Lepadicea* or *Anatifa*, containing the genera *Lepas, Gymnolepas, Pentalepas, Polylepas, Litholepas;* second family *Balanides*, contains the genera *Balanus, Ochthosia, Conia, Creusia, Chthamalus, Coronula;* the second class is called *Polyplaxiphora*, and is formed by the genus *Chiton*, which may be considered totally distinct from all the rest of the animal series, and forming the transition from the cephalopod molluscs to the chetopods of the type *Entomozoaria.*

NEMOPTERA (Latreille). A remarkable genus of neuropterous insects, belonging to the family *Panorpidæ*, having the abdomen destitute of the curious claw with which it is armed in the males of *Panorpa*, but especially distinguished by the form of their posterior wings, which are many times longer than the body, very slender, and more like feathers than wings. The species are found in Portugal and Africa; the type of the genus being the *Panorpa coa* of Linnæus, having yellow wings, with black spots. The writer possesses several undescribed species from the Cape of Good Hope; and Dr. Klug has informed him that he is preparing a monograph upon the group, in which the Berlin Museum is very rich.

NEMOSOMA (Desmarest). A curious genus of coleopterous insects belonging to the group termed *Xylophaga* (or wood-eaters) by Latreille, and placed in the family *Engidæ* (which see for some observations upon the natural situation of these insects). The body is long, slender, and cylindric; the head notched in front; the mandibles strong and protruded; the tarsi long and slender. There is one species of this genus, *N. cylindricum*, a pretty insect of small size, found, but very rarely, under the bark or stumps of trees, palings, &c.

NEOTTIA (Swartz). A genus of curious herbaceous plants, natives of many different parts of the world. The flowers are gynandrious, and of course the genus belongs to *Orchideæ.* Two of them are natives of Britain, viz. *N. nidus avis*, bird's-nest orchis, and *N. spiralis*, ladies' tresses of English botany. The first is found in damp woods, and the second on chalky pastures.

NEPENTHES (Linnæus). A genus of two species of curious half-aquatic Chinese plants, belonging to the natural order *Cytineæ.* These plants are remarkable for having the points of the leaves formed into pitchers of a considerable size, with a neatly-fitted lid, with a hinge. They are cultivated as curiosities in our stoves, planted in turfy-peat soil, with the pot constantly kept in a pan of water, and in a pretty high temperature.

NEPIDÆ (Leach). A family of aquatic hemipterous insects, belonging to the section *Hydrocorisa* of Latreille, having the antennæ minute, and inserted beneath the eyes, by which they are concealed from above; the tarsi are composed of two joints only; the eyes of large size; the anterior legs in the form of a claw, the femur being large, and channelled on its under surface, in order to receive the interior part of the tibiæ, which shut upon it in the same manner as in the *Mantidæ;* the tarsi are very short, and sometimes connected with the tibiæ, so as to form one piece. This structure indicates the raptorial character of the family, which consists of insects of large or moderate size, which are all inhabitants of the water, and which feed upon other aquatic insects, which they seize by the assistance of their fore legs, and convey to the mouth, which consists of a short, but acute and strong articulated proboscis, with which they are enabled to inflict a smart wound. The family corresponds with the Linnæan genus *Nepa*, and which have obtained the name of water-scorpions, in allusion to the form of the fore legs, which are somewhat similar to those of the scorpion. The genera of which this family is composed are *Galgulus, Naucoris, Belostoma, Nepa*, and *Ranatra*, and several others recently established by Messrs. Laporte and Burmeister, the second, fourth, and fifth, being inhabitants of this country. The genus *Naucoris* is described in its alphabetical situation; that of *Belostoma*, Latreille, is distinguished by having the abdomen terminated by two setæ; the tarsi are two-jointed, and the antennæ are dilated at the side into a comb. This genus comprises several exotic species of very large size, some of them being, in fact, nearly six inches in expanse, as in *Belostoma grandis*, Fabricius. The genus *Nepa*, Linnæus, has the anterior tarsi composed of a single joint, and the four posteri or tarsi two-jointed; the antennæ

furcate ; and the anterior femora are thick ; the abdomen is elliptic, and terminated by two setæ. The body of *Nepa cinerea*, Linnæus, the type of the family, is represented (with the limbs and anal setæ cut off near the base) in the article INSECT, vol. ii., p. 870, in which the respiratory apparatus of the insect is exhibited from the invaluable work of M. Leon Dufour. This insect is about two-thirds of an inch long, of an ashy colour, with the upper surface of the abdomen red, and the anal setæ shorter than the body. This is a very common species, found in all stagnant ponds, &c. ; it is very slow in its motions. The eggs are of a curious form, each having a series of terminal points, which bend upwards, and form a kind of cup for the egg placed above (see fig. 10, article INSECT, vol. ii., p. 834).

The genus *Ranatra*, Fabricius, having the *Nepa linearis*, Linnæus, for its type, is distinguished by its very narrow form, the rostrum porrected, and the anterior thighs long. The typical species inhabits this country, but is a local insect ; it is about an inch long, with the anal setæ as long as the body. It is beautifully figured, with its details, in Mr. Curtis's British Entomology. We have met with it in considerable numbers in one of the ponds on Wandsworth Common.

NERINA. A genus of molluscs established by De France, but reunited to the genus *Cerithium* of other naturalists.

NERITA (Linnæus, Lamarck, Cuvier). The true genus *Nerita* may be distinguished from the *Neritina* by the following characters, independent of its being a *marine* shell. It is solid, semi-globular, concave beneath, and not umbilicated ; the aperture is entire, semicircular ; the summit very obtuse, left side flattened and septiform, sharp, and often denticulated ; the inner one slightly concave, generally with granulations ; the operculum constantly calcareous and subspiral, the summit of it marginal at the left extremity, with one or two apophyses of muscular adhesion on its posterior edge, opening as the animal protrudes its body, and closely shutting when the animal is at rest. These shells are never spined, but are variously striated or sculptured ; and Lamarck distinguished them into the marine and fluviatile species, on a consideration of the thickness of the shell, which in the former is greater than in the latter, and by the denticulated edge of the right side, which does not exist in the second. We, however, agree with those naturalists who derive a more constantly distinguishing character from the external sculpture of the operculum—a guide we have pointed out in the leading article of CONCHOLOGY, as one to be depended upon, but hitherto not sufficiently examined ; under OPERCULUM we shall enlarge upon this circumstance. There are about nineteen species of marine *Nerites*, and twenty-five species of fluviatile *Nerites*, or, as we have separated them, *Neritinæ*. In the present genus, as constituted by De Blainville, a well-defined arrangement exists, including various genera of other authors. The first division includes such as have only one medial tooth on the left edge, called by Oken *Peloronta ;* the second species have two teeth, and the third three or four ; Lamarck's *Neritina* are without any teeth. Another species forms Sowerby's *Pileolus*. These molluscs principally inhabit the Eastern and American seas and rivers, two only of them being European. Fossil species are not numerous.

NERITINA (Lamarck). A genus of molluscs, see the article NERITA, from which it was separated by Lamarck, on account of its being a fresh-water shell, and the thinness of its texture. They are also sometimes armed with long spines, and variously coloured externally.

NETTLE. See URTICA.

NEUROPTERA (Linnæus). An order of winged insects, belonging to the division having the mouth formed with mandibles for mastication, and chiefly distinguished by the structure of the wings, which are naked ; that is, not enclosed by elytra or tegmina, but often having the anterior and posterior pairs of equal size, and furnished with a great number of nerves, which gives the wings the appearance, under the microscope, of a piece of the most beautiful net-work ; whence, indeed, the name of the order is derived, *neuron* signifying a nerve, and *pteron* a wing ; the membrane enclosed between these nerves is very fine and transparent, often exhibiting a reflection of the prismatic tints, or marked with spots or bands of various colours. The situation of these organs during repose is various ; in some they are horizontally extended at right angles from the body, as in the larger *Libellulidæ* ; in others, as in the smaller species of the same family, their inner surfaces are applied against each other, whilst in the *Perlidæ* they lie flat upon the back, or are deflexed at the sides like the roof of a house, as in *Hemerobius*, *Psocus*, &c. In many species the wings are of equal size, as in the dragon-flies, *Panorpa*, &c. ; in others the posterior pair are considerably smaller than the others, especially in the *Ephemeridæ* ; in which, indeed, the posterior wings occasionally are entirely evanescent. In *Nemoptera* the posterior pair are much longer than the anterior, and very slender.

These insects have the head of a large or moderate size, the eyes, which are lateral, sometimes occupying nearly the whole of this part of the body ; the ocelli are placed on the forehead ; the latter are, however, wanting in some species, as in *Myrmeleon*, *Osmylus*, &c. ; the antennæ are frontal, and of very different forms, being very short, and resembling a fine bristle, in the *Libellulidæ* and *Ephemeridæ* ; long and clubbed in *Ascalaphus* and *Myrmeleon* ; and filiform or setaceous in the others. The mouth consists of the ordinary organs composing a mandibulated mouth, the maxillæ being very robust, and the tongue well developed, in the dragon-flies. In some species, as the *Perlidæ*, *Hemerobiidæ*, &c., the construction of the trophi is almost identical with that of the *Orthoptera*. In the *Ephemeridæ*, which are destined to live but a day in the final state, the mouth is rudimental and almost obsolete. In the dragon-flies the palpi are also very minute, whilst in the *Myrmeleonidæ* they are long and slender. In the *Panorpidæ* the front of the head is prolonged into a kind of rostrum, at the extremity of which the trophi are placed.

The legs of these insects are of a moderate size, flight being the chief mode of locomotion in the imago state ; the legs do not acquire that degree of development which we find in some of the cursorial and saltatorial species ; the tarsi vary in the number of joints in the different species, there being five in the *Hemerobii*, *Perlæ*, &c., four in the *Raphidiæ*, three in the *Libellulæ*. In all they are terminated by two small hooks. The abdomen is long, cylindrical, or compressed, with the segments distinct, and terminated in the males of many species by hooks which are employed during coupling. In some species both sexes are provided with two or three very long and

slender hairs or bristles, as in the *Ephemeræ*, whilst the female *Raphidia* has a single long and sword-like appendage. In none of the species, however, do we find any instrument acting as the sting of the *Hymenoptera*.

There is considerable diversity in the transformation of this order; the larvæ are hexapod, and very variable in their habits and habitations. Many of them reside in the water, where they are either predaceous or vegetable feeders, some few feeding upon decayed plants, others in holes which they form in the sand. The majority are carnivorous, and feed upon other insects; the aquatic species are provided with an apparatus for obtaining a supply of fresh air, which has some resemblance to lateral series of external gills, but which are, in reality, the tracheæ greatly dilated externally. The pupæ are as active as the larvæ in the dragon-flies and some other species; but in both these states of these insects the mouth undergoes a remarkable modification of form. In the *Ephemeridæ* there is another curious modification in the transformations, as described in our article upon that family. In some the pupa state is inactive, and enclosed in a cocoon formed by the larvæ, as in *Hemerobius*, *Myrmeleon*, &c. The *Termitidæ*, or white ants, offer as curious an instance of departure from the type of the order as do some of the *Apidæ* in the order *Hymenoptera*, there being three kinds of individuals exclusive of the active larvæ and pupæ. The transformations of *Panorpa* are unknown. In the imago state the duration of life is variable, some species, as many of the *Ephemeræ*, being but the creatures of a day, or even still less. There is also very considerable diversity in the size of these insects; some of the *Libellulidæ* being amongst the largest of our insects, whilst some of the *Hemerobiidæ* or *Psocidæ* are very minute, but not so minute as the smallest *Hymenoptera* or *Coleoptera*.

From the considerable variation, both in structure and transformations of these insects, there has been a considerable diversity of opinion relative to the extent of the order, the *Libellulæ* and *Ephemeræ*, having an aquatic pupa, being regarded by some authors as the types of distinct orders. The same has also been maintained respecting the *Termitidæ*, or white ants, and the caddice flies (*Phryganeæ*), which last have been formed by Mr. Kirby into the order *Trichoptera*, whilst by Latreille, the order is maintained in its Linnæan extent. We have adopted the views of modern English authors, separating only the *Phryganeæ*. The order is therefore divisible into sections, which exhibit the following succession of natural relations founded upon the habits and transformations of the groups:—1. Carnivorous insects, having aquatic larvæ and active pupæ, bearing a certain resemblance to the imago; 2. Carnivorous insects having terrestrial or aquatic larvæ and incomplete pupæ; 3. Carnivorous or omnivorous insects, terrestrial in all their states, and having active pupæ differing from the imago only in wanting wings. Latreille, by introducing the *Phryganeæ* into the order (and which correspond with the *Ephemeræ* in the aquatic habits of the larvæ and the rudimental structure of the mouth of the imago, and forming together Dumeril's family *Agnatha* or *Buccelles*) adds a fourth group of herbivorous insects, with aquatic case or caddice-forming larvæ, and inactive, incomplete pupæ; terminating the order with those species of *Phryganeæ* which have the wings very slightly reticulated, resembling, in many respects, some of the least perfectly organized *Lepidoptera*. This last relationship is admitted by most recent authors, so that the neuropterous insects may be arranged with the *Trichoptera* on one side, leading to the *Lepidoptera*, whilst, on the other side, they are allied to the *Orthoptera*, as above noticed; the *Trichoptera* again are allied to the *Tenthredinidæ* in the order *Hymenoptera*, which renders it impossible to place these orders in a continuous series in regard to their affinities.

The order *Neuroptera* is divisible into the following sections and families.

1. *Subulicornes* (Latreille). Having the antennæ minute and setiform, with not more than seven joints; eyes large; ocelli two or three; larvæ aquatic; pupa resembling the larva; imago aerial.
   - A. *Odonata* (Fabricius). Wings of equal size; mandibles very large; respiration of the larva anal. Genus, *Libellula* (Linnæus).
   - B. *Anisoptera* (Leach). Posterior wings small; mandibles rudimental; respiration of the larvæ by means of lateral pseudo-tracheæ. Genus, *Ephemera* (Linnæus).
2. *Filicornes* (Latreille, *Planipennes*, Règne Animal). Antennæ long; filiform setaceous or clavate, much longer than the head; multi-articulate; eyes moderate; ocelli sometimes wanting; larvæ generally terrestrial.
   - A. Tarsi five-jointed. Linnæan genera, *Panorpa*, *Myrmeleon*, *Hemerobius*.
   - B. Tarsi four-jointed. Linnæan genera, *Raphidia*, *Termes*.
   - C. Tarsi two or three jointed. *Termes*, *Psocus*, (Latreille).
   - D. Tarsi three-jointed. Genus, *Perla* (Geoffroy).

Each of which genera constitutes the type of a modern natural family.

NICANIA. The late lamented naturalist and amiable man, Dr. Leach, constituted this genus, in consideration of the peculiar formation of the hinge, and its manner of interlocking the valves. This mollusc is, however, now placed as a species of the genus *Venus*, the animal not differing sufficiently from it. The philosophical and accurate views of Dr. Leach sometimes led him into distinctions occasionally too nice in the classification of testaceous mollusca. This is no fault in principle, but leads to great inconvenience, by the multiplication created in the number of genera.

NICOTIANA (Linnæus). A genus of herbaceous annuals, mostly natives of America. The flowers are pentandrious, and the genus belongs to *Solaneæ*. Few plants have been more regarded than the *N. tabacum*, for an account of which see TOBACCO.

NIGHTINGALE (*Motacilla luscinia*, Linnæus; *Curruca luscinia*, Bechstein). Under the word SYLVIADÆ, in the alphabetical order, there will be found a general notice and arrangement of those small forests birds, chiefly summer visiters, which make the early part of the season so cheerful, especially in the southern and warmer parts of Britain; but the nightingale has been so long celebrated, and is so local as a British bird, that we shall insert a very brief notice of it here, including some extracts from Bechstein's Cage Birds, because in Germany, where he observed and studied, nightingales are much more common,

and singing birds of all descriptions much more attended to, than they are in this country.

The nightingale is a bird of many names, and some others of the migrant birds of song are called nightingales, or, at least, by the popular names which the nightingale receives in different parts of the world. It is the *Philomela* of the ancients; that is, the bird that "loves darkness." This love of darkness is, however, not absolutely correct. During the period of its natural song, the nightingale does indeed sing later in the evening and earlier in the morning than any of its fellow-choristers of the grove; but there is, in some places at least, a silent hour or two in the dead of the night when the voice of the nightingale is not heard; but it always begins between dawn and sun-rise, and generally very near the first. It does not appear, however, to be partial to the chattering notes of many other birds. In the early time of fine summer mornings nothing can be more delightful than the *revellio* of the nightingale, when one is lying quietly in bed, with the window open, and no sound heard save that of the bird. The volume which it pours forth upon these occasions appears absolutely to make the air shiver and thrill, even though the songster is a furlong or two distant; and if two or more, posted in different parts of the grove, sing against each other, as is very often the case, their songs, which fall upon different parts of each other like a glee set for several voices, have a very pleasing effect. What may be the signal for nightingales giving over their song in the wild woods, we have had no means of ascertaining; but, in those which frequent groves surrounded with houses we have generally, if not invariably, found that the chattering of the house-sparrows puts an immediate stop to the music of the nightingales, even while the nightingales are in the woods, and the sparrows on the house-tops. We do not, of course, pretend to say that the din of the sparrows is the real cause of the silence of the nightingales, or that there is any tendency on the part of the latter to scorn the contest with such tuneless chatterers; but we have observed the fact during a succession of too many mornings for its being merely accidental in any one of them. It seems, indeed, that, however the aversion may operate, there is an aversion to singing, in a state of nature at least, in nightingales, if they have not all the song to themselves. We have heard them put to silence by a wild duck, scared from the ground within their hearing; and they do not sing when the wind is so strong as to rustle the leaves and shake the branches against each other, or when the rain falls in heavy drops, and makes its well-known pattering sound. In some situations, at least, the singing at night is prolonged into greater darkness than that at which the morning song commences; but this, of course, differs according to circumstances. While these birds continue their notes (and during the hours of song there are but few pauses), it is clear that they can neither seek food for themselves, nor contribute either to the nourishment or the accommodation of their young. How much of the duty of attending to these may devolve on the female nightingale we cannot say; but it is by no means unlikely that their songs, as well as those of many other birds, are delivered for the purpose (not with the *intention* on their part) of stimulating the female to the energetic performance of some duties. They are certainly not mere love-notes, affecting the nuptials of the birds, and nothing more; for they extend over much of the hatching time, and do not cease when the young have broken the shell. Singing birds, from their numbers, the variety of their notes, the seasons with which they are associated, and a variety of other circumstances, which, though they do not come within the category of mere calculating economy, have yet a wonderfully rousing effect upon the minds and the activity of mankind, are highly interesting creatures. Their singing is the most interesting circumstance about them; and therefore it were highly desirable that those who have opportunity, inclination, and leisure, for studying the manners of birds in something like a satisfactory way, should pay particular attention to how the female bird is employed when the male bird is engaged in what may be called the family music. It has been observed that the females of various other birds are strongly excited by the voices of the males when there can be no possible influence of pairing in the case. The crowing of the common domestic cock, or of any other of the gallinaceous birds, is not a love-note, but rather a song of triumph for the overcoming or avoiding of some real or apprehended danger. The love-notes of that order of birds are soft and low; and it is probable that those of most other birds, and of mildly-disposed animals in general, are of the same character. The loves of the cats, indeed, seem, as Bottom says, to be the enactment of "a part to *tear* a cat in;" though that is not exactly the result. We are but little acquainted with "the loves of the lions," but it is not probable that roaring at the "top of his bent" is even the lion's mode of courtship.

This is a very curious subject altogether, and one to which nobody has yet done anything like justice; and justice cannot be done to it without a great deal of the most close and judicious observation, without which mere speculations would avail but little. There is no doubt that the working out of results in natural history must be in great part speculative, as is the case in everything else; but this speculation must follow the observation of the facts, and not go before it. To return, however, to the analogies of the birds. Many persons must have observed the absolute inspiration, as it were, with which a brood hen is stimulated to courage by hearing a cock crow in the moment of danger. A brood hen is naturally brave enough; but the sound of the crowing transports her into a perfect fury, even when her maternal attachment is still wholly absorbed by her young brood; and it is by no means improbable that the notes of the singing birds may, in part at least, answer some such purpose, though their enemies, at least when in the trees, are much less formidable, even in proportion, than those with which the hen has to contend in the protecting of her chickens.

Naturalists have not been wanting who have advanced the opinion that there are more species, or, at all events, varieties of nightingales, than one; and that, besides differences of colour and size, there are day-singers and night-singers, as distinct varieties, which continue their different hours of song at least for two or three generations. Now, the differences of colour in nightingales are never very great; and the differences of the two sexes in this respect are less than perhaps those of any other song birds; so that it is probable that these, as well as the slight differences of size, are occasioned by differences of locality; for there is scarcely any species of bird

which does not show more differences in this respect than the nightingale.

If we can draw any conclusions with regard to the habits of birds in a state of nature from what we can observe in a state of confinement, we should not be inclined to reckon the nightingale as coming under the description of a night bird in any of the ordinary senses of that term. In confinement it is so far from being a lover of the dark, that it is impatient of a dingy or gloomy apartment, and it is equally impatient of impure air—the favourable spot for its cage being a cheerful one near an open window; and it languishes in health, and the colour of its plumage fades, if it is kept in the dark. These are certainly anything but characteristics of a bird which loves darkness, though we never can draw perfectly satisfactory conclusions from observations made upon birds unnaturally kept in cages, because in this state those seasonal changes which have so powerful an influence in the economy of the bird do not, and cannot, operate. If the bird is, like the nightingale, a migrant, the cutting it off from its migration, and its changes of climate, must, to a considerable extent, affect the whole of its economy, because there are circumstances in the transference of the bird from climate to climate which cannot be compensated by any regulation of artificial temperature. There is also the grand change from the free air of heaven to a grated prison in a limited apartment, and this would be of itself enough to change the habits of most animals. If, therefore, we wish to obtain correct knowledge respecting the nightingale of nature, we must observe it pursuing its natural instincts in its own way.

The peculiar manner in which the nightingale is localised shows us that natural circumstances have far more influence upon it than they have upon most other birds which pass over the same range in their migrations. Most of our other summer birds, in so far as they do come, come pretty indiscriminately to surfaces of which the sub-soils are different, though each bird selects a particular kind of surface, or surface-vegetation, as more exclusively and appropriately its own. The nightingale, however, misses large patches of those countries which it visits in the summer, and there is always something peculiar in the subsoil of these places. It is rare upon the clays, and never found upon the moor or the marsh, though, in situations favourable to it, it is most plentiful near the banks of streams and rivers. It does not appear, however, to have any particular partiality for the water, but only for the rich and close vegetation which is found near the banks of streams, and other clear and wholesome water, or perhaps rather for the insect food with which such places abound.

It is not a bird of the depths of the tangled forests, or found far in the interior of an extensive wood. The air of such a situation is neither favourable to the nightingale nor to that upon which the nightingale feeds; and it is one of the striking adaptations in nature that the effect of natural circumstances upon a bird is to impel it to that place where its food is best and most abundant; and such is the power of this, that there are some birds sent full five thousand miles, and back again, in the course of every season, chiefly by this means.

They appear to migrate farther northward in latitude in proportion as the summer is more dry; for they reach much farther north in continental Europe than they do in Britain; and farther still in Siberia than in western Europe. With us they do not reach any part of the country which can be considered decidedly hilly, and rainy in summer; and the places which they miss, or where their numbers are comparatively few, are always more subject to showers than those in which they are abundant. In those parts of England where nightingales are most common, and where the soil and the surface are a good deal diversified, places may be observed to which summer clouds frequently find their way, and pour down rain when there is none in richer places at no great distance, and it will be found that the song of the nightingale is very rarely heard in those places, though it may be abundant a very little way off. In this way the nightingale becomes a very excellent index to the summer character, at least of those districts which it visits; and, as the summer character of places is really the important one, the nightingale is of no inconsiderable use as a guide in topographical knowledge. In districts near London, the cold gravel-caped heights, the clayey bottoms, which retain stagnant water, and close woods of considerable extent, are the chief places which attract the summer showers, and they are places of which the absence of the nightingale gives warning.

It is quite natural to expect that we should get some topographical information from this bird, because it appears to be one of the most sensitive of the feathered race that journeys into such climates as ours; and what we see on a small scale in our own diversified country, we can infer on a large scale with regard to foreign countries. Nor is it difficult to see the reason why the nightingale should avoid places where there is much humidity, and where the ground is sterile if high, and the vegetation is rank if low lying. Soft caterpillars and soft insects are the principal food of the nightingale; and these are always abundant in proportion as, with an equal store of vegetation, the place or the season is dry. The winds, or more strictly speaking the weather, during which the leaves of our trees and hedges suffer so much from the larvæ of insects, are always dry; rain coming in time in a great measure prevents the injury, and checks it even when it has proceeded to rather serious lengths. On these, and many other points connected with the productions of the earth, the places most favourable for those productions, and their healthiness or unhealthiness during the particular season, the song of the nightingale may thus be turned to an artificial memory of no small value; and while its evening or its morning notes delight our ears, we may readily make it the means of informing our minds. With us the nightingale does not make its appearance very early, neither does it stay very late. The time differs a little with the season in every country; and the more northerly the country is, the arrival is always the later and the departure the earlier. Of course, the variations of the different years alter the time of the coming of this, and of all migratory birds; but, in those which stay for so limited a period as the nightingale, the extreme limit of the variation in time does not generally exceed a fortnight or three weeks.

They arrive in Italy generally during March, in the middle of Germany about the middle of April, in England towards the end of the same month; and they generally reach the extreme limit of their migration before the middle of May. In departing southward, September may be said to answer to April,

only reversed in the order, and October answers in the same manner to March. Some, however, linger beyond the general time of departure; but these may be regarded as strays, probably of the latest broods, which rarely, if ever, survive the winter in those countries where they have been left.

When the nightingales first arrive they do not resort to the groves, copses, and thickets, at least for a few days, but remain on the open ground in the vicinity; and it is at this time that they are most easily taken by the bird-catchers. It is said, however, that the female redstart is often captured and sold for the male nightingale; and thus, though the purchaser gets a bird certainly, he gets one which will not disturb him with its songs.

The general opinion is that every nightingale returns to the place where it was produced, if it survives the fatigues and casualties of the journey. This is extremely probable, because we believe it is the case with most birds; and if the actual locality has been so changed during their absence as to become unfit for their habitation, they choose a new one as close to it as possible. If the paternal domain is of limited extent, and the old male and his progeny return together, battles are said to ensue, in which the young males are generally driven off; but if, on the other hand, the accommodation has been improved so as to afford room and food for all, the old bird becomes the founder of a colony.

The nesting, and the appearance of the young birds, are so well described by Bechstein, that we shall quote the passage:—"The nest is in a grove or shrubbery, among thick branches in a thorn-bush, or the trunk of a tree tangled with climbing vegetables, and even on the ground if there is sufficient cover for it there. Its form is simple and inartificial,—dry leaves on the outside, hay on the inside, and fine roots, with the hair of animals, are all the apparatus. The female lays from four to six eggs, of a brownish green, on which she sits a fortnight. The young are fed with small caterpillars or butterflies. As the low position of the nest exposes them to become the prey of carnivorous quadrupeds, they soon quit it, even before they can fly. Their plumage before moulting has no resemblance to that of the old birds, except the red of the tail; the upper part of the body is of a reddish grey, spotted with yellowish white on the head and coverts of the wings; the under part is of a rusty yellow, spotted on the breast with dark brown; but after moulting the resemblance is so close that they can hardly be distinguished. If, therefore, any of these birds are caught towards the end of summer, they are carefully examined on the back of the head, round the eyes, and under the beak and neck, for, provided there remains in these places a small feather, or mere yellow point, it is sufficient to indicate that they are young. As these are the only means of judging, if no marks appear it is necessary to wait a few days till the bird begins to sing. This, however, is not a sure sign, as the young females sing as well as the males till the month of April, though in a weaker and more unconnected way, and without so visibly swelling their throats; it is by these nice observations that connoisseurs succeed in distinguishing them. It may also be remarked, as a hint to those who wish to rear nightingales, that, when in the nest, those which are marked with white, and especially those which have a white throat, are males; the reddest and brownest being always females. The young, when taken, are fed with ants' eggs mixed with white bread, grated and moistened. The males begin to warble even before their tails are quite grown; if the father and mother are taken at the same time as the young ones, they will, when caged, continue to feed them as before. It is said that nightingales sometimes build in the bird-room; this, however, can only succeed by giving up to a tame healthy pair a whole room, in which a sort of grove should be formed of branches."—Cage Birds, pp. 296—7.

While engaged in the work of incubation, the female nightingale is represented as being a very close sitter, and not leaving her eggs more than once in the course of the day. Indeed, this single quitting of the nest seems to have for its object the preservation of the bird's health by exercise more than the mere finding of food. The male is understood to carry food to the female during this time; and to do it much more during the day than during that part of the night which is silent, at least with many of these birds. The nest is, however, generally placed in a secluded situation; and the birds, after they once betake themselves to their nesting-places, are so much concealed, that very little is known respecting them. They are understood, however, to be very voracious. They are known to be so in confinement; and consequently the finding of their own food, and that of their young, not only costs them a great deal of labour, but is very serviceable in destroying insects and their larvæ. They are particularly fond of the soft larvæ of the smaller ground-beetles, and also of the pupæ of ants, which are vulgarly termed ants' eggs, and collected on the continent as a sort of article of commerce in those countries where nightingales are eagerly sought after. Nightingales may be procured at three different times of the year. The first is on their arrival, and before they betake themselves to the cover of the woods and copses. The males come earliest, and are boldest; and they are very readily caught by those who practise the art of bird-catching. The next time of capture is from the nest, which requires a good deal of practice, and succeeds best at those times when the male is singing; but the young birds are delicate, and should not be removed too early. The last time of catching is just before they depart in the autumn; and at this season birds of the year are most frequently obtained.

In Britain nightingales are not very often kept in a state of confinement, because it requires a very strong passion for captive birds to overcome the trouble of attending to them. In Germany, however, where the attending of them is much more a sort of trade, they are often kept for a great number of years; Bechstein mentions five-and-twenty in one instance. In that country, or at least in some places of it, the taking of nightingales is prohibited, though probably more of them are taken in it than in any other country; and near the shores of the Mediterranean, where small birds are much in request as articles of food, nightingales are not unfrequently eaten.

In confinement nightingales sing for a much longer period than they do in a state of nature, sometimes continuing their notes from autumn till spring; for it very often happens that confinement changes entirely the season of song in birds, and especially in migratory ones.

The various methods of rearing, teaching, and

managing nightingales, do not so strictly belong to the proper natural history of the birds as to the particular art of the bird-fancier, and, therefore, those who wish for information on those particular birds will naturally seek for it in the various works devoted to the art. We shall therefore only farther notice very shortly the appearance of the birds, so that any one who chances to see a nightingale may know that it is one, and learn in how very sober a dress the sweetest songster of the groves is clad. The annexed cut will give some idea of the general shape of this songster.

The size of the nightingale varies a little, but its length is in general about five or six inches, of which the tail takes up rather more than two. The tarsi are long, adapting the bird for rather vigorous hopping along the ground, upon which a considerable portion of its food is found, both by poking and by scraping. Its bill is more than half an inch in length, and very slender, of a dull brown colour, but with a yellowish tinge at the base of the lower mandible, and the tarsi and toes are nearly of the same colour. The upper parts are yellowish-brown, with traces of reddish and sometimes greyish colour. The principal quills and larger coverts of the wings are dusky brown, with a reddish tinge on the margin of the feathers; and the tail, which is slightly forked, is darker brown, and more inclining to red. The sides of the neck, the ear-coverts, and the flanks, are pale ashen-grey, passing into white on the throat and the middle of the belly; and a very obscure dusky mark proceeds from the gape at each side toward the neck, and these pass into pale ash-grey on the breast, dividing the greyish-white on the throat from that on the belly. None of the colours are by any means decided; and there is nothing striking in the appearance of the bird. The female is but little different; but the tarsi are rather shorter, the head rounder, the eyes smaller, and the throat not so white.

Though nightingales feed chiefly, if not exclusively, upon animal matters during their breeding season, and though in consequence of this, independently of their delicate constitutions, they could not, in all probability, endure the winter with us, or indeed in any part of Europe, yet they are not absolutely confined to animal food, but betake themselves to soft berries for a supply before they leave the country, as is done by many others of the summer birds of song. When this is the case, they of course become, to a very considerable extent, tree-birds; but, in their characteristic season, they find great part of their food upon the ground, though they also pick many caterpillars from the leaves of the trees.

Though the nightingale is exclusively a bird of the eastern continent, to which nothing corresponding is found in America, yet, with the local exceptions to which we have alluded, it is pretty generally distributed over that continent, being found as far as the islands of Japan. In every land where it is met with the nightingale is a favourite with the people generally, and especially with the poets. The old story of its song being a lamentation uttered by the female when deprived of her mate is of course too ridiculous for requiring any formal refutation at the present day; but still, as there are a good many people fond of poetry, and but little conversant with natural history, and as birds, especially singing birds, are favourite themes with poets, it may not be amiss to put such in mind that the nightingale never sings in sorrow; that though the female does sing, it is but rarely, and in strains far inferior in power and compass to those of the male bird, which is always the nightingale of ordinary admiration and poetic description.

The music of birds, we need hardly say, is almost entirely produced at the bronchial end of the windpipe; and the muscles which give motion to that organ in the male nightingale are larger and more powerful, according to his size, than those of any other bird. The song of the female is also much finer than that of the female of any other warbler; and it is worthy of remark that the female is more like the male in the nightingale than in any other species. These great powers of song have not been given to the nightingale without an inclination on its part to put them into vigorous exercise. We have already mentioned the tendency which the chattering cries of less tuneful birds have to silence the nightingale; but it is evidently not from the love of silence, but from the want of sufficient stimulus in the rival sounds, that the nightingale abstains from singing on these occasions. In its native groves the nightingale rarely, if ever, sings against any other species of bird; and song-birds in general do not sing against those which have notes inferior to their own, though most, if not all of them, are prone enough to contend with superior songsters, especially if there is much resemblance between the songs and the localities of the birds. This propensity is of great advantage in the teaching of singing-birds, because, to the full extent of their powers, proper training enables them to imitate either the notes of birds naturally superior, or the notes of human music. There are many instances of the contention of nightingales for the palm of victory with human musicians; and these are recorded of nightingales in so many countries, that there can be little doubt of their truth. Bartolomeo Ricci calls on the nightingale as evidence of the great superiority of Silvio Antoniano, as an improvisatore, accompanying his spontaneous verses on the lyre when under the delightful temperature of an Italian evening sky. Silvio was charming the ears of the listeners by a very superior specimen of his art: a nightingale, attracted by the tones, perched close by, and sung in concert or in rivalship with the poet; upon which Silvio broke into an impassioned strain in praise of the nightingale, and touched his lyre with an effect which was perfectly magical. A similar occurrence happened at the *Jardin des Plantes* in Paris, although, as the human musician there was no improvisatore, the nightingale got no song of praise for its exertions. M. Gerardin was sauntering

in the garden on a fine evening, at that season when the nightingales are in most powerful song, and listening with delight to two which were singing against each other in the trees near him. He took his German flute, and, touching a few passages in tender airs, approached the spot whence the songs of the birds came. At first they were silent; but he continued, and, before long, they accepted his challenge, and sung in a higher key than that in which he touched the flute. Gerardin raised his key a third, and instantly the birds raised their notes, still keeping above him. He then raised it an entire octave; but, without hesitating a moment, the nightingales raised their notes still higher, and Gerardin, acknowledging that he was vanquished, put up his flute, and lingered to enjoy their song of victory.

In Moscow, at least before the conflagration of that city, which may have changed the eastern character of mingled palace, and paradise, and hovel, which it formerly exhibited, nightingales are tamed and taught in great numbers; and Dr. Clark states that what with the tamed birds, what with the wild ones singing in rivalship from the gardens and groves, the streets of Moscow were vocal with nightingales, as completely and as long continued during the night, as if they had been the groves of Italy, or the rose-clad bowers of Persia. In the last mentioned country, the nightingale is an especial favourite. The Persians are not only a highly poetical people, but their sylvan poetry is of a high and exquisite character. They therefore introduce the nightingale (the *Bul bul* in their language), more frequently than the poets of any other land. These allusions to it are natural too, and partake little of that romance which our poets have borrowed from the fables of the ancients. The late Sir William Jones is a most competent authority in all which relates to the poetry and music of the East, especially of Persia; and the following short quotation from him will show that the nightingales of Persia are equally disposed to imitate or contend with choice music, as the nightingales of countries farther to the west. "An intelligent Persian," says Sir William, in his Dissertation on the Musical Modes of the Hindûs, "declared he had been more than once present, when a celebrated lutanist, surnamed Bul bul (the nightingale), was playing to a large company in a grove near Schiraz, where he distinctly saw the nightingales trying to vie with the musician; sometimes warbling on trees, sometimes fluttering from branch to branch, as if they wished to approach the instrument, and at length dropping on the ground in a kind of ecstacy, from which they were soon raised, he assured me, by a change in the mode." It would be easy to fill volumes with well authenticated anecdotes, and impassioned descriptions of this charming songster; but the above must suffice for our purpose.

The Greater Nightingale. (*M. Luscinia major*, Linnæus; *C. Philomela*). The above description applies chiefly or exclusively to the common nightingale of the species which visits England and the west of Europe; but there is, in the eastern parts of central Europe, one which has been considered as a different species, and that for the reasons following: it is larger than the other, being an inch longer in the body, half an inch longer in the tail, having a larger head and stronger bill, and different in its colours and its song. In this one the upper part of the body is dusky brownish-grey, the white on the throat has a dusky black border, the breast is brown mottled with darker, the belly is dull white, and the wings and tail are deeper brown than those of the common nightingale.

Altogether this seems a stronger and more vigorous bird than the common nightingale; and the notes of its song are so loud that it can hardly be tolerated in an apartment, except by those who are passionately fond of birds. Altogether its song is far inferior to that of the other, notwithstanding its ear-piercing loudness; and it is liable to break off and jar, and not bring its melodies to those fine trills and cadences which are so pleasant in the song of the common nightingale. There is no particular mention of this one in the south of Europe or the East; and Austria and Poland seem to be the countries in which it is most abundant, though Hungary on the east, Bohemia on the west, and partially also some parts of Saxony, are included within its range. It is most plentiful near the banks of the rivers in Hungary, and those of the Vistula in Poland. It is said to be more numerous there than the common nightingale, though its song is inferior to what it is farther south. No mention is made of the occurrence of this bird on the north side of the Baltic, it has not occurred in Britain even as a straggler we believe; and we are not aware of its having occurred even in France. It thus seems peculiar to a certain longitude in Europe, and is probably not so migratory in latitude as the common species; but of its manners, if they differ from the manners of the other, nothing is known with certainty. The difference in appearance between them seems of itself scarcely sufficient to constitute a specific difference; and as for the difference of song, one would require to hear the two birds before absolutely deciding between them. In order to enable the curious among our readers to do this, we shall quote the literal translations of the two as given by Bechstein, who, as he endeavoured to make a sort of language for them, is perhaps to be preferred to those who have measured their powers by the gamut of music. The song of the common nightingale, says Bechstein, "is so articulate, so speaking, that it may be very well written," (of course he writes it well). "The following is a trial which I made on that of a nightingale in my neighbourhood, which passes for a capital singer:—

Tioû, tioû, tioû, tioû.
Spe, tioû, squa.
Tió, tió, tió, tió, tio, tio, tio, tix.
Coutio, coutio, coutio, coutio.
Squó, squó, squó, squó.
Tzu, tzu, tzu, tzu, tzu, tzu, tzu, tzu, tzi.
Corror, tiou, squa pipiqui.
Zozozozozozozozozozozozozo, zirrhading!
Tsissisi, tsissisistsisisisis.
Dzorre, dzorre, dzorre, dzorre, hi.
Tzatu, tzatu, tzatu, tzatu, tzatu, tzatu, tzatu, dzi.
Dlo, dlo, dlo, dlo, dlo, dlo, dlo, dlo, dlo.
Quio, tr rrrrrrrr itz.
Lu, lu, lu, lu, ly, ly, ly, ly, lié, lie, lié, lié.
Quio, didl li lulylie.
Hagurr, gurr quipio!
Coui, coui, coui, coui, qui, qui, qui, qui, gai, gui, gui, gui.
Goll goll goll goll guia hadadoi.
Couiqui, horr, ha, diadia dill si!
Hezezezezezezezezezezezezezezeze couar ho dze hoi.
Quia, quia, quia, quia, quia, quia, quia, quia, ti.
Ki, ki, ki, io, io, io, toioioio ki.
Lu ly li le lui la leu lo, didl io quia.
Kigaiguigaigaigaigaigai guiagaigaigai couiov dzio dizo pi.

The following is the song of the other one:—

Guia, gu, gu, gu,
Hajai, hajai, dzu, dzu, dzu, dzu.
Gorgué, guéguéguéguéguéh.
Hoa goigoigoi gui.
Dzicka, dzicka, dzicka.
Davitt, davitt, davitt.
Gogock, gogock.
Guedum, guedum, guedum, guedum, gueei!
Gui, goi, goi, goi, guirrrr.
Golka, golka, golku, golk.
Hia, guaguiaguiuguia.
Glockglockglockglockglockglock.
Gueai, gueaigueai gui!
Goi, guaguaguagua guagui.
Heid, heid, heid, heid, hi.
Voi dada! voi duda!
Gai, gai, gai, gui, guirr, guirr.
Hoi, gueguegue gui.
Hoi goi!

NIGHTSHADE is the *Solanum dulcamara* of Linnæus, a common British weed found in hedges. It is also called bitter-sweet, or felon-wood; its fruit, leaves, and stem being all poisonous. The *Atropa belladona* is called the *deadly nightshade*.

NIPA (Rumphius). A genus of palms found in the East Indies. It requires, in our stoves, a loamy soil and strong moist heat.

NIPPLEWORT is the *Lapsana communis* of Linnæus, a common British weed, belonging to *Compositæ*.

NIRMIDÆ (Leach). A family of apterous insects belonging to the order *Anoplura*, and composed of the various species of lice found upon birds, to which they are exclusively attached, with the exception of one species found upon the dog. The mouth is placed on the under side of the head, and composed of two lips and two hooked mandibles; the tarsi are distinct, and terminated by two equal-sized hooks; the head is generally large and triangular, semicircular or crescent-shaped, and occasionally with angular projections. The sexes also differ in the size of the head and the antennæ. M. Savigny also observed a pair of maxillæ with a minute palpus, hidden by the lower lip, which has also a pair of palpi. The body is small and depressed, of an oval or elongated form, and often varied with spots of different colours. Some of the species are very peculiar in their forms. M. Leclerc de Laval informed Latreille that he had discovered in the stomach bits of bird's feathers, and hence he believed that this constituted their food. De Geer, however, found the stomach of one of the species filled with blood with which it had gorged itself. It is certain that they are able to live but a short time upon dead birds, upon which they may be seen crawling with an evident desire of escaping. The family has found but few authors who have taken any interest in its investigation. Redi, however, long since figured many species in a rude manner; and more recently we find, in the posthumous work of Lyonnet, representations of many others. Dr. Nitzsch also has published an elaborate monograph in the Magazine d' Entomologie of Germar; and S. G. Children, Esq., S.R., has just published descriptions of some of the arctic species brought home by Captain Back.

NISSOLIA (Jacquin). A genus of evergreen shrubs and climbers, natives of South America; the flowers are diadelphous, and belong to *Leguminosæ*. The plants succeed potted in sandy loam, and may be increased by cuttings.

NITIDULIDÆ (Leach). A family of coleopterous insects belonging to the section *Pentamera* and sub-section *Cercophaga*, having the body small and generally shield-shaped, with lateral margins; the mandibles are notched at the tips; the basal joint of the tarsi often small; the club of the antennæ perfoliate, two or three-jointed, and short; the palpi short, filiform, or but slightly thickened at the tips; the legs moderately long, and the tarsi pilose. These insects are of small size, and frequent decaying animal or vegetable matter, some species being found in rotten bones, others in the damp matter which exudes from the wounds of trees, others again in boleti and fungi, and some under the bark of trees. This family is nearly allied to the *Silphidæ*, or carrion beetles, the connection being satisfactorily established by the genera *Peldis* and *Thymalus*. Some of the smaller species frequent flowers, and these are of a metallic colour; the others are of obscure hues, but are often varied with spots or markings. The family comprises the following genera:—*Thymalus*, *Nitidulæ*, *Strongylus*, *Campta*, *Meligethes*, *Pria*, *Carpophilus*, *Anisocerus*, *Cateretes*, and *Mecropeplus*, all of which are British. The typical genus, *Nitidula* (Fabricius), is distinguished by the sub-depressed form; elytra rounded behind; sides of the thorax not depressed; and the third joint of the antennæ larger than the fourth. There are about twenty-five British species, including *N. depressa* (*Silpha depressa*, Linnæus), which is of a brown colour, with black spots. It is rather less than one-sixth of an inch long, and frequents the bark of willow trees.

NITRARIA (Linnæus). A genus of deciduous shrubs found in the north of Asia, belonging to *Ficoideæ*. The species thrive in sandy loam, and may be increased by cuttings. According to Sweet, the soil should be impregnated with a little salt to assist the growth, as they are maritime plants.

NIVENIA (Dr. R. Brown). A fine genus of Cape plants, belonging to the fourth class of Linnæus, and to the natural order *Proteaceæ*. Generic character: involucrum of four leaves, four-flowered, fruit hard; receptacle smooth and naked; calyx in four equal deciduous divisions; scales round the germen free; stigma clubbed and erect, nut swollen, sitting, and entire at the base. These plants thrive in a compost of loam, sand, and moor-earth, and require careful draining, and to be kept in a dry airy part of the greenhouse. They are propagated by cuttings, but not in heat.

NOCCA (Cavanille). Mexican shrubs belonging to *Compositæ*, formerly the *Lagascas* of Kunth. They do well in the greenhouse.

NOCTUIDÆ (Stephens; NOCTUÆLITES, Latreille). A very extensive family of lepidopterous insects, belonging to the section *Nocturna*, and distinguished by the elongated spiral tongue; the palpi sub-compressed, terminated by a small joint; the wings of moderate length, the anterior being sub-triangular, and not convoluted when at rest; the body thick, and covered with scales; the antennæ generally simple; the thorax often crested; the abdomen conical; the nerves of the wings are very strong, and the flight of the insects very rapid. "The typical groups of the *Noctuidæ*," observes Mr. Stephens, "as their name imports, fly only by night, and repose during the day on the crevices of the bark of trees, old walls, palings, &c., though others not only fly by night, but during the afternoon and at twilight. The

position of the wings during repose varies much ; in some groups (as *Triphœna*, &c.) they are placed horizontally, and closely applied to the body, giving the insect a somewhat cylindrical form ; in others (*Catocala*, &c.) they are also placed horizontally, but somewhat expanded, and forming a triangle ; in others (as *Phisia*) they are considerably deflexed, and the thorax is crested ; there is also considerable diversity in the form of the wings, though in general the anterior ones are elongate-triangular, and the posterior somewhat triangular-orbiculate ; some few have the posterior margins denticulated ; and the anterior wings are mostly ornamented with two stigmata, one more or less circular, the other reniform (kidney-shaped), a character rarely observed in any other family of this order. The larvæ are usually solitary, do not reside in a web, neither are they subcutaneous; but those of the genus *Ceropacha* twist up the leaves similarly to those of the *Tortricidæ* ; the pupæ are usually subterraneous." The caterpillars have generally sixteen feet ; some, however, have only fourteen or twelve ; the posterior or anal pair are never absent ; and in those species which have only twelve the anterior pair of the prolegs is as large as the following pair.

This family corresponds with the Linnæan section *Phalæna Noctua*, and comprises nearly four hundred British species, being mostly of a large or moderate size, and intermediate, as it were, between the *Bombycidæ* and the *Pyralidæ* or *Tortricidæ*. These are divided by Mr. Stephens into about eighty genera, often resting upon minute structural differences, which renders it unnecessary for us to notice them in detail, or even to give a list of them. In the work of Ochsenheimer upon the European Lepidoptera this family comprises forty-two genera, corresponding for the most part with the sections proposed in a valuable work published many years ago, containing a classification of the lepidoptera found near Vienna, and in which great use was made of the characters obtained from the transformations of these insects, and which consequently afford good distinctive groups. The classification of this family is certainly a matter of difficulty, which is greatly increased by the exotic species having been almost entirely neglected, lepidopterists having chiefly confined themselves to the European species, although it is evident, from the figures of many insects given by Drury, Cramer, &c., that the extra-European species exhibit even greater diversity of form than those of Europe. Dr. Horsfield proposes to divide the family into three principal groups upon the consideration of their metamorphoses ; and Latreille, after separating the genus *Erebus* (in which the wings are always extended and horizontal, and the last joint of the palpi long and naked, and which comprises some of the most gigantic exotic species of the order), proposes to divide the remainder into two extensive and parallel series. In the first the larvæ are geometrical, having either sixteen or twelve feet ; and in the second the larvæ are sixteen-legged. *Erastria* and *Chrysoptera* appear to terminate the respective series, and respectively to tend towards the *Pyralidæ*. Amongst the British genera may be especially mentioned *Catocala*, *Cucullia*, *Triphœna*, *Agrotis*, *Mamestra*, *Calyptra* (the herald moth, *C. libatrix*), *Xanthia* (the sallow moths), *Leucania* (the wainscot moths), *Phœsea* (the spangled moths), and *Mormo* (the old-lady moth), descriptions of most of which will be found in their alphabetical places. It is to be regretted, amidst the introduction of these new generic groups, that the old name *Noctua* appears to have been lost sight of as a generic title.

NOCTURNA (Latreille). A section of lepidopterous insects which fly by night. See LEPIDOPTERA.

NODOSARIA (Lamarck ; NAUTILUS, Linnæus). A genus of molluscs of the family *Orthocerata*, a very confused and badly arranged genus, which under the title *Orthoceras* includes many recent and fossil species, many of the latter being probably no other than the spines of *Echini*, and many have been described as minute *Nautili*. The recent species are found, some of them, on the Mediterranean shores, buried in the sands. This genus, like that of the *Spirula* of Linnæus, is blended with his genus *Nautilus*.

NOLANA (Linnæus). A genus of South American annuals, introduced into our flower gardens about 1761. They belong to *Solaneæ*, and are pretty flowering creepers.

NOLITANGERE is the *Impatiens nolitangere* of Linnæus, an English annual, remarkable for the elastic power of its capsules, which, when touched, discharge the seeds with considerable force.

NOMADA (Fabricius). A genus of bees, belonging to the family *Apidæ* and subfamily *Cuckoo-bees* (CUCULINÆ, which see), having three sub-marginal cells and six joints in the maxillary palpi ; the labrum is short and suboval. This is an extensive genus, consisting of nearly forty British species, being of a slender form, with the body destitute of pubescence, and ornamented with red and yellow or white bands, giving the insects the appearance of small wasps. They are chiefly found in the spring flying over sunny banks, and endeavouring to deposit their eggs in the provisioned nests of other bees, especially *Andrenæ*. The type of the genus is the *Apis ruficornis*, Linnæus.

NONATELIA (Aublet). A genus of South American evergreen shrubs, with pentandrious flowers, and belonging to the natural order *Rubiaceæ*. This genus has been called *Psychotria* by other authors.

NONEA (Moench). A genus of European annuals belonging to *Borragineæ*. This genus of plants was named *Lycopus* by Linnæus, but separated by Moench.

NORANTEA (Aublet). South American evergreen shrubs, bearing polyandrious flowers, and belonging to *Marcgraviaceæ*. They are stove plants, and succeed under the ordinary management.

NORWAY SPRUCE FIR is the *Abies excelsa* of Poiret, a well-known forest tree.

NOTARCHUS (Cuvier). This is a genus of molluscs without a testaceous covering. The animal's body is of a globular form, the foot similar to that of the *Bursatella*, to which it appears nearly allied, it has four tentaculæ, separated through a portion of their length, without prolonged labial appendages ; a very small lateral superior branchia, nearly external, or merely protected by a small fold of the mantle ; it has no internal testaceous portion. The only species described is the *N. Cuvieri*, which inhabits the Isle of France. This genus forms a connecting link between the *Bursatella* and the *Elysia*, and is one genus of the family *Aplysiacea*.

NOTELÆA (Ventenat). A genus of Australian evergreen shrubs, belonging to *Oleinæ*. The flowers are inconspicuous, but the plants are ornamental, and are managed like other plants from the same quarter.

NOTIOPHILUS (Dumeril). A genus of coleo-

pterous insects belonging to the family *Carabidæ* and subfamily *Elaphrides*, having the body depressed and elongate, the eyes large, the forehead channelled, and the elytra with a smooth and polished longitudinal space along each. These are very active little insects, found in gardens under stones, in sand, and gravel pots. They are generally of a shining copper or brassy colour. Entomologists are much at variance respecting the numbers of species which we possess in this genus. Stephens, in his Illustrations, gave two, suggesting the probability that we had more than that number. Mr. Waterhouse subsequently published a monograph in the Entomological Magazine, in which he described eighteen, which number Mr. Stephens has still more recently reduced to six, in the second edition of his Nomenclature. The type is the *Cicindela aquatica* of Linnæus, which is nearly a quarter of an inch in length.

NOTODONTIDÆ (Stephens). A family, or perhaps rather a subfamily, of lepidopterous insects, separated from the Linnæan division Bombyx (which see), characterised by the possession of a very short distinct but not spiral tongue, the antennæ bipectinated, especially in the males, the body more or less robust, and terminated by a tuft in the males. The larvæ generally fleshy and naked, or slightly hairy, with one or more tubercles, mostly with sixteen legs, the anal pair of which are in some species (the puss and kitten moths, *Cerura*) converted into a porrected caudal appendage; the pupa enclosed in a cocoon, and often buried in the earth. This family is perhaps too nearly allied to the *Arctiidæ*, with which it is indeed united by Latreille, composing his third section of *Nocturna*, named *Pseudo bombyces*. It comprises, according to Stephens, fourteen genera, including *Pygæra* (*P. bucephala*, the buff-tip moth), *Cerura*, *Stauropus* (*S. Fagi*, the lobster-moth), *Endromis* (*E. versicolor*, the glory of Kent moth), and *Notodonta* of Ochsenheimer, so named from the tooth or elevated scale upon the posterior edge of the anterior wings, and which, when the wings are closed, meet and form a crest on the back; hence the English name of the prominent moths given to these insects. Mr. Stephens has restricted this genus to the *N. dromedarius* (small crow prominent), *perfuscus* (dark prominent), and *ziczac* (pebble prominent). The swallow prominent (*dictæa* and *dictæoides*) form the genus *Lecocampa*, Stephens; the coxcomb and maple prominents the genus *Lophopteryx*, Stephens; and the pale prominent (*palpina*) the genus *Ptcrostoma*, Germar (*Ptilodontis*, Stephens; *Orthorhinia*, Boisduval; *Odoriptera*, Latreille). They are all handsome moths, and many of them of considerable variety.

NOTONECTIDÆ (Leach). A family of aquatic hemipterous insects, belonging to the section *Hydrocorisa*, Latreille, differing from the *Nepidæ* in the fore legs not being raptorial, but simple, directed downwards, with the thighs of the ordinary size and the tarsi similar to those of the hind feet, and very much ciliated or clothed with lateral hairs; the body is thick and of an oval or sub-cylindrical form, and much less depressed than in the *Nepidæ;* the hind legs are admirably adapted, both in their structure and mode of insertion, for swimming, being fringed with strong hairs and terminated with two very minute tongues. With the assistance of these legs, they swim with great rapidity. The name of the family is derived from the peculiar habit which these insects have of swimming with the back downwards. On approaching a piece of standing water, these insects may be seen resting with the tail upwards touching the surface, and the legs extending at nearly right angles from the body. In this position they are enabled to obtain a supply of air to the apertures of the air tubes along the sides of the body in the same manner as the *Dyticidæ*. No sooner, however, do they gain information of our approach (and how this is effected so quickly by insects whose heads are half an inch under water with the tail uppermost it is difficult to conceive) than they strike downwards, and are out of sight in an instant. They reside in the water in all their states, but the imago sometimes quits its native element and takes flight. The larva differs only from the imago in wanting wings and hemelytra. They are predaceous, feeding upon other insects which they seize with their short fore legs, and convey it to the proboscis. They are very bold, and will attack insects larger than themselves, and even their own species; they also destroy considerable numbers of the larvæ of the *Ephemeræ* which are themselves predaceous. They are enabled to produce a smart wound with their proboscis. The female deposits a considerable number of white elongated eggs, which it attaches to the stalks of aquatic plants. In the commencement of the following spring, these eggs hatch and produce minute active and voracious larvæ which afterwards become pupæ, differing from the former state in having rudiments of the organs of flight. The family is but of small extent and corresponds with the Linnæan genus *Notonecta;* it now comprises the genera *Notonecta*, *Ploa*, *Sigara*, and *Corixia*. The genus *Notonecta* is distinguished by its sub-cylindrical form, the scutellum large and distinct, with the first joint of the anterior tarsi long, and the claws of the hind legs minute. There are three British species, the type being the *N. glauca* of Linnæus, about half an inch long, of a greyish colour, with the margins of the elytra spotted with small black dots, and the back of the abdomen black. Dr. Leach has published a good monograph upon this family, in the twelfth volume of the Linnæan Transactions.

NOTOXIDÆ (Stephens; Anthicides, Latreille). A family of small coleopterous insects, belonging to the section *Heteromera*, and subsection *Trachelides*, Latreille, having the antennæ simple and slightly thickened towards the tips, the joints being of a reversed conical form, the maxillary palpi terminated by a large hatchet-shaped joint, the penultimate joint of the tarsi bilobed, the body narrowed in front, the neck generally distinct, the thorax narrowed behind or knotted. The species are of minute size, in general very active, often found in the neighbourhood of dung-heaps, or in sandy situations, others are found upon different plants. Latreille places in this family the genera *Seraptia*, *Steropes*, *Notoxus*, and *Anthicus*, the typical genus being distinguished at once by a large horn produced from the front of the thorax and extending over the head. The type is the *Notoxus monoceros* (Linnæus, *G. meloe*), a small and not very common species, which is prettily varied with brown and red, and found upon sand banks. The genus *Anthicus* comprises numerous small species, having the thorax unarmed.

NOTREMA. A genus of molluscs established by Rafinesque, neither the animal nor the shell is accurately known, and the only idea we can form of it is the *Hipponix* placed upon a distinct basis, with its

summit closed by a kind of operculum, analogous, perhaps, to the piece which closes the aperture of the *Fissurella*. So doubtful from the description we have of this genus is its proper place in malacology, that we are almost disposed to consider it a species of *Bulimus*, hitherto but little examined.

NUCLEOBRANCHIATA. The fifth order of De Blainville's malacology, second class, *Syphonobranchiata*. It includes the first family *Nectopoda*, composed of the genera *Pterotrachia* and *Carinaria*; second family *Pteropoda*, composed of the genera *Atalanta*, *Spiratella*, and *Argonauta*. The distinguishing characteristics of this order are the animals possessing a wing-like appendage on each side of the body, serving as propelling organs; the body gelatinous. The shell symmetrical, more or less turned longitudinally forward, and the texture very thin. One species of this order, the *Argonauta*, has given rise to doubts, whether the animal found in it, is the "architect of its fairy bark" or not; and two thousand years have elapsed without that question being yet set at rest. The general opinion seems, however, to be, that the animal discovered in the *Argonauta* is only a pirate, and not its proper inhabitant.

NUCULA (Lamarck). This genus of molluscs appears to form an evident transition to the genus *Trigonia*, and is the last division Lamarck has made of the genus *Arca*, of Linnæus, from which and the two other divisions it differs, in consequence of the ligament being partially inserted internally without the angular groove in the exterior of the valves, these are more or less pearly within, as are also those of the *Trigonia*, and evidently indicate an alliance with the *Naiades*. Lamarck describes six living species, and four fossil; of the first, three inhabit the European seas, and the rest the eastern ocean. De Blainville places this genus following the *Petunculus*, and it is the last of the family *Polyodonta*, or *Arks*.

NUMMULACEA is De Blainville's third family of the second order *Cellulacea*, and contains the genera *Nummulites*, *Helicites*, *Siderolites*, *Orbiculina*, *Placentula*, and *Vorticialis*. Of the genus *Siderolites*, two recent species are known; of the *Orbiculina* three; of the *Placentula* two; of the *Vorticialis* four species of a microscopic size; the rest are fossils analogous to this family.

NUMMULITES. A genus of fossil molluscs. De France enumerates about twenty, but more are known; the animal is of course entirely unknown; but the form of its habitation is lenticular, not exhibiting any appearance of the whorls of the spire, which are altogether interior, and divided into a great number of small cells separated by a partition, which is not perforated by a syphon.

NUPHAR (Smith). A genus of aquatic plants separated from the genus *Nymphæa*. The flowers are polyandrous, and belong to the natural order *Nymphæaceæ*. These are natives of northern climates, two of them are British, and frequently met with in brooks and pools. In Sweden, in years of scarcity, the roots of *Nuphar lutea* are pounded into cakes.

NUTCRACKER (*Nucifraga caryocatactes*). A genus of carnivorous birds, of the great order *Passeres*, and as such ranging with the crow family. Only one species is known as strictly belonging to this genus, the common nutcracker, or European bird, but so rare in Britain as to merit the character of only an occasional straggler. Generically it may be thus described: the bill large, long, straight, arched in the culmen, compressed laterally, and margined and pointed at the tip. The upper mandible rounded in its section, without any prominent ridge, and exceeding the lower mandible in length. The nostrils, at the base of the bill, small, open, but shaded by bristly feathers directed forwards; four toes to the feet, three in front and one in the rear, the external front one united to the middle at the base; and the tarsus longer than the middle toe. The wings wedge-shaped, the first and sixth quills being equal, and the fourth the longest in the wing.

The size and markings of the species are as follow: The length about thirteen inches, of which the tail occupies rather more than four; and the bird is thus about the size of the magpie. The general plumage of the male is black, with a decided brownish tinge, and mottled over with small white spots, very similar to those on the starling upon all parts, except the top of the head; these spots are most numerous on the under parts, where they form irregular clusters. The tail feathers are also marked with a large white bar at the ends; the bill and the feet are greyish, and the irides brown. The female is brighter brown than the male, and has something of a reddish cast. The colours are, however, by no means constant, either in different individuals or in the same individuals at different ages and seasons. Individuals are not unfrequently met with of a sort of albino character, the ground colour being the same dull white as the spots upon the ones commonly met with, and the spots being pure white. These birds belong to the northern hemisphere, and are not uncommon in the cold regions; and they rarely quit the fastnesses of their favourite mountains and woods, unless when driven thence by the severity of the weather. In Europe they extend from Lapland to the foot of the Alps; but they are to be considered more in the light of resident birds upon those localities which they prefer than as regular migrants with the seasons. They are very voracious and indiscriminate in their food, which consists both of the seeds and kernels of trees, and of various insects and their larvæ; they are partial to pine forests, where they hew the seeds out of the cones with their powerful bills; but they also feed upon acorns, nuts, and beech-mast, the coverings of which they break open with the greatest care. At some seasons they tap the bark of trees something after the same manner of woodpeckers; but they do not punch into the wood, or capture insects with the tongue, in the same manner as those curious creatures. During summer the nutcrackers inhabit the depths of the woods, and are said to be partial to those places of them near which there are springs and rills of water; but in severe snow storms, and indeed during the winter generally, they approach the abodes of mankind, and, like most omnivorous birds, pick up such substances as they can find, whether animal or vegetable. The nest is usually placed in the hole of a tree, and the birds are said to trim and enlarge those holes in the same manner as is done by woodpeckers. Indeed the nutcrackers seem to combine, to a considerable extent, the habits of the woodpeckers and those of the other omnivorous birds. Nutcrackers have nothing which can be called a song, for theirs is not a musical family. Most of the genera can, however, be taught to articulate words, and it is probable that the nutcrackers have this property, though we are not aware that it has been tried.

NUTHATCH (*Sitta*). A genus of *Tenuirostral*

birds with *anisodactylic* feet, of which the characters are: the bill of mean length, straight, circular in its section, depressed, conical toward the point, where the cutting edges are particularly sharp, and the texture very firm. The nostrils are placed at the base of the bill, rounded, and covered by bristly feathers. Four toes on each foot, the external one united to the middle of the base, and the hind one large and armed with a strong claw. There are twelve feathers in the tail, nearly square over at the ends, and with flexible shafts. The first quill of the wing very short, the second also shorter than the third, and the fourth is the longest in the wing. These birds are excellent climbers, and in this respect have no inconsiderable resemblance to the woodpeckers, and also to the tits, the former of which they resemble in their action upon the stems and large branches of trees, and the latter, in their action upon the small branches, from which they can hang suspended in a variety of positions; and thus search every part of a tree from the bottom of the trunk to the remotest bud, for insects or for nuts and seeds, all of which indiscriminately form part of their food according to the season.

The typical species is the common nuthatch (*Sitta Europæa*). It is about six inches in length, with a bill three quarters of an inch long, slender, but firm in its texture, and stiff by both mandibles being curved; the upper mandible is blackish-blue, the the lower one paler, and yellow at the base. The feet are yellowish-grey, furnished with very strong claws. The male bird is bluish-grey on the upper part, and blue on the forehead; the cheeks and throat are white, shown off by a black streak which extends from the gape to the neck; the flanks and thighs are brownish, and the breast and belly dull yellow. The quills are blackish, and the tail-feathers, which are twelve in number, are bluish-grey, except the lateral ones, which are black, and a white bar crosses the tail near the tip. As a British bird, the nuthatch is confined to the south of England, to nearly the same range as that occupied by the woodpecker; but it is a bird of different habits, not being migratory. It has not been observed in the extreme west of England, "We have never," says Montagu, "observed it far north, nor so far west as Cornwall. It chiefly affects wooded and enclosed situations, choosing the deserted habitation of a woodpecker in some tree for the place of nidification. This hole is first contracted by a plaster of clay, leaving only sufficient room for itself to pass in and out. The nest is then made of dead leaves, most times that of the oak, which are heaped together without much order. The eggs are six or seven in number, white, spotted with rust-colour, so exactly like those of the oxeye in size and markings, that it is impossible to distinguish any difference. If the barrier of plaster at the entrance is destroyed when they have eggs, it is speedily replaced; a peculiar instinct to prevent their nest being destroyed by the woodpecker and other birds of superior size, which build in the same situation."

As these birds have no song, they are kept in confinement only for the sake of their manners, even in those countries where the people are most partial to confine birds. Anecdotes are told of the difference between their manners when they are a sort of partially tamed in a free state, and when they are forcibly confined. "A lady," says Bechstein, "amused herself in the winter, and particularly when the snow was on the ground, with throwing, several times a day, different kinds of seeds on the terrace below the window, in order to feed the birds in the neighbourhood. These soon became accustomed to this distribution, and arrived in crowds when they heard the clapping of hands, which was the signal used to call them. She put some hempseed and cracked nuts even on the window-sill, and on a board, particularly for her favourites, the blue-tits. Two nuthatches came one day to have their share in this repast, and were so pleased, that they became quite familiar, and did not even go away in the following spring to get their natural food, and to build their nest in the wood. They settled themselves in the hollow of an old tree near the house; as soon as the two young ones which they reared here were able to fly, they brought them to the hospitable window where they were to be nourished, and soon after disappeared entirely. It was very amusing to see these two new visiters hang or climb on the wall or blinds, whilst their benefactress put their food on the board. These pretty creatures, as well as the tits, knew her so well, that when she drove away the sparrows which came to steal what was not intended for them, they did not fly away also, but seemed to know that what was done was only to protect and defend them." The different habit of the bird in a state of involuntary confinement is shown in the following account. "A nuthatch, which had been accidentally winged by a sportsman, was kept in a small cage of plain oak-wood and wire. During a night and a day that his confinement lasted, his tapping labour was incessant; and after occupying his prison for that short space, he left the wood-work pierced and worn like worm-eaten timber. His impatience at his situation was excessive; his efforts to escape were unremitted, and displayed much intelligence and cunning. He was fierce, fearlessly familiar, and voracious of the food placed before him. At the close of the second day he sunk under the combined effects of his vexation, assiduity, and voracity. His hammering was peculiarly laborious, for he did not peck as other birds do, but grasping hold with his immense feet, he turned upon them as a pivot, and struck with the whole weight of his body, thus assuming the appearance, with his entire form, of the head of a hammer, or, as birds may be seen sometimes to do on mechanical clocks, made to strike the hour by swinging on a wheel."

The common nuthatch is the only one which is found in Europe, or any of the immediately adjacent parts of the world; but there are some others in America and in the eastern Asiatic islands. These are all like the common species of tree birds, and remarkable for their expertness in climbing; and their manners do not appear to differ greatly from those of European nuthatch.

The Carolina Nuthatch (*S. melanocephala*) is not an uncommon species in North America, though some have regarded it as only a variety of the European one. It differs, however, in many respects, and some very zealous and talented students of animals, Mr. E. Blyth among the rest, are of opinion that, how much soever European and American animals may resemble each other, they are still specifically different. We do not take upon us to decide this; but we shall quote Wilson's account of the differences between the two, and also his finely characteristic account of the manners of the birds. "The head and

back of the European species," says Wilson, "are of a uniform bluish grey; the upper parts of the head, neck, and shoulders of ours are a deep black glossed with green; the breast and belly of the former are a dull orange, with streaks of chestnut; those parts in the latter are pure white. The European has a line of black passing through the eye, half way down the neck; the present species has nothing of the kind, but appears with the inner webs of the three shortest secondaries and primaries of a jet black; the latter tipped with white, and the vent and lower parts of the thighs of a rust colour. The European, therefore, and the present are evidently two distinct and different species. The bird builds its nest early in April, in the hole of a tree, in the hollow rail in a fence, and sometimes in the wooden cornices under the eaves, and lays five eggs of a dull white, spotted with brown at the greater end. The male is extremely attentive to the female while sitting, supplying her regularly with sustenance, stopping frequently at the mouth of the hole, calling and offering her what he has brought in the most endearing manner. Sometimes he seems to stop merely to inquire how she is, and to lighten the tedious moments with his soothing chatter. He seldom rambles far from the spot; and when danger appears, regardless of his own safety, he flies instantly to alarm her. When both are feeding on the trunk of the same tree, or of adjoining ones, he is perpetually calling on her; and, from the momentary pause he makes, it is plain that he feels pleased to hear her reply.

"The white-breasted nuthatch is common almost every where in the woods of North America, and may be known at a distance by the notes *quank, quank*, frequently repeated, as he moves upward and down in spiral circles around the body and larger branches of the trees, probing behind the thin scaly bark of the white oak, and shelling off considerable pieces of it, in his search after spiders, ants, insects, and their larvæ. He rests and roosts with his head downwards, and appears to possess a degree of curiosity not common in many birds, frequently descending very silently within a few feet of the root of the tree where you happen to stand, stooping, head downwards, stretching out his neck in a horizontal position, as if to reconnoitre your appearance; and, after several minutes' silent observation, wheeling round, he again mounts with fresh activity, piping his unisons as before. Strongly attached to his native forests, he seldom forsakes them; and, amidst the rigours of the severest winter weather, his note is still heard in the bleak leafless woods, and among the howling branches. Sometimes the rain, freezing as it falls, encloses every twig, and even the trunk of the tree, in a hard transparent coat or shell of ice. On these occasions I have heard his anxiety and dissatisfaction at being with difficulty able to make his way along the smooth surface; at these times generally abandoning the trees, gleaning about the stables, around the house, mixing among the fowls, entering the barn, and examining the beams and rafters, and every place where he may pick up a subsistence."

Red-bellied Black-capped Nuthatch (*S. varia*). This is a smaller species than the preceding. It measures only four and a half inches in length in the body, and the stretch of the wings is about eight inches. It corresponds exactly with the last in the form of the bill, nostrils, and tongue, and also in the colour of the back and tail feathers. The secondaries, however, are not varied with so deep a black as the other species. The legs, feet, and claws, are of a dingy greenish yellow; the head is black on the upper part; a stripe of white encircles the frontlet; a streak of black passes through the eye, reaching to the shoulder; under this streak there is a line of white, and the chin is also of this latter colour. The wings and primaries are of dusky lead colour, and the other under parts are light russet. The top of the head of the female is not of so deep a black as the male, nor is the belly and breast of so intense a brown.

These birds are migratory. They breed in the northern states, whence they pass to the southern ones in October, and return in April. This and the last mentioned species are readily distinguished both by the smallness of its size and the superior swiftness of its motions. There is also a decided difference in the voices of the two species. The notes of the present one are much sharper and quicker, and nearly an octave higher; but there is not much difference in the music they produce, which is altogether a monotonous and untuneful stave. From the close resemblance they bear in point of colours and general habits, it is not unlikely that in their mode of constructing their nests, and in other parts of their economy, they may also make a similar approach to each other. Both these little birds are extremely useful, on account of their destroying vast quantities of those destructive insects and their larvæ which are so destructive to our fruit and forest trees. Their principal haunts are those forests where pines are most abundant, especially in the winter season, as the seeds of the pine seems to be their favourite food.

It is highly probable that this migratory species has been called by different names in different parts of America, and different states of its plumage, though we still want correct information respecting the birds of those parts of the United States to which the keen-eyed observation of Wilson did not extend. According to him, and within the limits of his observation, the pine forests are almost the exclusive haunts of the red-bellied and black capped nuthatches; and many thousand acres of the deciduous forests may be traversed in winter without finding them, though they are abundant on the pine barrens as they are styled in that part of the country. It is indeed a point worth attending to in the natural history of pine forests, that the birds which take up their habitation almost exclusively there, are nearly as permanent all the year round in the locality as the greenness of the leaves. We find it so in the peculiar birds of the pine forests of Europe, however small they may be, and apparently ill able to endure the severe winters of the north; for the little crested wrens remain secure in the cover of the pines, when much larger birds, which summer on the open grounds in the same regions, are driven southward in flocks. In those pine forests, the red-bellied nuthatches are most frequently found in pairs, and not in flocks or packs of their own species, though they associate readily with tits, small-spotted woodpeckers, and other birds which prefer similar localities, and are capable of similar activity. "The whole tribe" (meaning the black-capped tit, the crested tit, the little spotted woodpecker, and these nuthatches), says Wilson, "proceed regularly from tree to tree through the woods like a corps of pioneers; while, in a calm day, the rattling of their bills, and the rapid motions of their bodies, thrown, like as many tumblers and rope-

dancers into numberless positions, together with the peculiar chattering of each, are altogether very amusing; conveying the idea of hungry diligence, bustle, and activity."

The Brown-headed Nuthatch (*S. pusilla*) is another American species, resembling the last-mentioned one in its manners, but differing in its locality, its colours, and being a little smaller. It is about four inches and a quarter long, and not eight inches in the stretch of the wings. The upper part of the head and neck are light rusty-brown, except a white spot near the setting on of the neck. The brown is mottled with darker spots of the same, and there is a dusky streak across the nostril to the eye. The chin and sides of the neck under the eyes are white; the wings are dusky, with some of the secondary quills and coverts slate-colour, which last is the colour of the upper part of the two middle feathers of the tail, and of the tips of the other tail feathers; but there is a white bar across all the tail feathers near their tips, and within this bar all across the two middle ones are black. The legs and feet are dull blue; the bill is black, but blue toward the base of the lower mandible, and the irides are hazel. The female has the head darker brown, and the dark streak across the eye less conspicuous. The voice of this bird is also more shrill than that of the red-bellied one, and it is more social, being found in small flocks during the winter. It is an exceedingly active and vigilant little bird, moving in all directions, and upon the most slender twigs of the trees with great activity, so that there are very few of the smaller birds of North America, of which it is more difficult to obtain specimens. It is not understood to reach Canada, or the northern, or indeed the central states of the American Union.

Nuthatches are also mentioned as occurring in Jamaica and some others of the American islands, and parts of continental America farther to the south; but the accounts of these are by no means precise, and it is possible that they may be the same as some of the North American species. There are specific differences between all of these and the nuthatch of Europe; but as the habits and habitations are so nearly the same, it is probable that they may be subject to the same changes of colour as we have noticed in the European one; and, therefore, a new species must not be hastily founded on a single specimen. From the general habits of the birds, however, which are not migratory at all in some of the species, and but very slightly so in others, it is scarcely to be supposed that they could pass even as stragglers from the United States to the West India islands. We are, however, very much in want of correct information relative to the geographical arrangement of the forest birds of America, which are certainly more different from each other in different latitudes, than the birds of the eastern continent. The division between North and South America, in a natural point of view, is also greater than in the eastern continent; and as those tenants of the pine forests do not inhabit at very great elevations in their native localities, we are not to suppose that they would gain those heights in Mexico, on which alone pines are to be met with in that country; while, as they avoid the forests of deciduous trees in the north, it is not likely that they would follow the line of the coast of the Caribbean Sea.

Violaceous Nuthatch (*S. frontalis*).—This is a more beautifully coloured bird than the European or any of the American species. The upper parts, including the head and nape, are rich azure; the sides of the neck and cheeks purplish-blue, and a distinct black band across the forehead (from which the specific name is given), and a smaller one of the same colour along each eye. The quill and tail feathers are blue, clouded with ash-colour; the chin white; the rest of the under part pale ash, clouded with purple; the naked parts of the feet brown; and the bill yellow in the greater part of its length, but black at the tip. This species measures about five inches in length; it is found in the forests of Sumatra, Java, and various other of the eastern islands. Its manners are little known; but it is highly probable that they differ considerably from those of the species which inhabit the pine forests of the north; nor is it at all unlikely, that if it were possible to examine those forests with the attention which its importance deserves, other species of these as well as tree birds of different genera would be found in them.

Some specimens of this genus have been brought from New Holland, which are still different from any of those hitherto described. One in particular has the colours of the last-named one reversed, being ash-coloured above and bright blue on the under part, and having the wings margined with golden yellow. Specimens have also been brought from Southern Africa, still different from these; but we have no account of their manners in that part of the world; and specimens imported from the Cape are not always natives of that country.

NUTMEG is the fruit, or rather the seed, of the *Myristica officinalis* of Linnæus, a well-known and valuable spice.

NUTTALLIA (Dickson). A genus of carrot-rooted herbs, natives of North America, belonging to the natural order *Malvaceæ*. They are cultivated in light rich soil, and, being almost hardy, succeed in our flower gardens with a slight defence against heavy rains and frost. They sometimes ripen seeds by which they may be increased.

NUT TREE is the *Corylus avellana* of Linnæus, a well-known British hedge plant, of which there are several varieties, as the filbert, cob-nut, &c.

NUT WEEVIL. The larva of this insect is the grub which is found in nuts. See Balaninus.

NYCTAGINEÆ. A natural order of plants comprising seven genera and forty-seven species. *Mirabilis*, the marvel of Peru, with *Abronia*, and the other associated genera, are herbaceous, shrubby, or arborescent plants, with occasionally tuberous under-ground stems and knotted stalks. Their leaves are exstipulate, opposite, rarely alternate, and almost always unequal. The inflorescence is axillary or terminal, the flowers solitary or aggregate, and surrounded by a calyx-like involucrum of one or more leaves, one or more flowered, and persistent. The perianth is single, corollaceous, monophyllous, and tubular; the tube contracted above the germen, and persistent; the limb plaited in æstivation, twisted to the left, and deciduous; the stamens are free, and exserted from an annular disk; the filaments are attached to the tube of the perianth; the anthers are two-celled and burst lengthways; the germen is superior and free; the style is single and terminal; and the stigma capitate. The fruit is a thin membranaceous utricle, one seeded, and included within the indurated tube of the perianth.

The roots of the *Nyctagines* contain a purgative principle, which renders them useful as cathartics; one of them was formerly thought to afford the jalap of medicine, and was hence named *Mirabilis jalapa*, and, although not the true jalap, its roots are not unfrequently powdered and mixed with the genuine drug.

The *Abronias* are extremely delicate and beautiful plants, but of no known use. The *Pisonias* are remarkable for being shrubs and trees in a large group of herbaceous genera. *Pisonia aculeata*, which is a scrambling tree devoid of beauty, with reclining thorny branches, is very troublesome to travellers in the savannahs of the West Indian isles, by arresting those who endeavour to pass, its strong incurved spines fastening themselves to the clothes and almost forbidding transit. The order contains the following genera, viz., *Oxybaphus*, *Mirabilis*, *Abronia*, *Allionia*, *Boerhaavia*, *Pisonia*, and *Boldoa*, all noticed under their generic titles.

NYCTERESITION (Ruiz and Pavon). A South American fruit tree, having pentandrious flowers, and belonging to the natural order *Sapoteæ*. This tree was called *Chrysophyllum splendens* by Sprengel.

NYCTERIBIA (Latreille). A small but extraordinary genus of wingless insects, very nearly allied to the *Hippoboscidæ*, or forest flies, and exclusively parasitic upon bats. The head is dorsal, very small, and generally bent backwards, and received in a channel which extends nearly to the base of the abdomen; the legs are very long; the basal joint of the tarsi as long as the tibiæ; the base of the middle legs is furnished with a curious comb-like appendage, which is the analogue of the anterior wings; the head is furnished with signs of variable form, two antennæ, and a proboscis. The type of this genus is the *Pediculus vespertilionis*, Linnæus. The motions of these insects are exceedingly quick; and, from the curious position of the head and the direction of the legs, which appear to be dorsal rather than ventral appendages, the movements are very curious. "It transports itself," says Mr. Montagu, "with such celerity from one part of the animal it inhabits to the opposite and most distant, although obstructed by the extreme thickness of the fur, that it is not readily taken. When two or three were put into a small phial, their agility appeared inconceivably great, for as their feet are incapable of fixing upon so smooth a body, their whole exertion was employed in laying hold of each other; and, in this most curious struggle, they appeared actually flying in circles; and when the bottle was reclined, they would frequently pass from one end to the other with astonishing velocity, accompanied by the same gyrations; if, by accident, they escaped each other, they very soon became motionless, and as quickly were the whole put in motion again by the least touch of the bottle, or the movement of an individual."—Linn. Trans., vol. xi., p. 13. There are two British species, whereof figures have been given by Leach and Curtis. A memoir, containing a complete account of the anatomy of these insects, with numerous illustrations, has been published in the first volume of the Transactions of the Zoological Society of London, in which several new exotic species have been described, and the transformations of this genus proved to be similar to those of *Hippobosca*, thus confirming the affinity between those groups.

NYCTERIUM (Ventenat). A genus of South American shrubs, belonging to the fifth class of sexual botany, and to the natural order *Solaneæ*. Generic character: calyx in from five to ten parts; corolla somewhat rotate and plaited; anthers connivent, opening by a pore at the apex; berry from two to four celled. This genus has borne several names, and is generally known as a *Solanum*. One of the species, *N. amazonium*, bears very showy flowers, and is a favourite stove plant. They are propagated by cuttings.

NYCTICHELIDON—Night-swallow. A numerous genus, or rather group, of fissirostral birds, forming, along with the day-swallows, the whole of that family of the order *Passeres*. In respect of names, these birds have been very unfortunate from the earliest periods of natural history, and they remain so at the present day. The typical bird, which was for a long time the only one known, is very much in the habit of resorting to cool places, where cattle stand when annoyed by flies; and it stood accused, as early as the days of Aristotle, of sucking goats, although its bill is quite unfit for any kind of suction; and, instead of doing any harm to ruminating animals when thus attending them, it does them a good deal of service by ridding them of the flies which annoy them. Still the bird got the name of "goatsucker," which name has passed through many languages, has remained to the present time, and has been applied to a great many species which have been discovered in foreign countries. To change the name of a number of birds, of which there are good descriptions under that name, is always inconvenient, as tending to destroy the general usefulness of first-hand information. The French have accordingly adopted one of their popular names for it, and called it *Engoulivent*, which means "swallower of the wind." This is not more correct than the former, though, as the bird flies open-mouthed when feeding, and as its gape is very wide, a large current of air sets into its mouth, and comes out again at the sides, where it makes a peculiar booming or whirring sound, something like that of the old-fashioned wheels used in the hand-spinning of wool. It has got some of its common English names from this sound, such as the "wheel bird," the "churn owl," the "jar owl," and latterly "night-jar," all of which are unfit for scientific purposes, and inapplicable to the greater number of the genus. It has also been called the "dor-hawk," partly perhaps from the sound which it emits having some resemblance to that emitted by the dor-beetle, and partly also from the number of those beetles which it captures. It has also been called the "fern owl," from its proneness to hawk about fern brakes in quest of its prey; and, among other names, the French have called it the "flying toad."

This multiplicity of names is a matter of small consequence in itself; but it serves to show the interest which the bird has attracted; and it must be admitted that this, the typical bird, is not only a very curious creature, but the family or subfamily of which it is the type is one of the most curious in the list of birds. The members of it differ greatly from each other in numerous respects, and these differences are often in points so essential that a subdivision into at least two genera has become necessary, in order that the generic characters might be more easily expressed and more clear. There is still, however, too much resemblance between the members of these two genera for admitting the perfect separation of the

description of their more general characters, and their place in nature; and hence it becomes necessary to make use of some distinct name at the head of this general description. That which we have taken is not wholly unobjectionable; but as we intend not to apply it either to the genera or the species, but to leave them under their old names, it may be used without any danger of misleading, and we have no desire to load the vocabulary with any new name, though it is still necessary to make a few general remarks on so curious a group of birds.

The genera which compose the group are *Caprimulgus*, or the goat-sucker properly so called, and *Podargus*, which has escaped the infliction of any peculiarly inappropriate name, but of which the scientific term which we have given, by a slight alteration of the last part, indicates that the feet are more clear, or fit for walking, than those of the former genus.

This being understood, we may mention that the swallows which feed by daylight, of which an account will be found in the article HIRUNDO, together with the present group, make up a family, which are so distinct in their habits that they ought perhaps to stand as a distinct order, under some such a name as *Chelonidæ*, and they are so arranged by some ornithologists. They take up the natural system where the birds of prey leave it off, far more naturally than it is taken up by those birds which are usually ranged nearest the birds of prey in the systems. Like them, too, they admit of division into two sections—diurnal feeders, or the swallows, and nocturnal feeders, or the group now under consideration, and the present group stand in almost precisely the same relation to the owls as the swallows do to the hawks and other diurnal birds of prey. The more powerful predatory birds, both diurnal and nocturnal, subsist chiefly on warm-blooded animals; but the last and feeblest species of both subsist, in part at least, upon insects; and the two sections of the *Chelonidæ* take up the insectivorous feeding where the others leave it off, the day ones feeding almost exclusively on the wing, but the night ones, as is understood, in part at least upon the ground, where they nestle among the herbage, and do not resort to elevated nesting places like the swallows. The difference between the day preyers and the night ones, and the agreement of each in the two orders, extend even to the plumage, and to the apparent strength and powers of endurance of the birds. The feathering of the swallows is firm and compact, like the feathering of hawks, while the birds of the present section have light bodies in proportion to their apparent size, and soft loose plumage like the owls. The lengths of their flights also correspond; for, while the best-winged hawks do not surpass the high feeding swallows in rapidity or continuance of flight, the flight of the present section, so far as is known, is short, like that of the owls. There is therefore a distinct office in nature for all the chelonian birds, and there is a distinct time and manner for the labours of each division of them. They have not been sufficiently studied for enabling us to bring the details into a very systematic form, as interwoven with this general notice; and so must take the rest that we have to say in the order of the two genera.

CAPRIMULGUS. The most striking characters of this genus are: a plumage of light texture, mottled and clouded with grey and brown, as is the case with most nocturnal birds. Their eyes are large, their bills are more deeply cleft than those of the swallows, and they are furnished at the margins with stiff moustaches, while the birds can retain in the mouth, by means of their glutinous saliva, the largest insects which are on the wing at the time of their feeding. Their nostrils are at the base of the bill, drawn out in the form of little tubes. Their wings are very long, but their feet are short, have the tarsi feathered, the toes joined by short membranes at the bases; and the hind toe partially united to the inner front one, and inclined a little forwards. The claw on the middle toe is often teethed like a sort of comb on its inner edge, and the outer front toe has only four phalanges.

They are birds, generally speaking, of retiring habits, rarely appearing during the day, and never in flocks. Their feeding time is in the twilight of still evenings, and their food is chiefly those moths, beetles, and other insects which are then on the wing. It is probable, however, that in still gloomy weather, they beat the bushes near the ground during the day; and also that those which frequent the deep and twilight forests of tropical countries, find sufficient twilight in the shade of these for enabling them to seek their food, while most living creatures are driven to repose by the heat of a vertical sun, which, as it throws the shadow of the forest upon the ground immediately under it, makes the under sides of all the leaves and branches dark.

Those with which we are sufficiently acquainted to judge of their habits are not nocturnal but twilight; and, indeed, the number of birds that are actually nocturnal is, in all probability, very few. Their long wings enable those birds to fly very lightly, so that being incessantly on the wing during their short feeding time does not greatly fatigue them. So far as is known too, they do not give themselves much trouble in preparing accommodation for their young, for their nests hardly deserve the name. The young also are few in a hatch; and thus the finding of food for them is the less laborious. Still it is probable that the few which they have require more food in proportion to their numbers than the young of day birds, upon the well-known principle that the production of feathers is more expensive in this way than the production of bones and flesh. We do not know directly the quantity of food which any of the caprimulgi may carry to their young; but as the analogy between them and the owls is very palpable in many other respects, we may naturally conclude that it must hold in the feeding also; and we do know, from direct observation, that young owls consume an immense quantity of food, far more than any one would imagine, judging only from the trifling volume of their bodies.

Altogether the caprimulgi are most singular creatures; and though there is but one of them which can be observed in a state of nature in Britain, and that one is somewhat local, and no where very numerous, yet their history is far from being the least inviting portion of ornithology. We shall now notice the leading species; but with the exception of the one which is native in Britain, we shall be able to give little else than a mere catalogue.

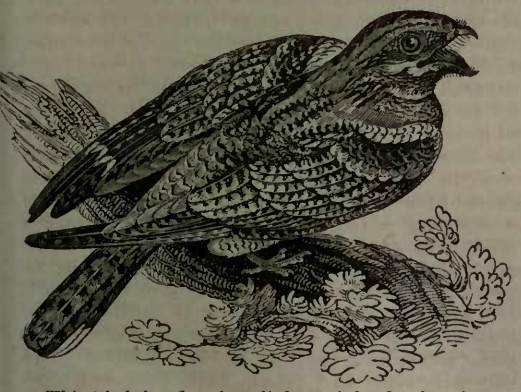
EUROPEAN GOATSUCKER (*C. Europæus*). Being the only species, not of this genus merely, but of the whole family of night birds which prey upon insects on the wing, and being besides a remarkable bird both in its appearance and its manners, this bird has always excited a good deal of interest both among

the country people and the lovers of natural history. This has got it a great number of names, none of them very appropriate, and yet all of them much more accurate than goatsucker, which has been adopted by writers, because each of them applies to at least one character or habit of the bird, whereas this applies to no part of its character. It is called "dor-hawk," which is correct in so far as dor is concerned, because the dor-beetle, which flies and drones in the twilight, is a very favourite prey with it; but then it can with no propriety be called a hawk. It is also called the fern-owl, which is right again in as far as the fern is concerned; for the undersides of fronds of ferns are favourite haunts for the beetles and larger moths, upon which also this bird lays heavy contributions; but the bird is certainly not an owl either in appearance or habits. None of the owls, at least none of them which are found in any part of the British islands, prey on the wing; and this bird rarely, if ever, preys in any other manner. Its other provincial names are mostly given to it from the sounds which it utters. Those of course depend much upon the fancy of the parties imposing the names; and all such nomenclature puts one forcibly in mind of the proverb,

As the fool thinks, so the bell clinks.

This is especially the case with the local names given to some of the American birds which utter wild notes, or sounds rather, in the deep forests of that country.

The following figure will give some idea of the form, and also of the markings, of the plumage of this curious bird. The tints of the latter are rather subdued, but the mottlings are exceedingly rich and beautiful.



This bird is of rather light weight for its size, as no small portion of its apparent bulk consists of feathers. Its length is at least ten inches, and the stretch of the wings, which are light and gracefully made, is from sixteen to eighteen. The tail is rather long, rounded, and consists of three feathers. The legs are slender, with the three front toes united as far as the first joint, and the claw on the middle one toothed like a comb. The hind toe is capable of being brought forwards, so as to act in the same direction with the other three. This is not decidedly a perching foot, that is, a foot which can hold on by a twig, while the bird uses his bill in seeking food, or for any other purpose, in a tree. It is simply a resting foot, by means of which the bird is enabled to repose upon twigs and branches until the twilight, and the appearance of its food upon the wing, calls it into activity. This food consists chiefly of beetles which are on or in the ground during the heat of the day. The goatsucker does not, however, search for them there; for its feet are short, feeble, and but ill adapted for walking. They hold on, however, with considerable firmness while the bird reposes; and in order to protect the muscles which move them from the chilling influence of the twilight air, they are feathered down below the tarsal joints. The use of the pectinated or comb-like claw upon the middle toe has occasioned puzzling and doubting among those writers in natural history who deem it incumbent on them to mention a use for every organ, and form of organ, whether they happen to understand what is the real use of it or not. Some say that it is for the purpose of cleaning the *vibrissæ*, or stiff bristly hairs, with which the margins of the mandibles, especially the upper one, are armed. Others say that it is a real comb, used for clearing the feathers of the bird of those *nirmidæ*, or parasitical insects, with which it is infested. Others again think that this singular form of claw may be useful to the animal in the securing of its prey.

It does not appear that there is very much, or, at least, very obvious truth in any of these. From the remains which are found in its stomach, it does not appear that this bird gives its food any preparation, but that it simply catches and swallows it, just as the day swallows do; and there is perhaps no bird which has a mouth better adapted for the receiving of prey in an entire state. The edges of the mandibles are quite incapable of cutting any thing, because the tips are the only parts that can come together. Besides, bristles or stiff hairs placed near the mouth of any animal, whether bird or any other, are less easily soiled than any other part of its covering. We must therefore pause before we admit this explanation. Then, as to the combing of the feathers, the case is not much better. Feathers are, from their structure, ungainly subjects to which to apply a comb. This comb could not be applied under the wings, which is the favourite place for the *Nirmidæ;* and most birds are in the habit of scratching with their claws such parts of their bodies as they can reach, the head chiefly, whether the claws happen to be toothed or not. Any instrument applied to the foot of a bird, commands so small an extent of the surface of its body, however, that it is not quite consistent with the system of nature to suppose that it should have a special instrument so applied. This hypothesis is also untenable; therefore, with regard to the use made of the pectinated claw in securing the food, we have no direct evidence; because, from the bird preying on the wing, and in the twilight, it is difficult, if not impossible, to see how its prey is caught. But still the probability is against the use of the foot for any such purpose. Instead of being a clutching foot, the foot of the goatsucker is as much the opposite as can well be imagined. In clutching feet the toes are free to their bases, so that the lateral ones may spread outwards; and if any of them is capable of being reversed, it is always the outer one backwards, so that they may act two against two in clutching. But the reversing of the toe in the goatsucker is, as we have said, toward the front, and, therefore, in such a way as to diminish its clutching power. It may be possible, however, that the bird, when it seizes a moth, the expanse of whose wings is too wide for its gape, may use the claw in removing these, either while it holds the moth by the sharp and hooked points of the mandibles, or by holding it against a twig with the one foot, and trimming it with the other. The con-

jectures of Gilbert White, upon such subjects of natural history as came under his own observation, always point to the direction of the truth, unless where deference to the allegations of earlier naturalists cross him, and then he suffers himself to be led astray. His opinion, as will be seen, rather leans to the supposition that the prey is actually taken with the foot, and conveyed to the mouth by that instrument. "On the twelfth of July," says White, "I had a fair opportunity of contemplating the motions of the *Caprimulgus*, or fern-owl, as it was playing round a large oak that swarmed with *Scarabæi*, or fern-chafers. The powers of its wing were wonderful, exceeding, if possible, the various evolutions and quick turns of the swallow genus. But the circumstance that pleased me most was, that I saw it distinctly more than once put out its short leg when on the wing, and, by a bend of the head, deliver somewhat into its mouth. If it takes any part of its food with its foot, as I have now the greatest reason to suppose it does these chafers, I no longer wonder at the use of its middle toe, which is curiously furnished with a serrated claw." As to the fact of the bird repeatedly bringing the foot to the mouth while hawking about for its prey, there can be no doubt, for White is never wrong in a matter of fact of his own observation; but we have already shown that the structure of the foot is against this opinion in the part which he could not observe, namely, in the particular office which the foot performed. Thus we must still regard the use of the pectinated claw as a subject open to future inquiries.

The mouth of the goat-sucker, including the bill, is very curious. Its gape is wider than that of any other bird of these islands. The hard parts of the mandibles occupy only a small portion of the gape; the *vibrissæ*, which are along the remaining part of it, have small muscles attached to their bulbous roots, by the action of which they can be extended outwards, or contracted inwards. Altogether the bill is weak, and, like the bills of the day-swallows, incapable of acting as an offensive weapon against any other bird, however small. The nostrils are contained in tubes, bearing some slight resemblance to those of some of the sea-birds; but what purpose this particular structure of nostril answers in the bird, it is not very easy to say. It is possible that they contribute to a keener sense of smell, which seems to be necessary, because, from the particular manner in which the head is carried when the bird is flying in quest of its prey, it cannot, notwithstanding the largeness of its eyes, see before it. It has indeed been alleged that it turns its eyes so as to look through the integuments of the mouth when flying; but this is too ridiculous to require any serious refutation. Its hearing is no doubt keen, and may serve it in great stead on its nightly excursions. The beetles on which it preys are all noisy in their flight, because the weight of the body, and of the wing-covers or elytra together, require an exceedingly rapid motion of the wings, in order to prevent these animals from falling by their own weight. The large beetles especially, upon which the goat-sucker feeds so much, have great difficulty in taking the wing; and when a tree is thick with chafers, if one shake it, they tumble down like a hail-shower, without being able to get into flight; whereas, if the same were done with naked-winged insects, not one of them would drop. Both beetles and moths have a peculiar scent, and this scent is of course stronger at night, or in the shadow, than it is in the heat of the sun, because the latter disperses it through the air. The scent may therefore enable this bird to direct the points of its mandibles correctly upon its prey, after the presence of that prey has been made known to it by the ear. But, from the largeness of its eyes, it must also use these to a very considerable extent in making its captures; and as the flight of its prey, whether beetles or moths, is not nearly so rapid as that of the prey of the day-swallows, and it is very dexterous in turning on the wing, there is no doubt that it can wheel round upon the lateral *vane* and so ultimately reach, by the scent, an insect which makes no sound.

We have hinted that the plumage is beautifully mottled. The colours are numerous, consisting of black, brown, rust-colour, ash-colour, and white, with a large white spot on the inner web of the three first quills, in the male bird only. The mottlings in the upper part are well made out in the figure which we have given; and the under part is rusty brown, with waving cross bars of darker colour, and this continues to the extremity of the feathered parts of the legs.

What may be the meaning of the booming or whirring noise which this bird makes when it flies, or whether it be a voluntary sound, or merely produced by the action of the air upon the wide gape and elastic *vibrissæ*, just as the humming of insects is produced by the action of their wings upon the air, we know not; though the goatsucker is not voiceless like these, but has besides various notes by which to express its affections the same as other birds.

This is not a very common bird in any part of the country, but it is much more widely distributed than several others of our summer visitants. It seldom arrives in this country before May, and it continues till about September. The lightness of its wings, the peculiar character of its plumage, and its lightness for its size, must render migration a very easy task to it; and it accordingly extends over great part of the country, being found a considerable way northward in Scotland, where very few of the warblers extend their annual excursions. Though it feeds on the wing, it nestles on the ground, and it spends little of its time in the construction of an artificial nest. Its eggs are deposited under some sort of cover, grass, bushes, or the roots of shrubberies, as it may find most conveniently situated for its feeding-ground. The eggs are only two in number, of a white colour in the ground, and very finely marbled with ash-colour and brown. The ground is also very often its resting-place during those times when it is not preying upon the wing. When thus resting it crouches very close to the surface; and, as its colours are not easily distinguished from those of dry clods, or withered herbage, it in general escapes observation. It does not, however, always take its rest upon the ground, but frequently on a branch of a tree. It chooses a large and horizontal one in preference to a small one which grows erect; and as, when in this situation, it remains motionless, one may pass again and again without observing it.

From the time at which this bird makes its appearance in Britain, and the other temperate parts of Europe, and that at which it retires, we may infer that its special office in nature is to thin the numbers of the larger beetles. In this it has a sort of rival in the kestrel, which, though a hawk, handsome in its

form, and active in its manners, preys a good deal upon beetles in the twilight. According to Selby, the kestrel darts rapidly into the midst of the cock-chafers, where they fly in numbers, and, clutching right and left, seizes them with its talons, and conveys them to its mouth without pausing in its flight. We have already remarked, that the feet of the goat-sucker are not well adapted for this purpose, but it has ample compensation in the wideness of its gape and the peculiar construction of its mouth.

In Britain it frequents places which are remote from human dwellings, and generally near the margins of woods or copses; but it is not found in the bleak and elevated districts, where indeed the beetles upon which it feeds are but few, and the large moths still fewer. Generally speaking, it is but thinly scattered over those parts of the country to which it does resort. A single pair appear to be all that usually frequent the same locality, and even these are but rarely seen in company upon the wing. A certain writer on subjects of this kind, who at one time appeared to take particular delight in "pulling plasters off the sores" of others similarly afflicted with himself, mentions having "seen in Scotland eight or ten on the wing together, in the dusk of the evening, skimming over the surface of the ground in all directions, like the swallow, in pursuit of insects, generally with its mouth fully extended." Now, as the bird is exceedingly rare in all parts of Scotland, we greatly doubt whether anybody ever observed more than one at a time in any part of that country; and eight or ten together are out of the question. Indeed, the writer seems to have been aware of this; for, in the sentence which we have quoted, he falls, unawares perhaps, into the singular number, and describes the "eight or ten" only as one. This puts one in mind of Falstaff's men in buckram, only the facetious knight made a climax of it, and this is an anti-climax; so that it more nearly resembles the account of the number of cats given by a young Scotch observer of nature:—"Mither, there are a thusand cats in the back-yard."—"It canna' be true, laddie; naebody ever saw sae monie cats a' thegither; and there are no half sae monie in a' the parish."—"Weel, mither, I think there wur' five hunder."—"It canna' be true, laddie."—"Then, mither, I am positive there was our ain cat an' anither ane." We mention this with no invidious intention, and with every disposition to give the most implicit credit to the sentence which called it forth; but really, the known habits of the birds, corroborated as they are by the singular number, repeated in allusion to the swallow, and also to the bird itself, some might be disposed to carry their scepticism a little farther, and doubt whether any goatsucker had been seen at all, and thus take up the concluding admission in the story of a great assemblage of foxes (*Scotticè* tods), in which the narrator sheltered himself between the horns of the following dilemma—"either a tod or a fern bush." The fact is, that twilight birds are all solitary in their hunting, and so are twilight preying mammalia, with the exception of jackals, and a few others, which give tongue when they are on the chase. Owls, for example, though several pairs may have their nests near each other, are never known to prey in concert; and, with this exception, we at least never heard of any sociality among goatsuckers for the capture either of beetles or moths.

It must be admitted that, besides its singular appearance and curious manners, this is a truly interesting bird; because it is the only one of the genus, or possessing the habit, which is found throughout all of Europe; and it ranges over the greater part of that extent, but only during the summer months. It appears, from all the accounts, to be exceedingly diligent while it is with us; and the very fact of its depositing its eggs on the bare ground, and producing only two at a hatch, and apparently having but one hatch in the year, proves that it requires much of its time for the performance of that office for which it is appointed, in regulating the numbers of those beetles and moths which are understood to be among the most destructive to vegetation, and which appear in the winged state, and fly about in the evenings, only during the warmest season of the year. In America, both North and South, birds of this genus are far more numerous. There are a good many species of them, some migrating into the temperate latitudes during the summer, and others appearing to remain in the tropical forests all the year round. Some of these American species are remarkable for the loudness and peculiarity of their voices. They thus command more attention than many other American birds. Wilson has described the North American ones in his happiest manner, and therefore we shall borrow a few extracts from his delightful pages.

C. vociferus (Whip-poor-Will) is perhaps the most interesting of all the species which appear in North America. Some naturalists have confounded it with two other species, the Carolina and the American, from both of which it is distinct in appearance and in voice. The following is Wilson's description of it:—"Whip-poor-Will is nine inches and a half long, and nineteen inches in extent; the bill is blackish, a full quarter of an inch long, much stronger than that of the night-hawk, and bent a little at the point, the under mandible arched a little upward, following the curvature of the upper; the nostrils are prominent and tubular, their openings directed forward; the mouth is extravagantly large, of a pale flesh colour within, and beset along the sides with a number of long thick elastic bristles, the longest of which extends more than half an inch beyond the point of the bill, end in fine hair, and curve inwards; these seem to serve as feelers, and prevent the escape of winged insects; the eyes are very large, full, and bluish black; the plumage above is so variegated with black, pale cream, brown, and rust colour, sprinkled and powdered in such minute streaks and spots, as to defy description; the upper part of the head is of a light brownish grey, marked with a longitudinal streak of black, with others radiating from it; the back is darker, finely streaked with a less dense black; the scapulars are very light whitish ochre, beautifully variegated with two or three oblique streaks of very deep black; the tail is rounded, consisting of ten feathers, the exterior one an inch and a quarter shorter than the middle ones, the three outer feathers on each side are blackish brown for half their length, thence pure white to the tips, the exterior one is edged with deep brown nearly to the tip; the deep brown of these feathers is regularly studded with light brown spots; the four middle ones are without the white at the ends, but beautifully marked with herring-bone figures of black and light ochre finely powdered; cheeks and sides of

the head of a brown orange or burnt colour; the wings, when shut, reach scarcely to the middle of the tail, and are elegantly spotted with very light and dark brown, but are entirely without the large spot of white which distinguishes the night hawk; chin black, streaked with brown; a narrow semicircular line of white passes across the throat; breast and belly irregularly mottled, and streaked with black and yellow ochre; the legs and feet are of a light purplish flesh colour, seamed with white, the former feathered before nearly to the feet; the two exterior toes are joined to the middle one, as far as the joint, by a broad membrane; the inner edge of the middle claw is pectinated, and, from the circumstance of its being frequently found with small portions of down adhering to the teeth, is probably employed as a comb to rid the plumage of its head of vermin, this being the principal and almost only part so infested in all birds."

This singularly noisy species is migratory in the United States, where it is first heard about the middle or toward the end of April. Its notes are as familiar to the people there as those of the cuckoo are in Britain. They resemble as nearly as possible the words "whip-poor-will," the middle one short, and the first and last very loud. At first they are heard from the depths of woods in lonely places; but they soon approach near dwelling-houses, and make such a noise during morning and evening twilight, and all night long if the moon shines brightly, and its clamour is so loud, that strangers find difficulty in sleeping. The inhabitants, however, welcome it as the harbinger of good weather, much in the same way as we welcome the cuckoo. As the season advances, it gets very familiar, and perches close by the house, or even on the house-top. From its singular voice, and the twilight gloom in which that voice is uttered, the ignorant regard it as a harbinger of some calamity to the family upon whose dwelling it takes its post. We must not be surprised at this, either on the part of the native Indians or on the part of the more ignorant European settlers; for there are still many parts of our own country where a magpie, perching on the top of the house, throws the whole family into the greatest apprehensions. When two or more male birds are near to each other, which is often the case, they sing in rivalry, as most songsters do; and when they raise the pitch of their voices, they also hurry the time. Wilson thus describes their manners:—"They fly low, not more than a few feet from the surface, skimming about the house and before the door, alighting on the wood pile, or settling on the roof. Towards midnight they generally become silent, unless in clear moonlight, when they are heard with little intermission till morning. If there be a creek near, with high precipitous bushy banks, they are sure to be found in such situations. During the day they sit in the most retired, solitary, and deep shaded parts of the woods, generally on high ground, where they repose in silence. When disturbed they rise within a few feet, sail low and slowly through the woods for thirty or forty yards, and generally settle on a low branch or on the ground. Their sight appears deficient during the day, as, like owls, they seem then to want that vivacity for which they are distinguished in the morning and evening twilight. They are rarely shot at or molested; and, from being thus transiently seen in the obscurity of dusk, or in the deep umbrage of the woods, no wonder their particular markings of plumage should be so little known, or that they should be confounded with the night hawk, which in general appearance they so much resemble. The female begins to lay about the second week in May, selecting for the purpose the most unfrequented part of the wood, often where some brush, old logs, heaps of leaves, &c., had been lying, and always in a dry situation. The eggs are deposited on the ground, or on the leaves, not the slightest appearance of a nest being visible. They are usually two in number, in shape much resembling those of the night hawk, but having the ground colour much darker and more thickly marbled with dark olive."

Most European describers of birds have confounded this species with two others, from which it is distinct as well in its manners as in its haunts. Dry and elevated places are the chief resort of this one, whereas the others prefer grounds of a different character. The song of the male does not continue above a month or five weeks, for it ceases as soon as the young are hatched; though it begins again, but more feebly, and of shorter duration, in September, before the birds begin to move southwards. The young, while incapable of flight, conceal themselves by lying motionless among the clods or the withered leaves; and the following anecdote will show that, as is the case with most birds which leave their young on the ground, the female has recourse to a good deal of stratagem in order to entice supposed enemies away from them. "In traversing the woods one day, in the early part of June," says Wilson, "along the brow of a rocky declivity, a whip-poor-will rose from my feet, and fluttered along, sometimes prostrating herself, and beating the ground with her wings as if expiring. Aware of her purpose, I stood still and began to examine the space immediately around me for the eggs or young, one or other of which I was certain must be near. After a long search, to my mortification, I could find neither; and was just going to abandon the spot, when I perceived somewhat like a slight mouldiness among the leaves, and, on stooping down, discovered it to be a young whip-poor-will, seemingly asleep, as its eyelids were nearly closed, or perhaps this might only be to protect its tender eyes from the glare of day. I sat down by it on the leaves, and drew it as it then appeared. It was probably not a week old. All the while I was thus engaged, it neither moved its body nor opened its eyes more than half, and I left it as I found it. After I had walked about a quarter of a mile from the spot, recollecting that I had left a pencil behind, I returned and found my pencil, but the young bird was gone."

C. Carolinensis—Chuck-will's-Widow. This species is not very correctly named the Carolina goatsucker; for it extends into South America, though it never reaches the northern parts of the United States in its summer migrations. It appears rather earlier than the last-mentioned species; and though its note is different, and it is a much larger bird than whip-poor-will, they haunt nearly the same sort of places. This one, however, keeps more constantly to the woods than the former, and therefore is less frequently seen. The eggs are deposited on the ground. They are two in number, and of equal thickness at both ends, as is the case with the eggs of all this genus. They are about the size of pigeons' eggs, of a dull olive, mottled with darker markings. This is the one which, in colour at least, most resembles the European goat-

sucker; but still they are perfectly distinct species, as will be seen from the description. "This species is," says Wilson, "twelve inches long and twenty-six in extent; bill yellowish, tipt with black; the sides of the mouth are armed with numerous long bristles, strong, tapering, and furnished with finer hairs branching from each; cheeks and chin rust colour, speckled with black; over the eye extends a line of small whitish spots; head and neck very deep brown, powdered with cream, rust, and bright ferruginous colour, and marked with long ragged streaks of black; scapulars broadly spotted with deep black, bordered with cream, and interspersed with whitish; the plumage of that part of the neck which falls over the back is long, something like that of a cock, and streaked with yellowish-brown; wing quills barred with black and white rust; tail rounded, extending about an inch beyond the tips of the wings; it consists of ten feathers, the four middle ones are powdered with various tints of ferruginous, and elegantly marked with fine zig-zag lines, and large herring-bone figures of black; exterior edge of the three outer feathers barred like the wings; their interior varies for two-thirds of their length, are pure snowy white, marbled with black, and ferruginous at the base; this white spreads over the greater part of the three outer feathers near the tips; across the throat is a slight band or mark of whitish; breast black, powdered with rust; belly and vent lighter; legs feathered before nearly to the feet, which are of a dirty purplish flesh colour; inner side of the middle claw deeply pectinated. The female differs chiefly in wanting the pure white on the three exterior tail feathers, these being more of a brownish cast."

This bird arrives in the extreme south of the United States of America about the middle of March, and, like the former, it very speedily gives notice of its arrival by uttering its singular call, which bears a striking resemblance to the words that have been adopted as its name. The different parts of this singular cry are uttered with a distinctness approaching to articulation. But it is only during the night that they are heard, for, like the rest of the genus, it remains perfectly mute until sunset. If the night is moonless, its voice is suspended during the dark part; but in bright moonshine, it is incessant the whole night over.

C. Americanus (The Night-Hawk). The specific name, *Americanus*, is by no means very happily applied to this, or indeed to any other species of the genus, for this and the two preceding ones appear equally in the United States; and in the tropical parts of the American continent there are many more. Generally speaking, this species inhabits more marshy localities than the others, and it also flies higher, making in that respect an approach to the day swallows. Though called the night-hawk, it appears to be less nocturnal than some of the others, and often dashes over towns and cities, something in the manner of the swift, but with far more varied motion. They arrive in their northern localities toward the end of April, and the eggs are deposited in the middle of May. They are two in number, as in the other species, of a dull bluish-white colour, mottled with small spots of olive-brown. The eggs, though without any form of nest, are always deposited in a dry place, and near trees, upon the branches of which the male, and frequently also the female, repose during the day, sitting lengthwise upon the branch, so as not to be easily discovered. But though the pair are usually found in the same neighbourhood, they seldom if ever repose in the same tree.

The conduct of the male, while watching the female and the eggs, is so graphically described by Wilson, that we cannot resist quoting the passage. "As soon as incubation commences," says he, "the male keeps a most vigilant watch around. He is then more frequently seen playing about in the air over the place, even during the day, mounting by several quick vibrations of the wings, then a few slower, uttering all the while a sharp harsh squeak, till, having gained the highest point, he suddenly precipitates himself head foremost, and with great rapidity, down sixty or eighty feet, wheeling up again as suddenly; at which instant is heard a loud booming sound, very much resembling that produced by blowing strongly into the bung-hole of an empty hogshead, and which is doubtless produced by the sudden expansion of his capacious mouth, while he passes through the air. He again mounts by alternate quick and leisurely motions of the wings, playing about as he ascends, uttering his usual hoarse squeak, till, in a few minutes, he again dives with the same impetuosity and harsh sound as before. Some are of opinion that this is done to intimidate man or beast from approaching his nest; and he is particularly observed to repeat those divings most frequently around those who come near the spot, sweeping down past them, sometimes so near and so suddenly, as to startle and alarm them. The same individual is, however, often seen performing the same manœuvres over the river, the hill, the meadow, and the marsh, in the space of a quarter of an hour, and also towards the fall when he has no nest. This singular habit belongs peculiarly to the male. The female has, indeed, the same harsh note, and much the same mode of flight; but never precipitates herself in the same manner as the male. During the time she is sitting, she will suffer you to approach within a foot or two before she attempts to stir, and, when she does it, it is in such a fluttering trembling manner, and with such appearance of a lame and wounded bird, as nine times in ten to deceive the person, and induce him to pursue her. This 'pious fraud,' as the poet Thomson calls it, is kept up until the person is sufficiently removed from the nest, when she immediately mounts and disappears. When the young are first hatched, it is difficult to distinguish them from the surface of the ground, their down being of a pale brownish colour, and they are altogether destitute of the common shape of birds, sitting so fixed and so squat as to be easily mistaken for a slight prominent mouldiness lying on the ground. I cannot say whether they have two broods in the season; I rather conjecture that they have generally but one."

As we already said, this bird is not so decidedly nocturnal as some of the other species. In gloomy weather it wings its aërial flight the whole day long; but when the weather is clear, it does not come into activity till about an hour or two before sunset. Contrary to the habit of many of the others, however, it appears to prefer the sun to the shade, for in the clearest summer days it is occasionally out, and, when reposing upon a branch, they are fond of doing so in the heat of the sun. When wounded or captured, they put on a semblance of defence, by gaping to the full extent of their wide mouths, and emitting a sort of hiss. They also endeavour to strike with their wings; but they never offer to use either the bill or the claws.

As this species is also confounded with whip-poor-will, in many of the books, it is desirable to be in possession of Wilson's highly discriminating description of it. His accounts of the three North American species of goat-suckers are indeed peculiarly interesting, as placing in the clearest light the distinctions of three of the most remarkable birds of that part of the world. "The night-hawk," says he, "is nine inches and a half in length, and twenty-three inches in extent; the upper parts are of a very deep blackish brown, unmixed on the primaries, but thickly sprinkled on the back, scapulars, and head with innumerable minute spots and streaks of a pale colour, interspersed with specks of reddish; the scapulars are barred with the same, also the tail coverts and tail, the inner edges of which are barred with white and deep brownish black for an inch and a half from the tip, where they are crossed broadly with a band of white, the two middle ones excepted, which are plain deep brown, barred and sprinkled with light clay; a spot of pure white extends over the five first primaries, the outer edge of the exterior feather excepted, and about the middle of the wing; a triangular spot of white also marks the throat, bending up on each side of the neck; the bill is exceedingly small, scarcely one-eighth of an inch in length, and of a black colour; the nostrils circular, and surrounded with a prominent rim; eye large and full, of a deep bluish black; the legs are short, feathered a little below the knees, and, as well as the toes, of a purple flesh colour, seamed with white; the middle claw is pectinated on its inner edge, to serve as a comb to clear the bird of vermin; the whole lower parts of the body are marked with transverse lines of dusky and yellowish. The tail is somewhat shorter than the wings when shut, is handsomely forked, and consists of ten broad feathers; the mouth is extremely large, and of a reddish flesh colour within; there are no bristles about the bill, the tongue is very small, and attached to the inner surface of the mouth. The female measures about nine inches in length and twenty-two in breadth; differs in having no white band on the tail, but has the spot of white on the wing; wants the triangular spot of white on the throat, instead of which there is a dully defined mark of reddish cream colour; the wings are nearly black, all the quills being slightly tipped with white; the tail as in the male, and minutely tipped with white; all the scapulars, and whole upper parts, are powdered with a much lighter grey."

South America contains many species of goat-sucker, besides those which we have already enumerated, as paying their annual visit to the northern part of that continent. In the warm regions of America they are indeed highly characteristic birds; and the same may perhaps be said of them in Africa, and even in New Holland, which, though rather scanty in its mammalia, is a very remarkable country for the numbers and character of its birds. We shall give little more than a running catalogue of a few of the goatsuckers of these parts of the world, beginning of course with South America.

C. cornutus (the Urutau) is a species mentioned by D'Azzara, as frequenting Paraguay from October till February, which is the summer of the year in that part of the world. It gets the name of *cornutus*, or horned, from a tuft of feathers which grow over each eye, and which fancy might convert into a species of horns, in the same manner as the tufts upon the heads in some species of owls are called by the same name. The upper parts of this species are brown, variegated with russet, and a portion of the under part is of the same colour but lighter. The belly is whitish. The quills and tail-feathers are brown, barred across with white. The throat, the fore neck, and the breast, are russet, but with black points to the feathers of the latter. The middle toe is without any toothing, and the feathers of the head, just over the eyes, are stiff, and form a sort of aigrette, from which the specific name is taken. They are decidedly tree birds; and the natural historian of Paraguay mentions that they are seldom seen on the ground, or indeed in any situation except on the trees. They adhere to the inequalities of the bark, in a style not very dissimilar to that of the woodpeckers; and they are rarely if ever seen upon the ground. They come in pairs, and breed in Paraguay, as indeed is the case with all migratory birds, which invariably breed in those places of their range which are most distant from the equator. The pair keep closely associated during the time that they reside in that part of America; and though they sometimes settle upon separate trees, they always, upon such occasions, call and answer to each other in a peculiarly melancholy sort of tone. The eggs are two in number, with a pale brown ground, and thickly mottled with darker spots of the same colour. The natural historian of Paraguay says that these eggs are deposited not in any sort of formal nest, but in a cleft of a tree, and that the female hangs over them in the act of incubation. Other reports state that the eggs are attached to the tree by some glutinous substance; but there is probably no more truth in this than there is in the similar allegation of some sea-birds gluing their eggs to the rocks. The manners of these birds, and indeed those of most of the South American species of the genus, are, however, but little understood.

C. psalurus (The scissors-tailed goatsucker). This is another South American species, for the first and the only accurate account of which we are indebted to the naturalist of Paraguay. He describes them as being rare, and appearing in Paraguay only during the middle of winter, which would lead one to conclude that the birds spend their summer in parts of America still farther to the south. The upper parts are ash-colour, mottled with brown and black; and the under parts are pale ash-colour, with black cross bars. The sides of the head, and over the eyes, are white, clouded with grey; the throat and breast are reddish grey, streaked with red and black; and there is a large band of bright yellow across the lower part of the neck; the coverts of the wings are beautifully mottled with brown ash-colour, black and red; the outer web of the first quill is red, and the other quills are chiefly grey; the tail-feathers are also grey, very handsomely marked with black; the two lateral feathers of the tail are of great length, equal to one and a half times the total length of the bird; they are very handsome, broad in their webs at the basal part, but tapering off gracefully toward the points; the feathers next them are gradually shorter until the middle of the tail is arrived at, in which again the feathers are rather longer, though still short as compared with the external ones; the length of the bird, exclusively of the tail-feathers, varies from fourteen to sixteen inches. The female is smaller than the male, has the colours less intense, and the external tail-feathers not nearly so much produced. This

is one of the most interesting of that curious genus of birds to which it belongs. Its colours, though not gaudy, are exceedingly beautiful, and it possesses great power over the long feathers of the tail, which, as it skims over the waters, it opens and shuts something after the manner of a pair of scissors; and it is from this form of the tail and habit in the use of it, that the bird gets the name of scissor-tailed. Those produced feathers are characteristic of maturity in the male bird; but it is not known whether they are or are not a nuptial livery, as the birds have not been observed in the same locality during the entire course of the year. They are found in Brazil as well as in Paraguay; and their singular form and highly interesting manners render them subjects of which it would be desirable to know a good deal more.

C. manurus. This species bears some slight resemblance to the former; but it is a smaller bird and lighter in the plumage, the ground colour being bright grey, marked with black spots, and powdered with small dots of white on the wings. The lateral feathers of the tail are not so much produced as in the former species; but still, in the adult male, they are fully five inches longer than the intermediate ones.

To enter farther into an enumeration of the species of this genus, which inhabit the extensive forests of South America, would be merely to increase the list of names and colours without adding to the quantity of information. Many have been enumerated by describers; but they have, in many instances, been single specimens, which had no history, and answered no other purpose than swelling the list of museum catalogues. We shall, therefore, only farther notice a few of the more remarkable of those species which are found in the warm parts of the eastern continent, some of which, at least, appear to inhabit Africa and India.

C. macrodipterus. This species is a native of Africa, from which it has frequently been brought to Europe as exhibiting one of the most singular specimens of bird with which we are acquainted. Western Africa is, we believe, the place from which it has been chiefly obtained; but its manners are as obscure as its form is singular. In its general form, colours, and markings, this bird bears a strong resemblance to the common goatsucker of Europe, being mottled with ash colour, brown, yellow, and black on the upper part, rather paler on the under, with white spots on the wings. The remarkable peculiarity of it, however, consists in two supplemental feathers which, issuing from the wings, extend considerably more than double the length of the bird, for the greater part of their length they are without any webs; but at the extremity they have a broad web externally and a narrow one internally, so that they resemble a pair of paddles. What use the bird may make of such furnishings it is impossible to say. That they have a use cannot be doubted, for nothing in nature is made in vain; but they are so different from all the ordinary appendages of birds, that no opinion respecting them can be given. The scissor-tailed species, and all the others which have the tail feathers long and much power of motion in them, are remarkable for the energy which they display in the working of these instruments; but it is difficult to see for what purpose two feathers issuing from the wings as they do in this bird can be worked. The species last mentioned is sometimes also termed the Leone, or Sierra Leone goatsucker, from its being met with in that part of Africa.

C. pectoralis. (The Collared Goatsucker) is described as being a native both of India and Africa. Le Vaillant describes it as being common in some parts of the latter country, and as causing itself to be heard from the loudness and peculiarity of its nocturnal notes. It was in the southern part of the Cape territory, where the bird was described by the naturalist whose name we have mentioned. The song of the male, if song it can be called, is chiefly delivered while the female is sitting. It is a nocturnal song, not beginning till about an hour after sunset, which includes a large portion of the twilight in that country; and in places where the birds are numerous, the noise which they make is very disagreeable to strangers. The female makes no regular nest, but deposits her eggs on the bare earth, sometimes in a regular footpath; and she sits so closely on them, and so much resembles the parched surface of the ground, that she may be passed without being observed. The eggs are two in number, of a white colour, with very few markings, and they are so brittle, that they can scarcely bear handling. During the day the male often takes the place of the female, in order that she may procure a supply of food; but it is understood that she sits closely during the time that he is uttering his cry. If the eggs have been touched, Le Vaillant says that the birds hide them; and the account which he gives is so circumstantial, that we shall quote it with some slight alterations. In order to witness this operation, he first handled the eggs, laid them down in their place, and then concealed himself in a tree to watch the result. The first of the birds which came to the eggs was the female, and she alighted on the ground close by them, and then approached slowly and deliberately, and having, by what instinct it does not appear, ascertained that they had been touched, she walked several times round the nest with her bill close to the eggs, and her breast close to the ground, beating the earth at the same time with her wings, and uttering several peculiar cries. This appeared to be the signal for the male to approach her, for he immediately approached, uttering the same cry, and joined her in the same operations. Both then got on the wing, and having flown several times round the eggs, each seized one in its mouth, and quickly disappeared.

C. furcifer is described as another African species, bearing some resemblance to the forked-tailed one of Brazil, and remarkable for its large size, as well as for the deep forking of the tail. The entire length of the bird is upwards of two feet, and the wings extend forty inches from tip to tip, so that, long as the tail is, they reach to the extremity of it when closed. In the length of its wings, and the forking of its tail, this birds bears a considerable resemblance to the swallow. There is also something very peculiar in the structure of the bill. The gape is very wide, but the upper mandible is narrowed at the tip till the extremity of it bears more resemblance to a claw than to the point of an ordinary bill. It also shuts very closely, by an edge of the lower mandible which encloses the sides of the upper upper one; and toward the extremity receives it into a sort of groove, which however, terminates, and leaves a portion of the hooked point of the upper one projecting over. There is, in fact, more provision made for the closing of the bill of this bird than for that of any other bird of which we have

any knowledge; and this closing is so complete, that when the bird is seen in profile, the bill seems to be a very small one. Le Vaillant describes this bird as being observed by him in the Namaqua country, northward of the settlement of the Cape, where the Gariep, or Orange river, by much the largest in Southern Africa, falls into the Atlantic. The mode in which he says he procured them gives a curious display of the characters of these birds. Whilst hunting one day on the banks of one of the branches of the Orange river, accompanied by his native attendant, they were overtaken by a violent storm of wind and rain, which obliged them to take shelter under some large mimosas. From this position they observed in their vicinity a huge tree quite dead, with its trunk almost entirely hollowed out, to which aperture a large opening communicated. They approached this tree in expectation of finding some insects under the bark; but, as they advanced, they heard a low humming noise issue from the cavity. Dreading that this sound might proceed from a nest of serpents, or other noxious animals, that might be lurking there, they took some precaution in exploring the place. To their surprise, however, they encountered only two large birds, which they drew forth one after another. M. Le Vaillant kept them alive for two days, but the light of the sun affected them so much that they did not attempt to escape in the day time; but, in the darkness of night, they made desperate efforts to get out of the basket in which they were kept captive.

There are some species in Australia, one of which has the head furnished with a crest of produced feathers, and some of the tints of its plumage are lighter than those of most of the genus, but otherwise it presents nothing worthy of very particular notice, and its manners are obscure and little known.

Podargus. These form the remaining genus of the night swallows, or rather of those birds which prey something after the manner of swallows, and generally in the twilight. It will be seen, from the account which we have given of the leading species of the former genus, that birds of this description are chiefly confined to those parts of the world which have their seasons strongly contrasted by alternating drought and rain; the former continuing with such intensity and heat as to produce a desolation something resembling that of winter, and the latter giving an excessive stimulus first to vegetable and then to animal life; the season of the last of which is later than that of the other. In consequence of this the night air is, at certain seasons, literally crowded with insects, upon which both genera of this family of birds feed in great numbers.

The genus *podargus*, as at present established, does not contain nearly so many species as the preceding one; but as there is a sort of gradation in that which forms the leading character, the line of distinction is not very easily drawn. One very curious species, which is described as the Trinidad goatsucker, seems to be of doubtful reference in this respect, and therefore we shall content ourselves with a few words of general description, without a positive reference of the bird to either genus.

Though Trinidad is in itself a comparatively healthy and tranquil island, there are violent contests of the elements in that portion of water by which it is divided from the main land of South America. The lower valley of the Orinoco then is subject to violent floods, which cover, at one season of the year, a large extent of surface which is dry at other times. The navigation of this passage is exceedingly dangerous; and therefore, though the natural productions of the banks and islands are matters of considerable interest, they are very little known. We quote the original description of the Trinidad goatsucker, as communicated to Dr. Latham by Mr. Thomson. "These birds inhabit coves of the islands forming the Bocata, an entrance into the Gulf of Paria, accessible only at the very lowest ebb tides, and in moderate weather; and as they are never observed on the wing in day-time, most probably, like the rest of the genus, they seek their food in the absence of the sun. Here they breed during the early part of the spring; and it is at the time of new and full moons, in April and May, that the people who are acquainted with these coves, resort thither to take the young, and such of the birds as they can knock down with sticks. They have a strong and a disagreeable fleshy smell, but some people compare it to that of the cockroach; when dressed they look like a round lump of fat, the little flesh there is tasting more like that of a sucking-pig than any other, but yet with a flavour and lusciousness perfectly its own. But what is most extraordinary is, that in a family supposed to be wholly insectivorous, this should constitute a single and solitary exception, and be found to subsist, at least during the breeding season, entirely on fruit; for, on examining the stomachs of a dozen of them, young and old, no other species of food whatever but the fruit of the palm appeared. The collector in ornithology will find a very troublesome task in preserving this bird, as the skin adheres with uncommon closeness and tenacity to the granular fat, which every where covers the body, and which liquifies under the touch."

It is by no means improbable that some at least of the singular birds which Humboldt and his associates met with in their researches among the very extraordinary ravines and chasms, which seam the northern slopes of the Peruvian Andes, and are cleft to depths which defy the beams of even a tropical sun, belong to this class. The notices of those birds were, however, chiefly obtained from the Indians, and their accounts cannot be implicitly relied on. Indeed we want much farther research into the natural history of that singular portion of the earth's surface before we can form an accurate estimate of any or part of its zoology.

Whether any of those birds, whose history is at present so shadowy, may belong more correctly to the genus *Podargus*, or the genus *Caprimulgus*, or whether they may be something intermediate between the two, are points which we are not at present in a condition for settling. The prominent characters of *Podargus* consist in the stronger nature of the bill and the enlargement of the claws. They may be described as having the bill hard, stout, and of an entirely horny substance, instead of being soft in part like those of the typical goatsuckers. The breadth of the bill at the basal part is excessive, so that the gape is actually broader than the measure of the forehead. The keel on the upper mandible is rounded, curved from its origin, and much hooked at the tip. Both mandibles are much dilated at the sides, and the angle of the gape extends to a considerable distance behind the eyes. The lower mandible is of hard texture, straight in the greater part of its length, but slightly hooked at the tip, which is furnished with

a groove to receive the hook of the upper mandible. The nostrils are linear, placed at some distance from the base of the bill, nearly closed by a horny plate, and concealed by the feather of the front. The tarsi are short, and the feet have four toes, three in front. The internal one is united to the middle as far as the first joint; but the external is free, and the hind toe is capable of being reversed. The claws are not very long, but they are hooked and sharp, and that of the middle toe is not pectinated. The first and second quills are shorter than the third and the fourth is the longest in the wing.

These birds were unknown as a genus until they were partially investigated by Humboldt in the Andes, and by Horsfield in the eastern continent. The species alluded to by the former of these authors is probably the Trinidad goatsucker, of which we have taken some notice; but the eastern species have been more carefully examined, and their characters are more clearly established. The whole of them are twilight birds, inhabiting caves and the thick shades of tropical forests, which are seldom visited by any human beings except the most savage tribes. Where they live, twilight may be said to reign all day long; and they rarely come into situations where the air is free and the sun bright. They are understood to subsist entirely upon insects, especially moths and beetles of the largest size, which they seize with the beak while upon the wing. Some naturalists, who are perhaps rather fond of tracing what are called affinities, have described these birds as forming an intermediate or connecting link between the goatsuckers and the owls. This relation is not, however, borne out by the habits of the two races. They belong geographically to different departments of the earth; their prey is different, and they catch it in a different manner. Small mammalia are the proper food of the owls, and they come upon these by stealth, and, of course, always secure them upon the ground. Insects again are the food of the *Podargi;* and they seize these chiefly on the wing. Those differences of habit very naturally point to corresponding differences of geographical situation. The polar parts of the world are the head-quarters of those small rodent mammalia, upon which owls in great part feed; and, therefore, according to that law of nature by which the prey and the preyer are invariably brought into juxta-position in the same locality, the polar parts of the world are also the head-quarters of the owls. But the tropical regions are the head-quarters of all insectivorous birds, being the head-quarters of those insects upon which the birds feed.

Notwithstanding the abundance of insects, chiefly small ones, which are found in the polar forests, and hovering over the polar marshes during the summer, there is not one to be found there during the winter, or in high latitudes, for nearly nine months out of the twelve. There is therefore no permanent place for an insectivorous bird in those high latitudes; and of course there is not one that remains there, though a few pay their annual visits during the short summer. It is very different in the dark caves and thick damp forests of polar countries. Such places do not feel the scorching heat which brings desolation on the dry plains; they have always heat enough, and also moisture enough, for an abundant production of insects; and consequently the insectivorous birds dwell permanently in them, enjoying a perpetual harvest, and rearing their broods indiscriminately at any time, without the slightest reference to any change of seasons. This is the character of the bird, which is most decidedly marked in the podargi; and any one who reflects upon the subject, with even a moderate degree of attention, will at once see, that in this there is not the slightest affinity or approach to the character of the owls. It is of great importance to keep in view the geographical tendencies of animals; because, whatever resemblance there may be in the structures of individual parts, we always find that the essential characters of the animal are so closely connected with its geography, that the one may in great part be made an index to the other; and this is one of the ways in which natural history is made to conduce most essentially to the advancement of general knowledge; a subject of far more consequence than the introduction of any one artificial system, however plausible that system may be, into any single department either of the animal world or of the vegetable.

We have already remarked, that the natural history of this particular genus of twilight feeders upon insects is very obscure; and we may add, that it is highly probable that we are not yet acquainted with the half, or probably even the hundredth part of the number, so that it is impossible to carry this very curious part of the geographical history of birds to that extent which would be desirable; we must, consequently, restrict our notices to the one or two species which have been ascertained by competent authorities.

P. cornutus—The horned Podargus. This appears to have been the species found in the woods of Java by Dr. Horsfield. It is a very singular-looking bird, from the great width of its gape, the forward position of the eyes, and the produced feathers with loose and straggling webs, which stick out from the sides of the head. Its upper parts are of a greyish brown colour, mottled with black and white; the forehead is covered with brown feathers, with shafts terminating like hairs, and the sides of the head with black feathers, of which the webs are loose and open, and, though less produced, bear no inconsiderable resemblance in their texture to the feathers on some of the birds of paradise. What may be the use of such feathers in the economy of the bird is not known, but, as they cover the external openings of the ears, it is not unlikely that they are, in some way or other, connected with the sense of hearing. The lower part of the neck is crossed by a white band, and there is a white spot upon the termination of each of the lesser coverts of the wings; the quills are brown, spotted on their outer webs with dark brown and russet; the tail-feathers are also brown, staged at their extremities, mottled with black, marked with eight bars, and the external ones are spotted with reddish white; the throat is brown, marked with small longitudinal lines; the centre of the breast is nearly white, marked with a large gorget of brown and black; the rest of the under parts are whitish, delicately streaked with lines of black and russet. The length of the bird is about eight inches, and its weight is but trifling even as compared with its size. Of its nest-building, or other habits, little or nothing is known. In the case of this, as well as of many other birds which have tufts of produced feathers on the sides of the head, the name horned is very inaptly applied, for in birds these additions to the head never consist of anything but feathers.

P. cinereus, is a New Holland species, the prevail-

ing colour of which, as its name imports, is ashen grey. It is, however, very much mottled by other colours. It is about the size of a jackdaw, or rather, perhaps, a little larger. The spots which mark it are chiefly black and white; and it differs from the Javanese species in having the bill and feet black.

Such are a few of the particulars known respecting one of the most singular families of the feathered tribes.

NYMPH. A name sometimes given to the pupa state of various insects. See INSECT, CHRYSALIS.

NYMPHÆACEÆ. A natural order containing four genera, viz., *Nelumbium*, *Euryale*, *Nymphæa*, and *Nuphar*. They are all aquatics, and some of them bear very splendid flowers. They occur in almost every pool, canal, or slow-running stream over all India and China; and the hardy nuphar is common in all similar situations in Europe.

Nelumbium and *Nymphæa* are the normal genera and types of the order. These, although essentially distinct, are in many particulars so much alike, that they were formerly considered but one species of one and the same genus. Collectively considered, the *Nelumbianæ* are aquatic *Ranunculinæ* with prostrate stems, which extend themselves in the mud, peltate, or cordate fleshy leaves, which mostly float on the water, sepals, petals, and stamens passing into each other, embryo excluded or without the albumen, but inclosed in a membranous sac. The inflorescence is solitary; the peduncles long, varying in length with the depth of the water, round, and ebracteate. The flowers are large and showy, regular and united.

The Pythagorean bean is supposed to have been the fruit of *Nelumbium speciosum*, or the water lotus, formerly a native of Egypt and other warm regions in Africa and Asia, but not now to be found in the Nile, its most celebrated habitat of antiquity. It was called *Cyamus* by the ancients, and its present generic name is an alteration of the Cingalese word *Nelumbo*.

The creeping jointed subaqueous stem or rhizoma, as well as the seeds, are eatable, and they are said to be both savoury and wholesome. In China the plant is called *Lien-fua;* and peeled seeds and slices of the rhizoma, with the kernels of apricots and walnuts, alternated with layers of ice, were frequently presented to the British ambassador and his suite, at breakfasts given by some of the principal mandarins.

The seeds of the *N. rubra* and *N. lotus* are eatable. The *odorata* and *alba* have been occasionally employed medicinally as astringents, but their use is almost obsolete, being seldom resorted to as styptics, and only occasionally chewed by singers to relieve relaxation of the uvula and soft palate, give firmness to the vocal organs, and clear the voice.

The tropical species are cultivated and flowered in our stoves, planted in tubs of muddy soil, and kept flooded with water during the growing season, but kept drier while dormant. They are raised from imported seeds, or by dividing the root.

NYMPHALIDÆ (Swainson). A family of diurnal butterflies, comprising those species which have the fore legs rudimental, the pupa only suspended by the tail, and not girt round the body; the caterpillar cylindric, spinose, and with two short anal spines; and the antennæ with a distinct club, and not hooked at the tip. These butterflies are distinguished by their strength of body and powerful nerves of the wings, giving great rapidity of flight. Their colours are generally brilliant and variegated, often ornamented with beautiful eye-like marks, or spotted with silver on the under side. The species are exceedingly numerous, especially in extra European countries, and their size generally far exceeds that of the *Hesperiidæ* or *Lycænidæ*, although often smaller than the *Papilionidæ*. The genera are Cethosia, *Argynnis*, *Melitæa*, *Vanessa*, *Cynthia*, Nymphalis, Libythea, Biblis, Melanitis, Morpho, Pavonia, Brassolis, Eumenia, Eurybia, *Hipparchia*, Fabricius (Satyrus, Latreille), *Apatura* and *Limenites*, those marked in italics containing British species. See the articles BUTTERFLY, LEPIDOPTERA, and DIURNA.

NYMPHON (Fabricius). A remarkable genus of apterous insects, belonging to the class *Arachnida* and order *Podosomata* of Leach (*Aporobranchia* of Latreille) having the body small and linear, the legs very long, with a pair of antennal claws, and two palpi. These are extraordinary marine animals resembling spiders, but having only four pairs of legs; they are found amongst various aquatic plants under stones, &c. They appear to be destitute of any appearance of breathing pores, whence Latreille's name *Aporobranchia*. The females are furnished with an additional pair of short filamentous processes to which the eggs are attached. There are several British species, but their characters have not yet been satisfactorily determined. Dr. Leach has figured two species, *N. gracile* and *femoratum*, in the Zoological Miscellany.

NYSSA (Linnæus). A genus of North American trees, belonging to *Santalaceæ*. The fruit of *N. candicans* are preserved and used instead of olives. *N. denticulata* is a lofty tree of great beauty. In British collections they answer the purpose of large shrubs, and grow best in damp situations. They are increased by layers.

OAK is the *Quercus robur* of Linnæus, the British oak. Of this most important genus of forest trees, there are sixty-one species and twenty-two varieties, named in our books. There are two, but very nearly allied, sorts met with in woods: one with the acorns sitting close upon the twig on which they grow, hence called *Q. sessiliflora;* the other bearing its fruit on footstalks, hence called *pedunculata*. The latter has been raised to the dignity of a species by modern botanists, and it is said that the timber of the one is much more valuable than that of the other; but which is the superior, remains to be ascertained. While botanists assert that the *pedunculata* is the true British sort, an eminent builder denies that it is so, and has proved, in the course of his long experience, that the *robur*, or sessile-fruited one, of Linnæus, is the true naval oak. See QUERCUS.

OAK APPLE. The excrescences often observed growing upon the leaves and young stems of oaks, and which, when gilt, form so prominent a part of the decorations of the "Royal-oak day," are thus named, and are caused by the wounds made by several species of gall-flies when in the act of depositing their eggs. See CYNIPIDÆ.

OAT is the *Avena sativa* of Linnæus, one of our most useful agricultural plants. For the principal part of the food of the labouring classes in the northern parts of Britain, and for the food of horses in the south, one-fifth of the whole arable land in the three kingdoms is annually sown with this grain. Oats are generally sown on newly reclaimed land, or in regular rotations, usually follow wheat. The seed

time is during Lent, and the return varies from four to nine quarters per acre; general average about five quarters (forty bushels) from about five bushels per acre sown. In the north, the crop is reaped and bound in sheaves before it is carried to the barn. In the south, oats are mown, and, when sufficiently harvested, carried to the rick or barn loose.

OAT GRASS is the *Avena præcox* of Linnæus, a common British-grass frequent on waste ground.

OBESIA (Haworth). A genus of succulent gouty plants, natives of the Cape of Good Hope. The flowers are pentandrious, and the genus belongs to *Asclepiadeæ*. Both plants and flowers are curious; they require to be potted in very light soil and lime rubbish, and mostly kept dry, except when flowering they may be allowed water more freely. They are propagated by cuttings, but not planted till the wound gets dry, otherwise they are apt to rot. This genus was separated from *Stapelia*.

OBSIDIAN. This mineral is found in two very distinct forms. The translucent obsidian, or *Lave vitreuse obsidienne* of Hauy, is most frequently of a black colour; but some varieties are olive-green, and exhibit a beautiful silvery or golden opalescence. The island of Iceland produces the best specimens, but it occurs in most parts of the world. Transparent obsidian varies considerably in its colour, and consists principally of silica.

OCHNACEÆ. A small natural order, containing four genera, viz., *Ochna*, *Walkeria*, *Gomphia*, and *Castela*. They are trees or shrubs abounding with watery juices; their stems and branches are very smooth, leaves simple, alternate (in *Coriaria* alone opposite), entire, or toothed, penninerved, and furnished at the base with two stipules, which are deciduous, or sometimes absent. The inflorescence is subracemose, the flowers regular, united, and in general yellow. The calyx is formed of five sepals; the petals are equal, alternate with the sepals; the torus is turgid and discoid, bearing the carpels arranged round the median style; the stamens are five, alternate with the petals, and protruding from the margin of the disk; the filaments are free, bearing two-celled anthers, opening lengthways or by terminal pores. The germen consist of from five to ten carpels arranged in a whorl on the disk, with their styles combined, and forming a straight thread-like column that rises from the middle of the disk, and is persistent. The fruit consists of from ten to five, or by abortion fewer, carpels, which are sub-drupaceous, and one seeded.

The *Ochnaceæ* are bitter plants, and some of them are esteemed as tonics, such as *Walkeria serrata*, the leaves and roots of which, when steeped or boiled in milk or water, are administered as a stomachic, and are said to remove nausea and arrest vomiting. *Gomphia hexasperma* is astringent, and is found serviceable as an application to the sores caused in cattle by the punctures of insects. *Gomphia Jabotapita* has a fruit which is eatable, but rather too astringent to be agreeable; it likewise affords a bland oil, which is fit for salads and culinary purposes. The flowers of this plant, as well as those of other species, are very fragrant. *Castela Nicholsoni* is the goat-bush of Antigua; like its associates it is remarkable for its bitterness, and like them might be useful as a tonic.

There are several species of *Ochna* and its allies in our collections: they grow well in loam and moor-earth, and are propagated by cuttings.

OCHROMA (Sweet). A genus of West Indian trees, bearing monadelphous flowers, and belonging to the natural order *Bombaceæ*. They grow freely in a mixture of loam and moor-earth, and are propagated by cuttings in the usual way.

OCTOMERIA (Dr. Brown). A genus of tropical herbaceous plants, belonging to *Orchideæ*. In our collections they are kept in pots of light sandy peat-earth, placed in cold frames during summer, but removed to the stove in winter.

OCULUS CHRISTI is a species of *Inula* so called. It is a hardy herbaceous perennial, and has a place in our flower borders. It bears yellow composite flowers.

OCYMUM (Linnæus) is a genus of sweet-smelling herbs, belonging to *Labiatæ*. Two of the species are cultivated as pot-herbs, under the name of sweet basil. They are raised from seed sowed annually in spring.

OCYPODA (Fabricius). A genus of short-tailed crabs (*Crustacea brachyura*), having the eyes large, and extending down their footstalks, instead of being terminal, as in the others. The tail of the males is very narrow, with the last joint elongate-triangular; that of the females is oval. The claws are of nearly equal size. These crabs, as their generic name implies, run with such great velocity, that it is asserted that a man on horseback has much difficulty in catching them; hence the specific name which was given to them by the old naturalists of cavaliers (*Eques*). During the day they keep in their burrows, which they excavate in the sand on the sea-shore. The species are chiefly tropical. The type is the *Cancer cursor* (Linnæus).

ODACANTHA (Paykull). A pretty genus of coleopterous insects, belonging to the family *Carabidæ*, and sub-family *Brachinides*, having the thorax long, narrow, and subcylindrical, the elytra truncate at the tips, and the tarsal joints entire. The type, and only British species of the genus, is the *O. melanura* (Fabricius), which is found in the fens of Cambridgeshire and Huntingdonshire.

ODICNEMUS—Thick-knee. A very peculiar genus of *Echassiers*, or stilt birds, having more resemblance to the plovers than to any other family; but still so distinct from it in structure, in haunts, and in manners, as to require a separate notice. Birds of the allied genera, and especially this genus, were most improperly classed as waders by the older systematists; for, instead of wading or otherwise seeking their food in the waters, they are found upon dry and sandy places, and upon such only. Africa and Australia are their head quarters, though some of them make excursions into light sandy places in temperate countries, and even pass the winter there, at least if it is very mild and open. They are characteristically birds of the desert, where that desert is open, and they studiously avoid the cover of woods and bushes. They thus form a distinct chapter in the history of nature; and their closest associates may be said to be the ostriches and the bustards, the last of which are found along with them in Africa; and the emeu takes the place of the ostrich in Australia, in which country there is no bird, hitherto discovered at least, which is properly typical of the bustards.

That the characters of the birds are well adapted to their very peculiar haunts will appear from the following enumeration: the bill is longer than the head, straight in its general line, and strongly made. It is a little depressed at the basal part, but com-

pressed toward the tip. The culmen of the upper mandible is elevated, and that of the lower forms an angle—a structure of bill which combines the two properties of lightness and strength. The nostrils open longitudinally in the middle of the length of the bill, and are in part protected by a horny plate. The legs are long and slender, with three toes to the front, but not even a rudiment of a hind toe. The three front toes are bordered with a membrane which unites them as far as the first joint; and this structure of foot possesses great elasticity, and also affords a firm plant or base to the bird in running. The enlargement of the knee, or rather of the ankle, from which the birds get their common name, is produced by the enlargement of the upper end of the tarsus, and the bones with which that is articulated. By this means a sort of cross lever power is given to the joint, which enables the bird to have great command over the tarsus, while the dry soil upon which it chiefly runs does not require,very great weight or general strength in that bone. The wings are of mean length, but they are rather pointed, the second feather being the longest. The tail is wedge-shaped, and the general form of all the organs of flight adapts the birds well for turning on the wing, or otherwise having a powerful command of the air.

Though this genus of birds were long confounded with the plovers, there is a remarkable distinction between them. Plovers, though they prefer open places and not woods, do not betake themselves absolutely to the desert; whereas the thick knees are always found on dry sands, and generally remote from the dwellings and the labours of man. They are exceedingly timid, and generally remain concealed during the day, so that one may pass near the places where they are without having the slightest chance of seeing them. When, however, the twilight closes in, the birds take advantage of its shade to come abroad on their feeding excursions. Their food consists of small ground animals, such as slugs, insects, and the more minute reptiles; all of which are, like themselves, abroad chiefly in the twilight. During the night they fly with rapidity, and utter a sharp plaintive cry, which is heard at a considerable distance. During the day the sound which they utter, when alarmed or otherwise excited, is in a deeper key, and heard at a much less distance. At these times they trust more to their legs than to their wings in seeking safety from enemies. There are very few animals of the same localities which can overtake them in running; the chief danger to which they are exposed is from birds of prey in the air, and by keeping the ground they can escape these better than if they were to take the wing. Birds of prey, which kill on the ground, could not descend with certainty upon a thick-knee if once alarmed, because that bird would be far enough out of the way before the enemy reached it; and as even those birds which prey on the ground, upon other birds or warm-blooded animals, must make a rush in the air in order to acquire the requisite impetus, it becomes impossible for them to make any thing of a bird which can run swiftly. Owing to these circumstances, the day flight of the thick-knees is always low and taken in short reaches. Their chief security upon the ground, however, consists in their being so like the colour of the sand, and squatting so closely upon it, that birds of prey cannot see them.

Their's is a wide range in nature, but it is exceedingly laborious; and therefore, besides their nocturnal activity in ranging from place to place, they are obliged to migrate with the seasons. They proceed northward about the month of April, and are driven south again by the autumnal rains. On their migrations they generally keep in flocks, resting during the day, and making their passage during the night with rapid wing, and apparently encouraging each other by their cries. When the nesting time comes the flocks break up, as is common with all birds which breed in comparatively bare pastures. Indeed this is so general a habit that it is necessary to be attended to by every one who wishes rightly to understand the nature of birds, and their general uses in the economy of creation. If the birds nestle where food is abundant for them, they are generally social in their nesting places. We have this exemplified in rooks, in herons, in house sparrows, and many others, especially of those birds of the rich tropical forests which load the trees with their nests. Of these social breeding birds it appears that the one excites the other, and the encouragement thus mutually given makes the labour proceed with greater celerity. But there is of course a limiting of this encouragement which bird can give to bird in the performance of labour; for, though the stimulus of a neighbour's voice and activity may prompt to labour, it cannot find a reward for that labour, unless such a reward is obtainable in the locality. We have often a very striking illustration of this in the case of the common rook. If, during the incubation, and especially after the young are beginning to break the shell, a severe frost should set in, and close the earth and the brooks for a succession of days, there is grievous lamentation among the dark inhabitants of the trees. The females cannot of course leave their charge, and thus the males are on the wing far and near in quest of a supply. This, which is always obtained with great labour under such circumstances, is often exceedingly scanty; and the complainings are sometimes painful to an experienced ear, as they express sufferings which are severely felt and cannot be relieved. When a kindly thaw comes, and the stores of the earth are again opened, the cawing of the rooks becomes exceedingly joyous; and no one would easily believe, if he had not carefully observed the fact, that notes so different in their sound and expression could be uttered by the same birds, at perhaps an interval of not more than two or three days.

Those birds which disperse at the pairing time are not subject to these casualties, because each has a sort of farm to itself, upon which no bird of the same species intrudes. There are not perhaps any two distinct species of birds which feed upon exactly the same sort of food; and therefore the dispersed birds are not so liable to suffer from other species as they would be from their own.

Birds which thus disperse in the breeding time rarely have any battles of gallantry among the males. Each pair betakes itself to its own station, where the two remain during the season in constant attendance upon each other. The female chooses some little hole sheltered by a tuft or bush, in which she deposits her eggs, which are usually two in number, generally of a greenish-yellow ground and spotted with brown. The young are carefully nursed for a time by the parent birds; and they are at least two or three years in acquiring the plumage of full maturity, which is gradually arrived at by a single yearly moult.

O. crepitans—Common Thick-Knee. This is the only bird of the genus which by any chance makes its appearance in any part of the British islands; and even there it is found only in the bare, dry, and warm places of the south and east, and is not found even in the midland counties. Norfolk, where there are many dry sandy plains, visited by rare birds more perhaps than any other part of the island, is so exclusively the abode of the few of this species which come to Britain, that the bird has been called the Norfolk plover. It is also called the stone plover and the stone curlew, though it cannot with propriety be referred to either of these genera. It is so exclusively a bird of the open plains that it is hardly seen in an inclosure, not apparently being fond of so much cover as that afforded by a single fence. It comes to us generally pretty early in April. Soon after this the cry of the male begins to be heard from the remote and bleak commons. It is rather loud, but harsh and grating, and resembles a sort of explosion. These birds have little time for nest-making, from the severe labour which the finding of food in such unproductive places requires from them. The sand or dry earth is merely a little levelled, and then the eggs are placed upon it. They are greyish in the ground, and mottled with red and brown. The time of incubation is described as extending to about a month. It is wholly performed by the female, for the male never sits on the eggs, but he watches very constantly beside the female during the day, to give warning of any danger that may present itself. In case of any such arriving, the female squats level with the surface of the ground; and the male shows himself, attempts to attract the enemy to a different quarter, and very generally succeeds in this. When he has succeeded in removing the danger to the necessary distance, he returns to his charge, and always does so by zigzags, of which no single line points directly to the nest.

The young birds, as is common with those of a species which do not construct formal nests, are thickly covered with down; and they are capable of using their bills and feet in finding their food, in which, however, they are assisted by the mother. The strong bills of these birds enable them readily to turn over small stones, and seize any little animals which may be below; and in this way they can find a supply of food in places where the surface does not present a single thing that a bird could eat. Morning and evening are their chief times of feeding, the latter especially, because it is the damper of the two, and the food of the thick-knees keeps longer out.

When the principal labours of the season are over, and the young able to procure for themselves the requisite supply of food, the birds again assemble in flocks, and they are a little bolder than they are during the breeding season. The hot sun always, however, reduces them to a state of languor, so that they squat down and remain still. But they never do this without having a watch set. If it is a single pair, in the breeding season, the male watches; but in the case of a flock, when the breeding season is over, there is always a regular sentry posted. As at this time each has nothing to do but find its own food, and provide for its own personal safety, they do not squat when the sentry gives the alarm, as the female does when she has her eggs to protect. They stand up, reconnoitre the danger, and each proceeds on its own way. In consequence of this watchfulness, these birds are much more rarely procured by sportsmen than one would suppose from the readiness with which they can be seen on the bare places where they reside. Such, however, is the fact, and these birds are less frequently shot than many others which are in reality more rare.

They are birds which indicate a bleak and wild state of the country; and it is doubtful whether pasturing sheep has not some tendency to thin their numbers, because the sheep gradually bring a grassy sod over the surface, and this either prevents or conceals such animals as the birds would feed upon. The falling off of their numbers is therefore to be regarded as conclusive evidence of a country being in a state of improvement, while their increase is, on the other hand, a sign that it is falling into decay.

This last-mentioned circumstance not unfrequently renders the birds of a country a sort of progressive history of its condition at different times. The forms of wild nature, upon which man, in a climate like ours, breaks in when he cultivates, are the arid waste on the one hand, and the stagnant fen on the other, and the birds which are characteristic of such localities have gradually been becoming scarcer in England for many years past. The bustard, which was once by no means rare in the south, has become nearly extinct; and it is probable that the thick-knee is following it.

The thick-knee, though not a very heavy bird, is one of considerable dimensions. It is about seventeen inches in length, and twenty-five in the stretch of the wings. The bill is about two inches long, and the tarsi are between five and six, which raises the bird above the thin herbage of its haunts, and thus makes it appear much larger than it is in reality. Its neck is of course long to correspond with the length of the legs; for, in a bird which feeds upon the ground, those two parts are always adapted to each other. The upper parts are reddish-ash colour, with a longitudinal streak of brown down the middle of each feather. The sides of the head, both above and under the eye, are marked with white, which is found also on the chin, but not on the nape. The belly and thighs are also whitish; and the fore neck and breast are russet, with longitudinal streaks of brown. The coverts of the wings are brown, crossed by a band of white. The quills are black, the first with a white spot on the middle, and the second with a similar one on the inner web. The six middle tail feathers are barred with brown; the others are white with black bars; and they have all black tips, except the two middle ones. The bill is yellow at the tip, and black at the base. The irides of the eyes and the naked parts of the legs, which extend a considerable way above the tarsal joints, are also yellow.

O. magnirostris—Large-Billed Thick-Knee. This is an Australian species, having the upper parts mottled with ash colour, with red, and with brown, and a white band along the head bordered on each side by a black one. There is also a long black spot on each side of the neck; and the cheeks, chin, and throat are white. The nape and upper part of the neck grey with black spots. The wing coverts pure ash colour, crossed by a white band. Quills black, but with a white spot on the middle. The turn of the wing and the lower parts of the body very pure white, but with a streak of brown down the middle of each feather on the breast. The bill is longer, stouter, and more compressed than that of the European species, and wholly of a black colour. Though not

gaudy in its attire, the large-billed thick-knee is a very beautiful bird; but it is one, with the manners of which we have very little acquaintance. The wide plains of Australia, which are its chief haunts, have been very imperfectly explored; and when the weather is sufficiently dry for visiting them with ease and safety, they are so naked of herbage, that it is very difficult to get near so vigilant and active a bird as a thick-knee.

O. longipes—Long-Legged Thick-Knee is also an Australian species, remarkable for the length of its legs, and measuring twenty inches in length. The sides of the neck are brown spotted with white. The top of the head and the upper part of the neck are grey with longitudinal lines of brown. A space over the eyes, the throat, and the belly, are pure white; and the fore neck and breast white with longitudinal lines of black. The quills are black, and the middle tail feathers are grey with deeper bands of the same, while the lateral ones are black with white bars. The bill is black, and the naked parts of the feet brownish. This is a handsome bird as well as the former, though the extreme length of its legs give it rather a tottering appearance. But notwithstanding this, it is both a steady and a swift walker. The existence of two species of birds, which are so characteristic of desert countries, in Australia, is one strong evidence against the chance of that great island containing any considerable portion of fertile ground in the centre.

O. maculatus—Spotted Thick-Knee. This is an African, rather larger than the common species, but not so long as either of the Australians. Its length is about a foot and a half. The upper parts of it are russet-brown, spotted with blackish-brown, and the small coverts of the wings are of the same colour, but with white tips. A space round the eyes, the mustaches, the chin, and the throat are pure white. The neck and breast are russet with longitudinal black lines. The under parts are reddish-white, streaked with black. The bill is black at the point and yellow at the base, and the feet are yellow.

It will be seen from this description, that this African species much more resembles the common species which migrate from Africa to Europe, than it does the Australian ones; while they again have a nearer resemblance to each other. All the four species have, however, a very strong family likeness, more so than very many other birds with which we are acquainted; and there are no birds to which we can say that any of them is very nearly allied in its habits.

ODYNERUS (Latreille). A genus of hymenopterous insects, belonging to the family *Vespidæ*, or the wasps, and comprising the solitary species, or those which do not congregate and form a common nest. The abdomen is conic-ovate, and broadest at the base; and the terminal lobes of the mouth are short. The species are of smaller size than the common wasp, which, however, they resemble in colour, being black, varied with yellow. The females construct their nests in hot sand banks, the crevices of walls, or in rotten wood. These burrows are several inches deep, and of a cylindrical form; the entrance being defended, in some of the species at least, by a curved entrance, formed of fine kneaded sand, which the architect has brought up from the bottom of the nest. In the interior, and at the foot of this retreat, the female buries eight or ten caterpillars of the same species and size, but varying in the different species; they are arranged in a spiral direction, and an egg is deposited in the midst, after which the mouth is closed. The young, when hatched, devours the inclosed caterpillars, which are just sufficient for its support; and then assumes the pupa state in a cocoon of a slender papyritious texture, which it has previously formed, and soon after becomes a perfect insect, and makes its escape. There are about twenty British species, but their specific characters are liable to considerable variation, so that the genus is very difficult of investigation. The type is the *Vespa muraria* (Linnæus). One of the largest species is the *Odynerus antilope*. A Memoir upon the habits of this species has been published in the Transactions of the Entomological Society, from which the following passage is extracted:—The writer noticed several specimens flying about, settling on a wall, and creeping into the holes which abounded in the rotten mortar. He observed one of the wasps fly down with something held beneath the whole length of its body, which it succeeded in carrying into its burrow. Another soon appeared, which he endeavoured to catch, in order to discover what the burthen consisted of; but the insect was too quick for him, and, with that solicitude which marks all the proceedings of these creatures in the constructing and provisioning their nests, it wheeled upwards to a considerable height, and made a circuit of several minutes' duration, and again attempted to reach the hole, which he again prevented by unsuccessfully attempting to knock it down with his handkerchief, when it soared away, and did not again return. He was, however, more fortunate with another, by allowing it to settle on the wall, and caught it as it was creeping with its prey into its burrow. This consisted of the green caterpillar of a *Crambus*, which is about the length of the insect's body, and which he noticed was held by the hind legs of the *Odynerus*, and consequently extended from the head to the extremity of the abdomen. Hence the *Odynerus* is essentially a fossorial hymenopterous insect (although belonging to a family containing the social tribes of wasps), furnishing its nest with larvæ; and yet neither the anterior nor the posterior legs are armed with those very remarkable spines which characterise those real fossorial nymenoptera which provision their nests. Here, therefore, we have another exception to the theory of M. Saint Fargeau, in addition to those observed by Mr. Shuckard, and described in his Memoir upon this subject in the first part of the Transactions of the Entomological Society.

ŒDEMERIDÆ (Leach). A family of coleopterous insects, belonging to the section *Heteromera*, and tribe *Stenelytra*, of Latreille, having the body linear or oblong, the antennæ inserted near the eyes, the mandibles notched at the tips, the penultimate joint of the tarsi bilobed, and the maxillary palpi terminated by a large hatchet-shaped joint, the posterior thighs often greatly thickened in the males of some species, whence the name of the family, which means gouty-legged. The elytra are generally narrowed behind, and not meeting along the back. These insects are found in the perfect state upon flowers and trees, and amongst long grass. In their general appearance they have a considerable resemblance to the *Telephoridæ*. They are in general very active, and fly well. The family is but of small extent. The genera are, *Œdemera*, *Oncomera*, *Ischnomera*, *Nothus*, *Conopalpus*, all of which are British; and

Rhœbus, Calopus, Sparedrus, and *Dytilus,* which are foreign. The genus *Œdemera,* as restricted by Stephens, consists of those species only which have the posterior femora greatly incrassated in the males, the antennæ long, and the elytra very much narrowed behind. The type of the genus is the *Œdemera cœrulea* (Linnæus), a pretty little insect, found in the summer months upon various flowers.

ŒNANTHE (Linnæus). A genus of herbaceous perennials, mostly natives of Europe, belonging to *Umbelliferæ.* They are comparatively useless plants, and when grown in botanical collections are placed in water or on damp rich soil.

ŒNOTHERA (Linnæus). A genus containing many species of annual, biennial, and perennial herbs, found in various parts of the world. They are ranged in the eighth class of Linnæus, and in the natural order *Onagraria.* Generic character: Calyx tubular, limb four-cleft; petals inserted into the calyx; stamens erect or declining; filaments awl-shaped; anthers incumbent; style filiform; stigma in four divisions; capsule nearly three-sided; seeds naked. The *Œnotheras* are in general fine flower-border plants. One of the most common in old gardens is that known by the vulgar name of *evening primrose,* from the flowers mostly expanding immediately after sunset. The roots of the *Œ. biennis* are esculent, and were once cultivated for the sake of their tubers, which in some measure might have stood in the stead of potatoes, but were superseded by the introduction of that much more valuable plant. The roots of this *Œnothera* were formerly eaten after dinner, as olives now are, being esteemed incentives to wine-drinking, and hence the generic name was changed from *Onagra,* the ass-food, to *Œnothera,* the wine-trap.

ŒSTRIDÆ (Leach). A very interesting family of dipterous insects, belonging to the section *Athericera,* having the mouth, in the winged state, quite, or almost entirely, obsolete, being replaced by three small tubercles, which can in nowise be applied as organs of nutrition. These insects have the appearance of large flies, with the body often very hairy, and ornamented with bands of various colours like the humble bees. The wings are very strong, and generally extended; the alulets are large, and conceal the halteres; the tarsi are terminated by two ungues and two pulvilli.

The habits of these insects are very peculiar, since their larvæ reside in the stomach, beneath the skin, or in the frontal sinus of various quadrupeds. We have, in the article Bot, given an account of the habits of those species of this family which attack the horse, and are known amongst farriers by that name, forming the genus *Gasterophilus* (Leach; *Gastrus,* Meigen); and have herein stated, that in the present article we should detail the habits of the other species.

It may, however, be observed in a general manner that these insects are rarely to be observed in the perfect state, although sufficiently common, and often very annoying to the animals which are subject to their attacks whilst larvæ. Each species of the family is confined to its own peculiar quadruped, and selects, for the deposition of its eggs, that particular spot which will be best adapted to the wants of the future larvæ. The ox, horse, ass, rein-deer, stag, antelope, camel, sheep, hare, and rabbit, have been ascertained to be subject to the attacks of these insects, which instil a surprising degree of alarm into these animals when about to deposit their eggs. The larvæ, according to the situation in which they are found, may be called subcutaneous, cervical, and gastrical; the bots belonging to the last-named species. The larvæ are thick and fleshy, of a somewhat conical form, and destitute of legs; the body is composed of eleven segments, exclusive of the head, and furnished with minute tubercles or spines, often arranged in transverse series so as to be of service in progression. The chief organs of respiration are placed upon a scaly plate at the extremity of the body, which is the thickest part of the larva; their situation being, however, different in the gastrical species. Moreover the mouth of the subcutaneous larvæ is only composed of fleshy tubercles, whereas that of the gastrical species is armed with a pair of strong hooks—a variation of the structure dependent upon the variation of habit, and which requires that the larvæ placed in the midst of the stomach of an animal, and subject to the action of the food of such animal in its passage through its body, should be furnished with the means of holding itself firmly in its place. When full fed, these larvæ quit their retreats and descend to the earth, in which they pass the pupa state, the skins of the larvæ serving as the cocoon of the inclosed pupa.

The œstrus of the oxen, to which, in allusion to its habits, Latreille has applied the very appropriate generic name of *Hypoderma* (that is, living beneath the skin, or subcutaneous), is one of the most renowned of insects, its habits having been recorded by Virgil, in his third Georgic. Dryden gives the following translation of the passage in which the insect is referred to:—

> About the Alburnian groves, with holly green,
> Of winged insects mighty swarms are seen.
> This flying plague (to mark its quality)
> *Œstros* the Grecians call—*Asilus,* we—
> A fierce loud buzzing *breeze.* Their stings draw blood,
> And drive the cattle *gadding* through the wood;
> Seized with unusual pains they loudly cry——

The claims of Dryden as a poet may be unquestionable, but he was no naturalist; and in these few lines may be seen examples of his merits and demerits. For the sake of his verse he has introduced the statement that the stings of this insect draw blood, and he has employed the popular but indefinite terms *breeze* and *gadding* (that is, flying from the *gad-fly*). Thus it would appear from this passage, that the insect in question was a Tabanus, which have the power of drawing blood with their powerful apparatus of lancets in the mouth. But Virgil was a naturalist as well as a poet, and he knew well that the effects which he has described were not caused by a Tabanus, but by an Œstrus. A more correct translation of the passage is given by Kirby and Spence:—

> Through waving groves where Selo's torrent flows,
> And where, Alborno, thy green ilex grows,
> Myriads of insects flutter in the gloom,
> (Œstrus in Greece, Asilus named at Rome)
> Fierce and of cruel hum. By the dire sound,
> Driven from the woods and shady glens around,
> The universal herds in terror fly;
> Their lowings shake the woods and shake the sky.

Now this is precisely the effect which the presence of a female œstrus (*Hypoderma*), buzzing about to deposit her eggs, has upon a herd of oxen. Terrified, with their tails in the air, or stretched out stiffly at full length, they gallop about the fields, resting only when they can make their way into a neighbouring

pool of water, where they are safe from the attacks of the insect. But the most curious part of the subject is, that this dread is merely instinctive. The œstrus inflicts no pain whilst in the act of depositing its egg, for it now seems decisively proved that the old account, that the ovipositor of the insect was capable of inflicting, and in fact inflicted, a wound for the reception of each egg, is unfounded, and that the eggs are merely glued by the out-stretched ovipositor of the female fly upon the hair of the back of the ox. No sooner is the larva hatched than, according to Mr. Bracy Clark, it burrows into the skin, and soon forms around itself a bump or protuberance upon the animal's back—a place, as Reaumur observes, where food is found in abundance, where it is protected from the weather, where it enjoys at all times an equal degree of warmth, and where it finally attains maturity. Reaumur has given a very detailed account of the habits of this insect; but admits that he never saw a female deposit her eggs, so that his supposition as to the parent fly piercing the skin of the ox does not rest upon direct observation, and is contradicted both by the texture of the ovipositor itself, and the statements of Mr. Clark. These larvæ are called warbles or wurmals, their habitations increasing in size according to the growth of the inclosed larvæ; the largest are nearly an inch and a half in diameter at the base, and about an inch high; they are scarcely perceptible externally during the winter, but attain their full size by the beginning of the summer. It is necessary that the tumour should have an orifice for the supply of air to the larva, and the situation of the spiracles is precisely that which is most admirably adapted for the nature of the habitation of the insect; had the spiracles been disposed along the sides of the body, as is their general situation, it would have been necessary that an open space should have been maintained around the body of the insect, but they are placed at the hinder *extremity* of the body, which is kept constantly applied to the orifice, which it exactly fits, and by this means not only is the aperture closed but a supply of air is maintained, and the head of the insect is placed at the greatest distance from the surface, and consequently most deeply into the flesh, where of course it obtains a great supply of food, which consists of pus, or matter secreted in consequence of the irritation produced by the insect. It is commonly upon the young cattle of two or three years old that they are found; they seldom attack old animals. The number of bumps upon an ox is various; in some not more than three or four are to be found, whilst in others as many as thirty or forty may be discovered. They are generally placed near the spine, but sometimes upon the thighs and shoulders; sometimes they are far apart, whilst occasionally several of them are so close as to touch each other. It must be evident, that if these larvæ fed upon the flesh of the beast the presence of so great a number must be attended with the greatest pain and suffering, but so far is this from being the case, that it would appear that they do the ox no material injury, and occasion none or but very little pain; indeed cattle most covered with bumps are not considered by the farmer as injured, the warbles being regarded as proof of the goodness of the animal, since these flies attack only young and healthy oxen. The tanners also prefer those hides which have the greatest number of warble holes in them, which are always the best and strongest.

The œstrus of the sheep which, from its larva inhabiting the frontal sinus of that animal, has been appropriately formed into the genus *Cephalemyia* by Latreille, is of a smaller size than the foregoing, being not more than five lines long, and of a greyish colour. The dread produced by the presence of this insect is exhibited in a different manner to that caused by the ox œstrus. The sheep shake their heads and strike the ground violently with their forelegs, or, running away, get into ruts, dry dusty spots, or gravel pits, where, crowding together, they hold their noses to the ground. The object of all this is to prevent the œstrus from depositing its eggs in the inner margin of the nostrils, whence the larvæ, when hatched, ascend into the head, feeding in the maxillary and frontal sinuses on the mucilage there produced. When full grown they fall through the nostrils, and assume the pupa state on the ground. The *Œstrus trompe*, of Fabricius, inhabits the same situations in the rein-deer.

It appears certain, from numerous recent observations, either that there is a species of this family appropriated to man, or that, under certain circumstances, man is attacked by some of those insects which ordinarily infest quadrupeds. Gmelin, indeed, has introduced a species into the Systema Naturæ, under the name of *Œstrus hominis*, with the observation, "Habitat larva in America Australi per sex menses sub cute hominum abdominali, turbetur profundiùs penetrando periculosa, adeo ut fertur, lethalis; imago muscæ domesticæ magnitudine." The larva of this insect is found in South America, where, for a period of six months, it burrows beneath the skin of the abdomen of the inhabitants, penetrating deeper when disturbed, so as to become very dangerous, and, as it is said, to cause death, the imago being of the size of the domestic fly. Latreille also states, that M. De Humboldt noticed, in South America, Indians whose bellies were covered with small tumours, produced, as he supposed, by the larvæ of an œstrus, most probably belonging to the genus *Cuterebra* of Clerck. The same statement is also made in the Essai sur la Geographie des Plantes, p. 136, by Humboldt and Bonpland. See also the Bulletin des Sciences Naturelles, 1823; the 27th number of the Magazine of Natural History; the Annales de la Société Entomologique de France for 1833 (wherein is a valuable memoir by M. Geoffroy Saint Hilaire), and the Medical Journal for 1835; in which works various notices upon this subject are to be found, but of which want of space compels us to omit further notice.

The family is divided by Latreille as follows:—

A. Proboscis distinct, but very small and retractile. genera *Cuterebra* and *Cephenemyia*.

B. Proboscis wanting.

a. Palpi two. *Œdemagena* (*Œstrus tarandi*).

b. Palpi wanting.

Genera *Hypoderma*, Latreille (*Œstrus bovis*); *Gasterophilus*, Leach (*Gastrus*, Meig.; *Œstrus*, Latreille; *Œstrus Equi*); *Cephalemyia* (*Œstrus ovis*).

OIL NUT is the *Hamiltonia oleifera* of Muhlenberg, a genus belonging to *Santalaceæ*, formerly the *Pyrularia pubera* of Michaux.

OLACINEÆ. A small natural order of plants, containing four genera and six species. The genera are *Olax*, *Spermaxylon*, *Heisteria*, and *Ximenia*. The *Olacaccæ*, as this order is called by some authors, are arborescent plants, with alternate entire simple leaves; sometimes the foliage is abortive, and the stipules are

always absent. The inflorescence is axillary, and the flowers small, unsymmetrical and united, or, by abortion, polygamous. The calyx (?) is small, entire, or slightly toothed, and often becoming enlarged or fleshy. The corolla of from four to six hypogynous petals, which are separate or connected in pairs through the intervention of the filaments. The stamens are definite, part being sterile in the form of hair-like nectarines, opposite or attached to the petals, and coherent with them by the filaments. The germen is free, and one-celled. Style filiform, and stigmas from three to four. The fruit is sub-drupaceous, indehiscent, and often invested by the persistent fleshy calyx or involucrum. One-celled and one-seeded.

Of the properties of these plants there is very little known: some are esculent, and all, as far as experience goes, innocuous. *Olax Zeylanica* is used in Ceylon as a pot-herb, and also as a salad: it is there called *mæla-hola*, which signifies salad-tree, whence its generic name, which is more probably a corruption of *hola* than a misapplication of ὁλαξ.

The fruit of *Ximenia Americana* is eatable. It is about the size of a pigeon's egg, of a yellow colour, and has a sweetish subacid flavour. *Heistera coccinea* is the "bois perdrix" of the French colonists in Martinique, and it affords the partridge-wood of European cabinet-makers.

Decandolle, Lindley, and other botanists, are not decided whether the genera associated under this title really deserve to be made a separate order, as all of them may be fairly referred to other and well-established orders. They are all increased by cuttings.

OLEINÆ, or OLEACEÆ. A generally cultivated natural order of trees and shrubs, containing eleven genera and one hundred and twenty-four species. The genera are: *Fraxinus*, *Ornus*, *Chionanthus*, *Millingtonia*, *Linociera*, *Fontanesia*, *Notelæa*, *Olea*, *Phillyrea*, *Ligustrum*, and *Syringa*.

The *Oleaceæ* have aqueous juices, erect or climbing stems; their leaves are opposite, petiolate, simple, seldom ternate or pinnate, and destitute of stipules; the inflorescense is paniculate, and the flowers regular and united, or sometimes, by abortion, polygamous; the calyx is free, disk absent, corolla hypogynous; the stamens, two in number, are hypogynous when the corolla is absent, epipetalous when it is present, being exserted from its tube, alternate with its lateral lobes, or, when tetrapetalous, connecting the lateral petals in pairs; the filaments are free, anthers two-celled, opening laterally by longitudinal clefts; the fruit is drupaceous, baccate, or capsular; the seeds erect or pendulous; and the albumen fleshy or horny.

Among the most important genera for ornament are the lilac, phillyreas, and different varieties of ash; and of the most useful is the olive, the fruit of which abounds in a bland fixed oil. This oil is expressed from the fleshy pericarp, the olive being one of the several, yet few, exceptions to the general rule of fixed oils, being obtained from seeds alone. The olive grows freely in the south of Europe; and, although it does occasionally bear fruit in this country, the crops would be too scanty and uncertain to allow an extensive cultivation. Our chief supplies of olive oil are obtained from Italy, especially from Florence and Lucca; but that from Provence is of superior quality. In Spain and Italy this oil supersedes the use of butter; hence its consumption in those countries is far greater than amongst us, our annual imports averaging only a little more than two million gallons. Besides the oil, the unripe fruit of the olive is pickled and eaten on the Continent to provoke an appetite. Here olives are taken after dinner to cleanse the mouth, so that the flavour of the wine may be the more enjoyed.

Ornus Europæa is the manna-ash. This and the other species yield that peculiar saccharine cathartic known in medicine under the name of manna; chiefly brought from Calabria, where the trees abound.

The plants of this order are chiefly increased by grafting or budding, and sometimes by layers and cuttings.

OLIVE WOOD is the *Elæodendron orientalis* of Jacquin: East Indian and Australian trees and shrubs, belonging to *Celastrineæ*.

OMALIUM (Gravenhorst). A small genus of rove beetles (*Brachelytra*), forming the type of the sub-family Omalides (*Omalidæ*, MacLeay). See BRACHELYTRA.

OMASEUS (Zeigler). A genus of coleopterous insects, belonging to the family *Carabidæ*, and sub-family *Harpalides*, the true type of which is the *Carabus melanarius*, a very common English species, in which the wings are rudimental, the thorax with the hinder angles acute, margins incrassated, mandibles striated, body oblong, depressed, and anterior tarsi with three dilated joints in the males. There are eight or ten British species, found chiefly under stones, moss, &c.

OMOPHRON (Latreille; SCOLYTUS, Fabricius). A small but very interesting genus of coleopterous insects belonging to the family *Carabidæ*, but differing from the majority of those insects in the form of the body, which is nearly orbicular and convex above, the thorax, very short, and the scutellum not visible. The basal joint of the tarsi is alone dilated in the males. The species are but few in number, and frequent the margins of water in Europe, North America, Egypt, and the Cape of Good Hope. In this respect, as well as in the form of the body and of the larva, this genus is regarded as the connecting link between the hydradephagous and geodephagous predaceous beetles.

OMPHALEA (Linnæus). A genus of West Indian trees, belonging to the natural order *Euphorbiaceæ*. Generic character: flowers in panicles and monœcious; calyx in four parts, divisions concave and obtuse; corolla none; stamens, the filaments dilated above; anthers two-celled; style thick; stigma somewhat trilobed; fruit of three berries; seeds hemispherical. This is a stove exotic, and thrives in light soil, and may be increased by cuttings.

OMPHALOIDES (Lehmann). A genus of annual and perennial herbs, having pentandrious flowers, and belonging to *Borragineæ*. The Venus navelwort is a common flower-border annual seen in every garden.

ONAGRARIA. A natural order, containing fourteen genera and one hundred and forty-six species, already described and named. This, says Lindley, is a well-defined order, generally known by its pollen cohering, by a sort of filamentous substance, an inferior polyspermous ovarium, a four-sepaled, four-petaled flower, with a definite number of stamens and a single style. They are all innocuous plants, but more celebrated for the beauty of their flowers than for their medical or economical importance.

Many of them, such as the *Fuchsia, Epilobium, Gaura, Clarkia*, and *Lopezia*, are highly ornamental plants. *Montinia acris*, which is remarkable for having albuminous seeds, likewise deviates from the other genera in having an acrid fruit. Of the *Epilobia*, or willow herbs, the *E.* or *Chamnerion angustifolium* is said to produce a kind of intoxication, or to stupify those who drink a decoction of the stems and leaves; and hence perhaps the reason why it is added by the Kamtschatdales to "enrich the spirit" they prepare from the cowparsnep. The pith when dried becomes sweet, and the same people brew from it a kind of ale, and also procure their vinegar. The young shoots of this and other species are also eatable, when dressed in the same manner as asparagus. The *Epilobia* are valuable for shrubberies, growing in the shade, and remain unhurt among the smoke of large towns. The leaves of *Jussieua Peruviana* are esteemed in America for making good emollient poultices. *Circœa*, the enchanter's nightshade, is a common British plant, and though it bears an ominous name, being named after the famous enchantress Circe, it is an entirely innocuous plant. All the genera are increased by cuttings or seeds.

ONCIDIUM (Swartz). A beautiful genus of South American perennial herbs, bearing gynandrious flowers, and belonging to the natural order *Orchideæ*. This, like many of its congeners, is found growing on the stems of trees in thick shady and damp woods of Brazil and other parts of South America. In our collections the species are grown in moist stoves kept at a high temperature; and, to imitate their natural habitat, are fixed to a rugged branch of a tree among moss, and outer shells of the cocoa-nut nailed round to form a bed for the roots. They are increased by division of the roots.

ONION is the *Allium cepa* of Linnæus, a well-known culinary vegetable. Garlic, and onions of various kinds, were highly esteemed in Egypt, and, according to Hasselquist, not without reason. He conjectures that the *A. cepa*, which is still used in that country in amazing quantities, and forms a most delicious food, is one of the species of onion after which the Israelites longed when in the wilderness. He says—"Whoever has tasted onions in Egypt will allow that none can be had better in any part of the universe. Here they are sweet, in other countries they are nauseous and strong; here they are soft, whereas in the northern and other parts they are hard, and the coats so compact that they are difficult of digestion. Hence they cannot be eaten in any place with less prejudice and more satisfaction than in Egypt."

It was probably an assumption of austerity and show of self-denial which caused the Egyptian priests to abstain from the use of onions as food, and this subsequently led to the superstitious reverence with which, by the bulk of the people, they were regarded. Lucian, when giving an account of the different deities worshipped in Egypt, states that the inhabitants of "Peluseum adore the onion." The Egyptians, indeed, were commonly reproached for swearing by the onions and leeks in their gardens; for Pliny says—"Allium" cepasque inter Deos in jure jurando habet Egyptus," an absurdity which did not escape the scourge of Juvenal:—

> "O sanctas gentes quibus hæc nascuntur in hortis Numina."
>
> "Religious nation, sure, and blest abodes,
> Where every garden is o'er-run with gods."

But, while some of the people did not dare to eat leeks, garlic, or onions, for fear of injuring their gods, others fed on them with enthusiasm, excited by the zest of appetite, if not by religious zeal, if we may judge from the distich which declares that

> "Such savoury deities must sure be good,
> Which serve at once for worship and for food."

ONISCUS (Linnæus). A genus of apterous insects, belonging to the class *Crustacea*, order *Isopoda*, and forming the type of the family *Oniscidæ*, in which the body is of an oval or hemispherical form, with four antennæ, the intermediate pair being very small, and only two-jointed. The abdomen is six-jointed, and very short, with two or four terminal styles, and without any lateral swimming plates; some of the species of this family are aquatic, whilst others are terrestrial, and the modifications which the organs of respiration undergo in those different species are very interesting. The restricted genus *Oniscus*, of modern authors, comprises only terrestrial species, being confounded with the *Glomeris marginata*, under the common name of wood-lice. They have eight joints in the lateral antennæ, the base of which is not exposed; the two external appendages of the tail are much larger than the two interior. They frequent dark and retired situations, such as cellars, caves, the cracks of walls, &c. They are also fond of burrowing into rotten window-sashes, beams, decayed trees, &c. They feed upon vegetable and animal matter in a state of decay, appearing abroad only in rainy or damp weather. They creep slowly, and are easily alarmed; the eggs are enclosed in a pectoral pouch, in which the young are hatched, these, at their birth, are deficient, wanting one segment and a pair of legs, which they afterwards acquire. The typical species *Oniscus asellus*, Linnæus, is very abundant, and commonly called pigs'-louse, wood-louse, &c. It was formerly employed in medicine, and was supposed to cure agues, consumptions, &c.; but it has now, like many other similar medicines, been expunged from the Pharmacopœia. The writer has observed, that the young of the common species, whilst very small, and of a white colour, frequents the nest of the brown garden ant, with which it lives in perfect harmony. Mr. Knapp has noticed the same thing in the nest of *Formica flava*. He says, "some of these ant-hills contained multitudes of the young of the wood-louse, inhabiting with perfect familiarity the same compartments as the ants, crawling about with great activity with them, and perfectly domesticated with each other; they were small and white, but the constant vibration of their antennæ, and the alacrity of their motions, manifested a healthy vigour, although the ants at the same time were in a torpid state."—Journal of a Naturalist, p. 304.

ONOBRYCHIS (Tournefort). A genus of herbaceous plants, chiefly natives of Europe. The flowers are diadelphous, and belong to the natural order *Leguminosæ*. Several of the species were ranked as hedysarums by Linnæus, and of them the type of the genus is the well-known agricultural plant called saintfoin. On chalky loams this plant is a useful one to the farmer when the season for making the crop into hay is favourable. It is fit for the sithe as soon as any of the clovers (except, perhaps, the scarlet trefoil), and its hay is prized above that of all other plants; but one shower of rain upon it, after it is cut and withered, spoils it entirely, so that it is not so generally cultivated as it otherwise would be,

more especially since our summers have been so very unsettled. Saintfoin hay is preferred for fatting deer by the park-keepers, and always commands the highest price in the hay-markets. It is also a useful pasture plant, particularly in dry summers, its deep-running root reaching moisture when other shallow-rooting plants are burnt up. Saintfoin should not be grazed late in the spring, lest the points of the strongest shoots be nibbled off.

ONONIS (Linnæus). An extensive genus of annual and perennial trailing herbs and undershrubs, natives of Europe and Southern Africa. The flowers are beautiful, and monadelphous and bearing pods belong to *Leguminosæ*. One, the *O. spinosa*, is a British plant, and known by the name of Rest-harrow. None are in cultivation.

ONOPORDIUM (Linnæus). A genus of European herbs, chiefly biennials, belonging to *Compositæ*, and in English lists are called cotton-thistle. *O. acanthium* is a British plant, which, together with some of the continental species, being stately plants, are admitted into our shrubberies.

ONOSMA (Linnæus). A genus of half-hardy herbaceous perennials, bearing pentandrious flowers, and belonging to *Borragineæ*. Generic character: calyx in five parts; corolla tubular or bell-shaped; stamens included or equal with the corolla; anthers broad at the base; nuts oval and stony. These are handsome plants, and thrive in rich light soil; a few should be kept in pots, and placed in a frame during hard frost.

ONTHOPHAGUS (Latreille). A genus of lamellicorn beetles of very great extent, belonging to the family *Scarabeidæ*, distinguished by wanting a scutellum, as well as the third joint of the labial palpi; the legs are short and robust, with the tibiæ somewhat triangular; the body is short, with the thorax thick, broader than long, orbicular or semicircular, and incised in front. The head, and often the thorax, are armed with horns or spines in the males. The species are of small size, and are found in the excrement of various animals. Their colours are often obscure. The *Scarabeus taurus*, Linnæus, belongs to this genus, and is remarkable for the two strong curved horns on the head of the male, which resemble those of a bull. A single individual of this species has been found in the New Forest in Hants. There are ten British species.

ONYX. This is one of the forms of the common calcedony, and it is usually marked by an alternation of white, black, and dark brown layers. The ancients attributed wonderful properties to the onyx stone, and imagined that it would cure many diseases if worn on the finger, and on this account it sometimes fetched enormous sums.

OPAL. There are few minerals that have been more highly valued than this gem. The principal colour of the common opal is white and semi-transparent, with a brilliant lustre. The fire opal on the contrary is of a hyacinth-red colour, and both kinds are found in every part of the world. Wood opal is the only other species of this mineral that is usefully employed. It varies considerably in its colour, and, as its name implies, much resembles the branches of trees. It is principally found in Hungary, and, when cut into plates, is employed by the jeweller and lapidary.

OPATRUM (Fabricius). A genus of small heteromerous beetles, generally found in sand-pits, and belonging to the family *Tenebrionidæ*. The *Silpha sabulosa*, Linnæus, is the type. The body is sub-depressed, the antennæ short, with the terminal joints broader and transverse, the anterior tibiæ sub-triangular. These insects are of black or obscure colours, and feign death when alarmed.

OPERCULARIEÆ. A small natural order of plants comprising only two genera, viz., *Opercularia* and *Cryptospermum*; exotic weeds nearly allied to *Rubiaceæ* and *Valerianeæ*.

OPETIORHYNCHUS. A genus of American birds, with anisodactylic feet, resembling the bee-eaters in some of their habits, but differing greatly from them in others. Their characters are: the bill longer than the head, straight, or but slightly curved, and but very slender, depressed at the basal part, but compressed at the tip, which is awl-shaped; they are not wild and solitary birds, and one rarely meets with them in any other situation than in pairs. They fly about houses, and often enter them, and they are seldom met with in the depth of the close forest. Their wings are short, and their tail is also short, wedge-shaped, and feeble. They are therefore not well adapted for long flights; but they stand high on the legs, and thus are well adapted for walking. Their nests are constructed something in the form of ovens, for which reason they have been termed oven-birds by some naturalists. These nests are indiscriminately placed against large branches of trees, the corners of windows, gate-posts, and various other means of support. The nest is of a hemispherical shape, formed entirely of soft mud by the labour of the birds. The interior of this nest is about six inches in diameter, and divided in the middle by a partition, through which an opening is left for the passage of the bird from the one chamber to the other. It is understood that the inner chamber is the one in which the incubation is carried on, and it is bedded with soft vegetable matter, in order that it may better answer this purpose. The eggs are four in number, nearly white in the ground, and marked with small reddish dots. Some of the species construct nests; and it is astonishing that so small a bird should construct this kind of nest, and make it so firm in its texture as that it will bear to be agitated by the rude winds at the end of a flexible branch. In order to give this consistency to the large pendent nests, vegetable fibres are intermixed with the other materials, and very firmly worked or matted together. The large nests are usually divided into a number of chambers to which there are various openings. The partitions which divide these chambers from each other, answer another important purpose besides mere convenience to the inmates. They bind the structure together, much in the same way as a house is bound together by the wooden framing of the floors and partitions. We cannot suppose that the birds have the slightest tendency to *contrive* those partitions for the strengthening of their fabrics; but still this does not lessen the extraordinary fact, that instinct should be able to accomplish, without any contrivance, far more nice, and even far more scientific structures, than man can frame, notwithstanding the use of observation, and reason, and the help of scientific investigation. But we must not wonder at this; for there is not a single part in the structure of any animal, or any plant, or in the distribution of any one portion of mineral nature, which does not, when properly improved, tend to lay the whole fabric of man's boasted science in the dust, and send him to school

to the very humblest thing in the whole operations of nature. But while we are thus humbled in the unjustifiable part of our vanity, by what appears to us as a spontaneous evolvement without design, so greatly excelling all that we can possibly design, there is still room for us to feel the warmest gratitude for the goodness of our Creator in placing us in that situation which we do occupy. All the other creatures, how curiously soever they may carry on their operations, are still ignorant of the fact, that those operations are curious, and they may truly be said to have "no part or lot in the matter," and nothing like intellectual pleasure when their labour is performed. We bear our part, and we enjoy the pleasure; and, therefore, this is more than a compensation to us for those failures which naturally, and almost necessarily occur in our peculiar kind of practice, though of course they are altogether avoided by those creatures which entirely depend on a higher power.

In the curious nests of some species of these very interesting birds, only one of the apartments which are partitioned off is destined for the eggs and the hatching of the brood. The other apartments are not, however, without their use; and there is something very pleasing in contemplating the use to which they are applied. They are a sort of play rooms for the young birds, in which they are enabled to exercise their limbs, which are with them by far the most essential organs of motion, so as to have acquired the requisite degree of strength, before they have the accommodations of the maternal dwelling.

Some provisions made in this way by the birds, and even by insects, so far exceed what human beings can do, that did we not consider from whom they originate, they would be among the especial wonders of the world, all wonderful as it is. But when we reflect on the natural laws according to which the whole system of nature is carried on, we cease to wonder at the matchless superiority which they display. These are all direct results of a Wisdom which is complete in everything which respects the materials, the structure, and the office which that structure is to serve, whereas we are originally in total ignorance upon all these points; and though we learn ever so long, and with ever so much diligence, still our learning reaches only a very little way, how far from perfection we cannot know in any case, but with most, or, indeed, with all of us, it may be said to be but a mere beginning. There is no department of nature in which we may receive lessons at once calculated to correct that self-sufficiency which tends to make us rest contented in our ignorance, and to produce a thirst for knowing more, than the study of birds, which are so much before our eyes, and which perform such singular labours. The present genus, from its familiarity, is one well calculated for the instruction of those who inhabit the countries that it frequents. Three principal species are mentioned, all American, and not spending the summer, at least, in the very hottest parts of that continent. Their names and appearances are as follow.

O. rufus is a native of the southern parts of the United States. The upper parts are russet-brown, and the top and sides of the head dark brown. Over the eyes there is a yellowish-brown streak; and this also is the colour of the upper side of the wings, which are, however, traversed by a band of russet. The quills are reddish-brown, and so are the flanks. The under part is whitish, the bill brown on the upper part and whitish on the under, and the feet black. In its plumage this is but a homely bird; but its appearance is pleasing.

O. annumbi. This species is a little larger than the North American one, being seven inches and a half in length. It is reddish-brown, spotted with black on the upper part. bright brown on the forehead, and deeper brown on the top of the head and upper part of the neck. The coverts of the wings and the smaller quills are clear brown, and the primary quills bright reddish-brown. The sides of the head are whitish, with a brown streak behind the eye. The throat is white, with a brown streak descending from each angle of the gape, the under part mottled with brown and white. The under coverts of the wings shining white, clouded with reddish. The lateral feathers of the tail are black with brown borders, and a white spot upon the tip of each. The two middle ones are clear brown, the bill reddish-brown, and the feet olive. In its colour this is a much more handsomely-formed species than the last; and it is described as being exceedingly numerous in some of the provinces along the river of Paraguay and its affluents.

O. ruber is also a species of Paraguay, and larger than the preceding one, measuring fully eight inches in length. It is also the most gaily coloured of the whole. The upper parts are russet-brown; the sides of the head brown; the wing coverts carmine-red; the larger coverts deeper red with blackish tips; and the quills reddish-purple. The under parts are white, forming a fine contrast with the bright colours of the upper parts. The feathers on the head and upper part of the neck are stiff, with the shafts projecting a little beyond the webs in small points, which give these parts something of the appearance of being composed of a mixture of feathers and bristles. The bill is blackish above and whitish on the under side, and the feet are greenish-brown.

With the exception of colour, and partially also in size, all the species of these birds resemble each other very closely; while the peculiarity of their manners points them out as a well-defined and strongly-marked genus.

OPHICEPHALUS—Serpent Head. A genus of spinous-finned fishes, with cells on the bones of the pharynx fitted for retaining water, so that the fishes can travel for considerable distances and climb up trees, still retaining enough of water to moisten their gills. Their bodies are lengthened and nearly cylindrical. Their muzzle is short and blunt, and their head is depressed and covered with large polygonal plates, resembling the scales on the heads of serpents, from which they have obtained their name. They have six rays in the gills; their dorsal fin extends their whole length. Their anal fin is also long, and the termination of the caudal is rounded off. They are chiefly found in the fresh waters of India, where some of the species grow to the length of four feet, while others do not exceed ten inches in length. The small ones are often exhibited as curiosities in India, from the length of time that they can creep about on dry ground, and the heights to which they can climb. The species are rather numerous, and they are highly characteristic of countries where fishes' food is abundant during the floods, and where the fishes themselves require to follow the ebbing off of the waters when the dry season sets in.

OPHIDIA, from Ophis, a snake. The fourth order into which Cuvier divides the class of reptiles,

and which includes all the serpents and snakes, whatever be their nature or their modes of life. They are animals of obscure habits, and principally confined to the warmer climates of the world; and they are the only vertebrated animals which have a distinct apparatus for infusing venom into wounds, and thereby occasioning the death of most animals which they bite, and severe pain to all animals. Their general relations will be pointed out in the articles REPTILE and SERPENT.

OPHIDIUM. A genus of fishes, belonging to the soft-finned ones, which are without ventral fins, and have the body eel-shaped. The body is lengthened and compressed, so that it has been compared to a sword in shape. The scales are very small, and closely embedded in the skin. But though in their general form they very much resemble the eels, yet they differ considerably from them in the structure of their gills, which are open, so that the fishes have more free motion in the water, and cannot live so long when removed from it. The species best known are natives of the Mediterranean. One small species is flesh-coloured, with small black spots on the dorsal and anal fins. Another is larger, of a brown colour, without any spots on the fins, which last one is reckoned very wholesome food. Others are found on the shores of Brazil and in the South Sea, in the last of which there is one of large dimensions, rose-coloured in the ground, and spotted with brown. All these have appendages to the under jaw, of greater or less length in the different species; but there are others which want these appendages, and also have the dorsal fin nearly obliterated. The largest one is found near the coast of New Zealand, six feet in length: they are much esteemed as food. Their history is very obscure.

OPHION (Fabricius). A genus of parasitic hymenopterous insects, belonging to the family *Ichneumonidæ*, having the ovipositor of the females scarcely exserted, the abdomen compressed and sickle-shaped, the antennæ filiform or setaceous, the second cubital cell of the upper wings is very small or obsolete. The type of the genus is the *Ichneumon luteus*, Linnæus. It is of a reddish-yellow colour, and about three-fourths of an inch long. It often flies into lighted rooms at night. The female deposits her eggs upon the caterpillar of the puss-moth (*Cerura vinula*), being attached at the extremity of a long and slender footstalk. When hatched they reside outside the body of the caterpillar, with the extremity of their bodies placed in the pellicle of the egg, from which they have burst forth. After the caterpillar has spun its cocoon, it is so much exhausted by their attacks, that it soon dies; the parasites then spin their own cocoons within the cocoon of the dead caterpillar, and soon afterwards make their appearance in the winged state. Mr, Curtis observes respecting this insect, "It has struck me as very remarkable, that one often can obtain only one sex of *Ophion* from an infested larva, although a considerable number may be hatched; having observed this several times, it can scarcely be accidental. I am therefore inclined to think that one sex appears before the other, and that the eggs of each are deposited separately in different caterpillars."—British Entomology, No. 600.

OPHIOPOGON (Ker). A genus of two curious herbaceous plants from China, belonging to *Smilaceæ*. Generic character: calyx corolla-like, half superior, limb six-cleft, spreading; stamens above the germen, filaments short, anthers erect, long, heart-shaped; style three-sided; stigma three-lobed; berry three-seeded. These plants grow freely in any light rich soil, and are increased by dividing the root.

OPHIORHIZA (Linnæus). An East Indian undershrub, called in that country *Mungos*, and in China *Chyn-lcn*, bearing pentandrious flowers, and belonging to *Rubiaceæ*. Its rhizoma or underground stem is called by druggists snakeroot, and is a very strong bitter, highly valued in China. In our stoves the plants are grown in loamy moor-earth, and are increased by cuttings.

OPHRYS (Linnæus). A genus of tuberous-rooted herbs, chiefly natives of European meadows, belonging to the class *Gynandria*, and natural order *Orchidcæ*. The curious forms of these flowers have gained for them provincial names, by which in common language they are known. One is the bee, another the drone, one is the fly, another the spider, ophrys, &c. The flowers are more curious than showy, but are all admirable, whether in their wild state or in botanical collections. The best artificial soil for them is a mixture of chalk, loam, and moor-earth, but when so cultivated, they require protection as well from long continued rain as from hard frost.

OPILO (Latreille; NOTOXUS, Fabricius). A genus of coleopterous insects, belonging to the family *Cleridæ*, having all the palpi terminated by a large hatchet-shaped joint, the antennæ gradually thickened to the tips, the intermediate joints being of a conical form. These are pretty insects, generally of considerable rarity, one species only being found in this country (*Attelabus mollis*, Linnæus), which is met with under the bark of old trees where the larva has fed upon other wood-boring larvæ.

OPUNTIA (Haworth). A genus of succulent undershrubs, commonly called Indian fig from the form of their fruit. The flowers are icosandrous, and the genus belongs to the natural order to which it gives a title, viz.

OPUNTIACEÆ, or CACTEÆ. A natural order containing nine genera, and one hundred and fifty-six species. They are all succulent plants, destitute for the most part of leaves, the place of which is supplied by fleshy stems of the most grotesque shape: some angular, and attaining the height of thirty feet; others roundish, covered with stiff spines like the hedgehog, and not exceeding the height of a few inches. Their flowers are in many cases large and remarkably specious, varying from pure white to rich scarlet and purple, through all the intermediate gradations of colour. The species are chiefly natives of the hottest and driest parts of the tropics, and are cultivated with little care in pots filled with lime rubbish in a dry stove. Their fruit is fleshy and watery, and generally insipid, but it is eaten in their native countries for the sake of its refreshing moisture and coolness. Two species of *Opuntia* are hardy in Britain. The order consists of two tribes, namely, *Opuntiaccæ* and *Rhipsalideæ*. The first contains *Mammillaria*, *Cactus*, *Melocactus*, *Echinocactus*, *Cereus*, *Epiphyllum*, *Opuntia*, and *Pereskia;* the second comprises the genus *Rhipsalis*, Lindley. They are all easily increased by suckers, offsets, or cuttings, the moist base of the cutting being first allowed to become dry before placing in the soil.

ORACHE is the *Atriplex hortensis*, a native of Tartary, and belonging to the natural order *Chenopodeæ*. It was formerly cultivated in our gardens

as a spinacious vegetable, but is now very much out of repute.

ORANGE TREE is the *Citrus aurantium* of Linnæus, an Asiatic fruit, and long cultivated in our greenhouses, but much more for the beauty of the foliage and fragrance of their flowers than for their fruit. The orange is a species or variety of a very numerous family, including the lime (whence perhaps the whole have sprung), lemon, citron, orange, and the shaddock, of all of which there are innumerable varieties. The lime is the smallest, and found wild in the jungles of India. The shaddock is the largest, but much inferior to the orange. The lemon is most used for medical and culinary purposes. The *C. Paradisi* is a variety called the "forbidden fruit," from its size and beauty, but is inferior to the best oranges. We have the following imported sorts, viz., the common sweet, the China, the Majorca, the Nice, the Genoa, the Portugal, the Malta or blood-fruited, the St. Michael's, and the Oporto or pipless pot oranges. There is also the Seville orange of inferior quality for the table, but they are extensively used for other purposes. We have orangeries in this country, in which the fruit is brought to the greatest perfection; but the imported fruit, being so plentiful and cheap, renders glass covered buildings less necessary for the culture of oranges.

ORCHIDEÆ. One of the most natural and well-defined orders in the vegetable kingdom. In the latest published lists there are above one hundred and fifteen genera, and four hundred and thirty species enumerated, to which we are every day adding new genera and many new species, chiefly from South America. The *Orchideæ* are chiefly perennial and herbaceous plants, some few only being suffrutescent, and in many the stem is obsolete; but to the crown of the root, one, two, or more fleshy tubers are attached, which contain the buds that are to form the plants of the succeeding year; in others the tubers are bundled or composed of thick fibres; in others again the above-ground stem is enlarged and succulent; many of them are epiphytic, as the *Epidendreæ* and *Vanillæ*.

The leaves are simple and entire, alternate, either sheathing or articulated, with striated veins, and occasionally degenerating into scales.

The perigonium consists of six pieces, mostly petaloid, and arranged in two series. The sepals of the calyx are in general similar to each other, the odd one being uppermost; the petals of the corolla vary in form; the upper petal, which by the twisting of the ovarium becomes apparently the lower, is called the *lip* (labellum), as the two lower sepals, which become from the same cause uppermost, are named the *helmet* (galea). The lip, which is often lobed and assumes a great variety of forms, likened to men, monkeys, flies, butterflies, bees, &c., has been called by some persons the nectary. The stamens are three in number, becoming by abortion two or one, and, united with the pistil, forming a fleshy column, called the *gynostεme*, which surmounts the ovary; and hence these plants have been termed *epigynous* by Jussieu, and *gynandrous* by Linnæus. On the apex of the gynosteme there is found, in the *Orchideæ*, a two-celled anther; and on either side an eminence (*staminoida*) marking the abortion of the other two, which remain in a rudimentary state in all the type named, from orchis, the *Orchideæ*, and which are placed by Linnæus in his order *Monandria* of the twentieth class.

In front of the single anther in *Orchis*, and rather before and between the two anthers in *Cypripedium*, there is a secreting cavity, which is the naked stigma of the pistil, the other part of which is blended with the stamens in the gynosteme. The pollen contained in the anthers is sometimes pulverulent and free, but more frequently waxy or granular, with the grains cohering in masses, which are called sectile masses; these have often prolongations, called *caudicula*, by which they are attached to a viscid gland that has been named *retinaculum*.

The fruit in the *Orchideæ* is capsular; seeds small and many; their reversed gynandrous flowers and coherent pollen distinguish them from other sections. The *Orchideæ* have the flowers monandrous and the germen one-celled. The *Cypripedieæ* have diandrous flowers, and germen one-celled; and in the section *Apostasiaceæ*, the flowers are diandrous or triandrous, the anthers discrete, and the germen trilocular.

The *Orchideæ* are more prized for their beauty and the strangeness of their flowers than for any very important dietetic or medicinal properties they possess. The tubers, however, of some of them contain farinaceous matter which is nutritious. The substance known by the name of *salep* is made of the tubers of some of the English species of orchis. It used to be sold at the corners of the streets in London, and was a favourite drink of hard-working people; and it is highly esteemed both in Turkey and Persia, under the name of *sahleb*.

Vanilla is the produce of the *V. aromatica*, the old *Epidendrum vanilla*. This plant is a climbing epiphyte, growing in both Indies, and its root is used for flavouring chocolate, and also for perfuming snuff.

So many of the *Orchideæ* are now in our collections that houses are specially erected for their preservation and culture, almost all the tropical species requiring a strong moist heat. Some of their flowers are most splendid, and all are remarkably curious and some are delightfully fragrant.

The habitat of many *Orchideæ* is on the trunks and branches of trees, though they are not parasites, their food being chiefly extracted from moist air. Hence their culture is difficult, as the roots require very peculiar media to expand in, and these are particularly liable to be preyed on by woodlice.

ORIOLE (*Oriolus*). A genus of omnivorous birds which, in the older systems, included a great many species both of the eastern continent and of America. Further discoveries have led more modern ornithologists to separate them, and form the American ones into a group consisting of two genera, of which some notice will be given in the article TROUPIALES. In consequence of this, the genus *Oriole* is now restricted to birds of the eastern continent, to all of which the same generic characters apply much better than they do to the western ones. There is one external appearance which is rather striking in these birds, and that is the tendency to have their plumage of a brilliant golden yellow, which is of course the reason of their having been originally termed orioles, the meaning of which is nearly synonymous with golden birds.

The characters of the genus are: the bill in the form of a lengthened cone, compressed horizontally at its base; the upper mandible strengthened by a keel along the ridge, notched toward the tip, and both mandibles with strong tomia or cutting edges; the nostrils are lateral, naked, and pierced in a large

membrane; the feet have three toes to the front and one to the rear, the outer one joined to the middle one at its base; the wings are of moderate length, with the first quill shorter than the second, and the third the longest in the wing.

In some respects the orioles bear a resemblance to the thrushes; but still the differences between them are such that they cannot be brought into one genus. They are more decidedly woodland birds than the thrushes are, and they perch and also build their nests in more elevated places. They also belong to more southerly climates than the thrushes, and are more migratory than the typical species of these. They generally live in pairs, and construct their nests with great neatness, working an external basket of vegetable fibres, which they afterwards line with softer and warmer matters, such as down, feathers, and the substance of spider's webs, the last of which are often found in great abundance, and of no inconsiderable strength, in the places which these birds inhabit.

Their feeding is indiscriminately animal and vegetable; but, when they have recourse to the latter, they prefer such substances as are soft and succulent, such as different sorts of berries. Their animal food consists indiscriminately of insects, small mollusca, and worms. They are all tolerably well characterised both by their expression and by the colours of their plumage. Yellow and black are the prevailing colours of the males; and greenish-yellow and blackish those of the females. The young males resemble the females, and do not acquire the characteristic dress of their own sex until the third year. We shall very shortly notice the leading species.

O. galbula—the European Oriole—is one of the most showy of European birds, though it is rather confined in its distribution, and does not make its appearance in Britain, except as a very rare straggler. On some parts of the continent it is plentiful, however; and it is especially so in Germany, which is, generally speaking, a well-wooded country, and which opens up a passage for birds of an eastern migration, as well as for those which migrate in the direction of the meridian. Those eastern birds are not so ready to come to Britain as the birds of the south, even though they should naturally belong to more temperate climates. Eastern birds find their way across the narrow seas between Europe and Asia Minor; whereas birds that come from the southward of the Mediterranean must take the breadth of that sea in some longitude or other, and there are but few islands on the way to serve them as resting places. Hence we find that the southern bird, after passing over one sea, hesitates much less in taking its flight over another, than a bird which has made the greater part of its journey over land.

The colours on the male bird of the European oriole are fine yellow and pure black. The first occupies both the upper and under parts of the body, with the exception of a little spot of black on each side of the upper mandible above the eye. The prevailing colour of the wings and tail is black, with a yellow spot on the middle of the wing, slight margins of whitish yellow to the tips of the quills, and the tail black with a whitish-yellow border to the feathers, with the exception of the two middle ones. The bill of the male bird is red. The female is olive green on the upper part, and grey mottled with yellow and small black lines on the under part. These birds are so plentiful in Germany and some parts of France, that they are sometimes styled German thrushes. In France and various other parts of the European continent the golden oriole resides during the summer, and breeds there. About the end of May it is seen in the neighbourhood of Paris, and it generally takes its departure about the beginning of September. When they first arrive, they are so fatigued and emaciated that the sportsman finds them an easy prey, for, when they are feeding, he can approach within gunshot of them before they attempt to rise. Soon after their arrival, however, they commence pairing. They pass Malta in September on their way to more southerly climates, and return by the same route to their northerly habitations in the spring. Retzius informs us that they visit Swedish-Finland about the latter end of May, and leave that locality towards the middle of September. There are not many well-authenticated instances of their appearance. Insects, worms, and caterpillars constitute a considerable portion of their food, but they have also a great partiality to cherries, berries, and other sweet fruits. Their nest has the appearance of a shallow basket. It is suspended by the edge from the forked end of some slender twig or branch. It is a remarkably neat and highly-finished structure. The forked ends of two branches are wreathed together with vegetable fibres, the two extremities of the branch being connected for the purpose of forming the base of the nest. The straws are then neatly adjusted and curiously interwoven from one side to the other, and forming a cavity in the centre. As the work proceeds, the structure is thickened with the finer grasses intermixed with mosses and lichens; and, to complete the work, it is finely lined with the most delicate substances that can be procured, such as the silken bags of the chrysalides of moths, spider's webs, and other soft materials. So soon as this luxurious habitation is completed, the female deposits her eggs, which are generally four or five in number. They are of a dirty white colour, mottled with blackish-brown spots, which are thickest at the larger end. The sitting lasts twenty-one days. The parents are very bold and courageous in defence of their young, which they feed on caterpillars, bringing generally not fewer than ten or a dozen of these to the nest at a time. Such is the parental affection of the female for her progeny, that she has been known to suffer herself to be captured rather than abandon her post while in the act of incubation. This bird has a loud shrill and somewhat disagreeable note, which is preceded by a kind of mewing sound. In captivity it rarely lives above two years, and it is not tamed without a good deal of difficulty. When in this state, it is subject to a goutish affection in the feet, which generally terminates its existence. When fed with a plentiful supply of figs, grapes, berries, and other sweet fruits, it is reckoned a great delicacy as human food. As we noticed, these birds are very lean and exhausted on their arrival from the south, which appears to establish the fact that they do not quit their southern abodes until they are actually driven by famine. On their return southward, however, they are in far better condition, and the people of Italy and, also of Egypt, eagerly seek after them for the table. According to the ordinary British notions of dainty fare, they would not be highly prized; because they belong to the omnivorous section of birds, the flesh of most of which is unpleasant both to the sight and to the taste.

The remaining species resemble this one so much that it will not be necessary to give more than a brief catalogue of them.

O. chinensis is a species of eastern Asia, where its summer range extends from the southern part of the Oriental Archipelago northward into China. In many respects it resembles the European one; but it is a larger bird, and there are some differences in the colours of the plumage. The coverts of the wings are yellow, and there is a conspicuous black band passing the base of the bill, and extending over the eyes to the occiput.

O. paradiseus is another species of the south-east of Asia, found in those islands which may be regarded as the head-quarters of the birds of Paradise; and for this reason it was formerly classed with them under the name of the orange bird of Paradise. The throat, the base of the bill, and a large portion of the wings and tail, are black, with the exception of some small yellow spots near the extremity of the principal feathers. The head, the neck, and the mantle of very long plumes with which the neck is ornamented, are brilliant orange; and the greater part of the rest of the body is yellow. The male, with the produced feathers on the neck, is a very splendid bird, but the female and the immature males are without the produced feathers, and dressed in sober olive.

O. regens—the Prince Regent Oriole, is a finely coloured species, and native of New Holland. The prevailing colour is an intensely rich velvet black, with the upper part of the head and neck covered with very closely-set feathers of brilliant orange, and the secondary quills of the wings are bright yellow.

O. variegatus is another New Holland species, more diversified in its plumage than these birds generally are. The front of the head is black, and the rest of the upper part is mottled with black, green, and white; the under part of the body is white, with black spots; the tail is blackish, with a bluish-grey margin, and a large white spot on the lateral feathers.

O. viridis is another Australian species. It is generally of a pale green colour, with the lower part whitish, mottled with brown and black spots on the throat; the wings and tail blackish; the bill horn colour; and the feet black.

O. xanthonotus. This is a much smaller species than any of the rest, and has been observed in Java. It is only between six and seven inches in the total length. The male has the back and scapulars of a bright yellow colour, and the under side of the tail and the inner webs of its lateral feathers the same. The other parts are black, with the exception of the belly, which is white, excepting a few minute black spots.

Such are the principal species of the orioles. Two or three African ones have been mentioned, but they do not appear to differ materially from the one which migrates between Europe and Africa. * Orioles are not only very handsome birds, but they are highly useful in those countries which they visit in numbers. They eat a good deal themselves, and they collect diligently for their young, so that they destroy a vast number of the caterpillars of those insects which are most destructive to trees. They all belong to tropical countries, or at least resort seasonally there; and though they consume a good deal of small fruits on their return to the south, they more than repay the injury by their labours in the early part of the season.

ORNITHOGLOSSUM (Salisbury). A small genus of bulbous plants, from the Cape of Good Hope. They belong to the sixth class of sexual botany, and to the natural order *Melanthaceæ*. They are treated like other Cape bulbs.

ORNITHOLOGY. That department of natural science which treats of birds. On many accounts it is the most interesting portion of the science of animated nature. Birds are the most elegant of animals; they have the most numerous and varied motions, and they have more command of the earth than any other class, in consequence of being able to range from country to country with great rapidity, and comparatively little fatigue. They are therefore better indexes to the seasons, and to the state of nature in countries remote from each other than any other animals. A pretty full account of their structure and principal actions and habits, together with the structural arrangement of them will be found in the article Bird in this work.

ORNITHOPUS (Linnæus). A genus of European annuals, belonging to *Leguminosæ*. One of them, the *O. sativus*, is cultivated in Portugal. It is the bird's-foot of English botany.

ORNITHORHYNCHUS. A most singular genus of Australian mammalia, of which neither the physiology, nor the proper place in the systematic arrangement of animals, can yet be said to be determined in a satisfactory manner. That it belongs to the mammalia, and not to any other class, is established by the fact of milk glands, and milk itself being found in the female, though differing both in their structure and their external appearance from those of every other animal which is known to give suck.

The habits of the animal are, however, so obscure, it is so timid, and has been so nearly extirpated from all those places of Australia which are near the chief settlements, that no opportunity has hitherto been afforded of ascertaining in what state the young are produced. That there is a greater advance in substance, or accumulation of matter, in the young of these animals, before there is any specific development of structure, than there is in the young of typical mammalia which are placental, is unquestionably true. This fact, which, as we shall see afterwards, might have been inferred from analogy, was ascertained from actual observation by the Hon. Lieut. Maule, whose leisure and opportunities gave him every facility for acquiring a knowledge of the animal; and the short passage which contains the statement of this fact, contains also so many traits of the habits of the creature, that we shall give it in his own words. "The *Platypus*," (another name for the *Ornithorhynchus*,) says he, "burrows in the banks of rivers, choosing generally a spot where the water is deep and sluggish, and the bank precipitous and covered with reeds, or overhung with trees. Considerably below the stream's surface is the main entrance to a narrow passage, which leads directly into the bank, bearing away from the river (at a right angle to it), and gradually rising above its highest water-mark. At the distance of some few yards from the river's edge this passage branches into two others, which, describing each a circular course to the right and left, unite again in the nest itself, which is a roomy excavation, lined with leaves and moss, and situated seldom more than twelve yards from the water, or less than two feet beneath the surface of the earth. Several of their nests were, with considerable labour and difficulty, discovered. No eggs were found in a perfect

state, but pieces of a substance resembling egg-shell were picked out of the debris of the nest. In the insides of several female *Platypi* which were shot, eggs were found of the size of a large musket-ball, and downwards, imperfectly formed, however, namely, without the hard outer shell, which prevented their preservation."

That the ova of so small an animal as the ornithorhynchus should equal the size of a large musket-ball, before there is any appearance even of rudimental organisation in them, is certainly different from what occurs in placental mammalia of the same or even greater size. But whatever may have been the size, it is perfectly clear that they were not eggs in the ordinary sense of the word, in which an egg means a germ which, when matured, and still without even the slightest development of organs, is entirely separated from the parent animal, and developed by the heat of that animal or of another, by artificial heat, or simply by the natural heat of the ground, as it may happen. The egg so produced contains in itself all the essential elements of the animal, and wants neither a supply of substance or of food from the mother.

There are two stages in the process even here. The germ, like the germs of all animals, has its essential part formed in the ovary of the female; and though it descends into another vessel, in order to be perfected, the chief additions which it receives there are merely an increase of size, and the hard external shell, by the maturing of which it appears to be finally severed from its connexion with the mother. But the largest germ which Lieut. Maule found in the female ornithorhynchus, had no shell, or firm external covering, by means of which it would be preserved; neither does it appear that it indicated the slightest tendency to the formation of one. Regular oviparous animals, or those which deposit their eggs, so that they are hatched externally, always produce them, if mature, with a firm covering. In some, as in the shells of birds, this covering contains a good deal of salts of lime; whereas in other animals it is more gelatinous, and in some it is flexible. In all, however, it is of sufficient strength to protect its contents from those casualties to which their external situation would expose them; and there are many instances in which, though the life of the animal producing the egg is very easily destroyed, the egg itself is durable beyond any known animal in the organic state.

In the second case, or in that of ovoviviparous animals of which the only known vertebrated ones are either reptiles or fishes, there is always an integument to the egg, which cuts it off from all communication in substance with the body of the parent, as soon as it comes to maturity. After this it merely receives, within the body of its parent, that particular kind of protection and stimulus which are necessary for its development. Thus, though the situation and the circumstances in which it is placed during the hatching, differ in the oviparous and the ovoviviparous animal, it appears that in the state of the egg itself, as indicating a certain stage in the progress from the rudimental germ to the fully developed animal, there is scarcely any difference.

Both from this analogy, and from the physiology of the marsupial mammalia, it does therefore really appear, that wherever the young of the ornithorhynchus may receive its organic structure, it cannot with propriety be called ovoviviparous, in the proper sense of the word, any more than it can be called oviparous, as it has been done by those who fancied they got possession of its eggs. The germs which have been actually found in the female, whether of larger or smaller size, have never been in a state for final separation from the body of the mother, or even in the slightest progress for being so separated, until some organic development had taken place.

To have a right understanding of the physiology of this most singular of all mammalia, we must therefore, in the absence of certain information, which, from the obscurity of the subject, is probably unattainable, seek for our analogies in another quarter. Now we find that in the kangaroos, and other typical marsupial animals, which there have been opportunities of observing, the placental separation, if placenta there be, in cases where no organ is distinctly evolved by placental action, takes place before the animal produced is capable of performing any one animal function. But then, when discharged from its internal lodgment, the rudimental animal is not in such cases, hatched like an egg, by the application of external stimuli operating upon it through an integument, which forbids the reception of any new matter. The nipple is developed for its reception; and a new attachment, and direct communication of substance by the parent to the young is established, and goes on until it gradually passes into a supply of milk to an animal tolerably perfect in its organisation, as is the case in the common mammalia. In those marsupial animals which have this type in their skeletons, but which have the marsupium so little developed in ordinary cases as to be incapable of receiving the young, we know very little of the young when first produced, for we are not aware of a single instance in they have been found until so far developed as to be able to cling to the mother and perform the operation of sucking. The absence of information with regard both to the mother and the offspring, in this stage of the process, is evidence that the conduct at this time is obscure and concealed. The analogy also points out, that it is to such animals that the ornithorhynchus ought to point, in this particular stage of its being. We know that placental mammalia come into the world in very different states of development; some so far advanced as to be able, in a very short time, to move about, and partially to find their own food. Others again are so backward in their development, that if left to themselves they would inevitably perish.

If we find this difference among placental mammalia, none of which can be said to have anything of a gestation external of the uterus, we may surely be prepared to expect it in marsupial animals, the process of whose development passes through a stage more than the others. The state of the young ornithorhynchi, as found in the nest, tends to show that when there they make a close approximation to the young of the other marsupialia in the early stages of their organic development. A description of the young of this animal, abridged from an able exposition by Richard Owen, Esq., one of our best and most candid physiological anatomists, contains so many particulars, bearing closely upon this most singular and most mysterious point in animal history, that we shall lay them before our readers, as they appear in the proceedings of the Zoological Society of London, a small work, but one in which an immense volume of first-rate talent is concentrated. "The circum-

stances which first attract attention in these singular objects are the total absence of hair, the soft and flexible condition of the mandibles, and the shortness of these parts in proportion to their breadth, as compared with the adult. The tongue, which in the adult is lodged far back in the mouth, advances in the young animal close to the end of the lower mandible, and its breadth is only one line less in an individual four inches in length than it is in fully grown animals; a disproportionate development, which is plainly indicative of the importance of the organ to the young ornithorhynchus, both in receiving and swallowing its food. On the middle line of the upper mandible, and a little anterior to the nostrils, there is a minute fleshy eminence lodged in a slight depression. In the smaller specimen this is surrounded by a discontinuous margin of the epidermis, with which substance, therefore, and, probably, from its having been shed of a thickened and horny consistency, the caruncle has been covered. It is a structure of which the upper mandible of the adult presents no trace, and Mr. Owen regards it as analogous to the fœtal peculiarity of the horny knob on the upper mandible of the *bird*. He does not, however, conceive that this remarkable example of the affinity of the ornithorhynchus to the feathered class is necessarily indicative of its having been applied, under the same circumstances, to overcome a resistance of precisely the same character as that for which it is designed in the young bird, since all the known history of the ovum ornithorhynchus points strongly to its ovoviviparous development. The structure of the eyes is indicated by the convergence of a few wrinkles to one point; but the integument is continuous, and completely surrounds the eyeball. In the absence of vision in the young animal, strong evidence is afforded of its being confined to the nest, there to receive its nourishment from its dam; and this deduction is corroborated by the cartilaginous condition of the bones of the extremities, and by the general form of the body: the head and tail are closely approximated on the ventral aspect, requiring strength to pull the body into a straight line; and the relative quantity of integument on the back and belly shows that the position necessary for progressive motion is natural at this stage of growth. Mr. Owen describes other external appearances of the young ornithorhynchus, and then enters at considerable length into its anatomy. The stomach is nearly as large in an individual four inches in length as in the adult animal. In this specimen it was found filled with coagulated milk, and no trace was visible, on the most careful examination, of worm or bread, on which, up to the time of his discovery of the mammary secretion, lieutenant the honourable Lauderdale Maule had believed that this individual had been sustained. A portion of this coagulated substance was diluted with water, and examined under a high magnifying power in comparison with a portion of cow's milk coagulated by spirit, and similarly diluted. The ultimate globules of the ornithorhynchus's milk were most distinctly perceptible, detaching themselves from the small coherent masses to form new groups: the corresponding globules of the cow's milk were of larger size. Minute transparent globules of oil were intermixed with the milk globules of the ornithorhynchus. A drop of water being added to a little mucus, it instantly became opaque, and its minutest divisions, under the microscope, were into transparent angular flakes, entirely different from the regularly formed granules of the milk of the ornithorhynchus."

There are many highly interesting points in these remarks of Mr. Owen, which would bear, and indeed which require, more making out, and less disposition to be fettered by the insinuating doctrine of affinities, that appears even in his account. The hardened knob on the upper mandible, for instance, cannot be regarded as having the slightest resemblance to the enlargement in the tip of a young bird's bill, and that for this obvious reason; the appendages to the jaws of the young ornithorhynchus, are not mandibles, but really lips adapted for sucking, and the tongue is a sucking tongue. The knob upon the upper lip is clearly intended for assisting the young one in obtaining milk from the mammary apparatus, which, from the large size of the stomach, it evidently does in very considerable quantity. This agrees with the very partial development of the young as at first seen, and the maturity at which they arrive before leaving the mother, and also the comparatively rapid rate at which this development takes place. In many of the regular mammalia, and even in the human subject, the inside of the upper lip is provided with a knob much firmer than the rest of its substance; and there seems little doubt that this knob operates in some way in pressing the mammary apparatus. There is no regularly formed teat upon that apparatus in the female ornithorhynchus; and thus there is little doubt that the knob upon the upper lip assists in pressing the mammary glands so as to obtain the requisite supply.

The quotations and remarks which have been made, embody the greater part of the knowledge which we at present possess respecting the physiology of this very singular animal, and, taking the general scope of them, they completely refute the notion of its being oviparous, and render that of its being ovoviviparous exceedingly doubtful; but till the facts between what has been last observed of the internal germ, and what first of the produced young, have been ascertained so as to complete the series, some doubt must remain; and doubt of such a nature, as not to be removed without the greatest difficulty. The chief difficulty appears to consist in this, that the female, at the time of parturition, never makes her appearance; and the nest is so concealed in its entrance, that it is scarcely possible to detect her there, except by one of those accidents which can be but rarely looked for in those wild and unfrequented parts of a savage country which the animal inhabits. All the authorities agree, that the burrows of these animals are formed in secret, and the entrances of them are carefully concealed. The water line is the elevation at which the burrows of aquatic mammalia generally open; but these have two openings, one below the surface of the water, and the other at a considerable elevation above it, but always so hidden among the herbage, that it is impossible to know where to look for them. They are dug to a great length, sometimes as much as fifty feet, and seldom less than thirty. They are winding in their direction, and incline upwards; but the animal never throws up any heaps on the surface, or leaves any excavated earth at the entrance. It is probable, therefore, that it bores into the earth by the forward pressure of its body, as the mole sometimes does, and does not remove any of the earth with its claws. The fore paws, which are the effective digging instru-

ments in all burrowing mammalia, are not, indeed, very well adapted for scraping the earth, though the claws upon the toes are strong. The web, though it can be retracted, would be much in the way in such an operation, though it might assist the animal in pushing itself forward, and also in patting and smoothing the burrow after being once formed. The working of the animal in the formation of its retreat is as obscure, however, as the undetermined part of the mode of its production.

Mr. Bennett, who was at great pains in finding out all the observable habits of these curious animals, mentions, that the utmost caution is necessary in getting a sight of them when they come to the surface of the water, as the least sound or even motion in an observer, when sufficiently near for getting a view of them, is sure to send them under water, and they do not rise again at the same place. One who remains perfectly still and quiet, may observe them paddling about for a minute or two. They soon descend, however, even when not alarmed; and if the least alarm is given, they descend instantly, plunging head foremost. A sketch of one in the act of swimming at the surface, was given in the article MAMMALIA, at page 197 of this volume; and there is also a figure on the steel plate, entitled "AMPHIBIOUS ANIMALS."

In the interior chamber of the burrow, the female constructs rather a comfortable bed for the young, consisting of dried vegetable matters; but as most burrowing animals construct beds of this kind for their young, no particular conclusion can be drawn from this circumstance.

Their food is understood to be obtained entirely in the water, or rather in the soft mud and sludge at the bottom or close by the margins. It is understood to consist entirely of animal matter—insects and their larvæ and small mollusca. They feed after the manner of the dabbling ducks; though, as their feeding is generally under water, it is not easily observed.

Long as Australia has been a British colony, and many of these animals as have been captured, it is somewhat remarkable, that it was not till Mr. Bennett made his observations in that country, that any thing was known of their dispositions. The spurs on the hind legs had long been regarded as inflicting poisoned wounds; but Mr. Bennett teased and irritated the male, the only one which has these spurs, in a variety of ways, and the animal never showed the least disposition to use the spurs, or any other part of the body, either for offence or defence. The probability therefore is, that in all respects these are among the most harmless of animals. They are not, however, destitute of kindly and playful dispositions, or even of resources for the accomplishment of purposes very unsuitable, as one would suppose, to their very singular organisation.

In the course of his researches, Mr. Bennett succeeded in procuring from the nest two young ones, sufficiently advanced to have the fur complete; and he contrived to keep them not only alive, but in health and playfulness for some time, though, probably from the want of food rightly adapted to them, they soon languished, and died at the end of five weeks, thus defeating Mr. B.'s hope of bringing them alive to England. While they were in his possession, he was watchful of their manners; and the results of his observations are valuable, as containing all that is known on the subject.

They were obviously much attached to each other, and slept great part of their time. When sleeping profoundly, they could be handled without complaining; but when their sleep was less perfect, they uttered "awful little growls," as Mr. Bennett expresses it. Sometimes they slept with their bodies extended; and at other times they rolled themselves into balls. In doing this the head is bent backwards, and the tail forwards on the under part, so that the tail extends over the head, as is done by most animals which roll themselves up without having a contractile case like that of the hedgehog. They used to play with each other, using both the mandibles and the fore paws in their little sham fights, and continuing till one was upset. There never appeared, however, to be the slightest tendency to triumph on the one side, or to irritation on the other in these displays; for when one was down the other always waited till it got up again; and the fallen one very frequently took the opportunity of trimming its fur with the hind feet; and both of them would sometimes pause and perform this operation, which appears to be a very common one with the animals when they come on land.

One of the most singular indoor exploits was that of climbing to the top of a book-case; and their mode of doing this shows something of their manner of proceeding when they work their way in the earth. The book-case stood within a short distance of the wall; and the animal by getting its paws to the book-case, and its back to the wall, and working the muscles of both, contrived to make its way to the top with more celerity than one would have expected from its apparent slowness and helplessness on the surface of the ground. The form of the body, and the nature of the fur appeared both to assist in this kind of motion. The back is exceedingly muscular, and the legs very short, while the smoothness of the fur favours a forward motion, and its stiffness prevents a backward one; and by thus working double, it is probable that these animals can move with great rapidity and little labour along their subterranean retreats. For some account of the swiftness of another burrowing animal under ground, as compared with its helplessness upon the surface, see the article MOLE in the present volume. This climbing seemed to be a favourite style of motion with these curious animals; for they obtained no food or any other gratification of a desire, as the reward for it, and yet they practised it again and again, appearing to take a great pleasure in it.

Mr. Bennett paid attention also to their aquatic habits, in order that he might establish something with regard to their manners in both elements. He took them to the water, using the precaution of securing them by a cord fastened to the hind leg, in order to prevent their escape. They entered it readily, swimming about and feeding, and resorting in preference to places containing aquatic plants for the latter purpose. When they had wearied themselves in this way, they returned to the bank, trimmed their fur with their claws, and fell into a state of repose; and there is little doubt that such is their habit in a state of nature, only they retire to the burrow instead of reposing on the bank.

Such is the most authentic account which has hitherto been received of the disposition and manners of these curious animals. We may add, that the length varies from fifteen inches to upwards of two

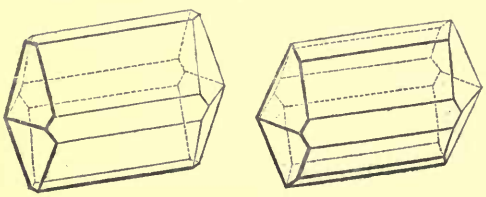
feet, the dimensions of the female being inferior to those of the male. The long silky fur on the body is dark brown, the downy fur grey, and most abundant on the under part of the animal. The tail is flattened, has an up-and-down motion in swimming, and is about one fourth of the length of the other parts.

ORNUS (Persoon). A genus of deciduous trees, natives of Italy and North America, and commonly known by the name of the flowering-ash. The flowers are diandrous, and the genus ranks among the *Oleinæ*. These grow with us to be middle-sized trees, and their tufts of flowers are rather showy. They may be raised from seeds, but they are most commonly increased by grafting upon the common ash.

OROBANCHEÆ. A small natural order, containing only two genera, viz., *Lathræa* and *Orobanche*, of which there are seven species, six of the last and one only of the former. They are mostly parasites, living either upon dead or living plants. The *Lathræa* is found on the roots of trees in shady woods, and provincially called tooth-wort, from the scales on the stem resembling teeth. The *Orobanche, minor* and *major*, are found growing on the roots of common broom (*Genista tinctoria*), hence called broom-rape, but much more frequently on the roots of the red or broad clover, and in such quantity as to form one-third of the second crop, being, however, a very useless addition, as it is a robber of the clover as well as the broom. The *O. ramosa* is a parasite on hemp. They are leafless plants, having scales occupying their place.

OROBUS (Tournefort). A genus of perennial herbs, mostly European. They bear pretty diadelphous flowers followed by pods, which places them in the order *Leguminosæ*. They are called the bitter-vetch, and several of them are cultivated as ornamental plants.

ORPIMENT. This valuable mineral is much employed as a pigment. It was formerly better known as ruby sulphur. The primitive figure of the red orpiment is an oblique four-sided prism, and two of its most common secondary figures are represented in the annexed engraving.



It occurs most frequently in veins in gneiss and clay-slate, and it is usually accompanied with arsenic. Yellow orpiment is of a lemon colour, and is rarely found in the same situations as the preceding. It is found in great beauty at Andreasburg in the Hartz mountains.

ORPINE is the English name of the *Sedum telephium* of Linnæus, a British plant found in hedge banks. The genus *Telephium*, a south of Europe plant, is also called *Orpine*.

ORTHOCERAS (Dr. R. Brown). A New Holland genus, belonging to *Orchideæ*, introduced about 1826. It is a cold frame plant.

ORTHOPOGON (Dr. R. Brown). A genus o tropical *Gramineæ*, one of which, the *O. hirtellus*, is cultivated in the West Indies.

ORTHOPTERA (Olivier). An order of mandibulated insects, united by Linnæus at first with the coleoptera, and afterwards arranged by him with the haustellated hemiptera, from the construction of the wings. By Geoffroy they were also arranged with the coleoptera, forming the third primary division of that order.

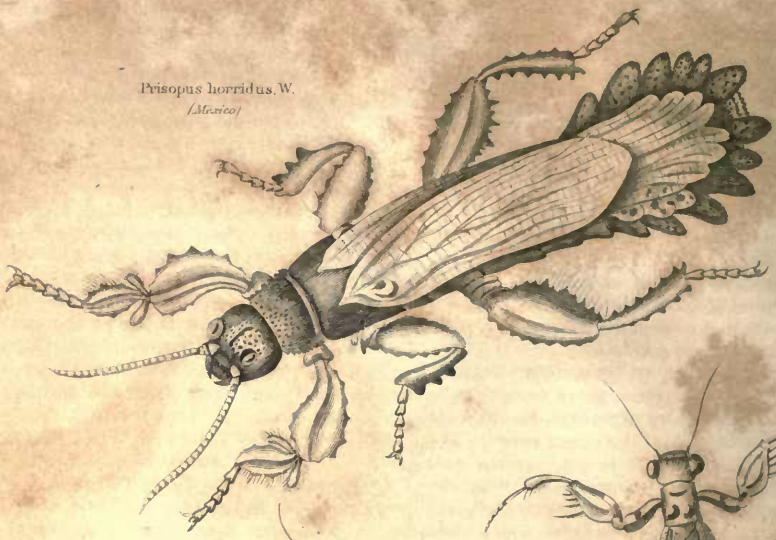
De Geer, however, saw the impropriety of retaining these insects in either of these two classes, from each of which they differed in the structure of the wings and mouth, or in the nature of their metamorphoses, and accordingly raised them to the rank of a distinct order, to which Olivier subsequently gave the name of *Orthoptera*, from the longitudinal or straight (ορθος) folding of the wings (πτερα). Fabricius had also raised these insects to the rank of an order which he termed *Ulonata*, from the Greek ουλος, an outer gum, and γναθος, a jaw, the lower jaws being laterally armed with a helmet-like plate, which is in fact but the greatly developed external lobe of the maxillæ. See vol. ii. p. 853, fig. 104, *c*.

The body in these insects is generally of a large size, less firm in its consistence than in the coleoptera, with the tegmina or wing-covers soft, coriaceous, provided with numerous nervures, and not uniting when closed in a straight line down the back; the wings are membranaceous, and furnished with equally numerous nerves, arranged longitudinally, with transverse threads, so that the wings fold up something like a fan; the mouth is furnished with a very considerably-developed organ, which is the analogue of the tongue. These characters alone would suffice to point out their differences from the coleoptera, in which the outer lobe of the maxillæ is not helmet-like, and the wings are transversely folded, whilst the mouth in the hemiptera is not formed for mastication, being unprovided with jaws, and the wings are simple, extended, when at rest, beneath the wing-covers, without being folded.

The head of orthopterous insects is in general large, and almost perpendicular in the majority, the antennæ being placed on its upper part, and which are of variable length and structure, but often long and multiarticulate; the eyes are large and lateral; and the ocelli which are found in the majority are placed on the forehead, sometimes widely apart; the thorax, or, more strictly speaking, the pronotum, is large, being in many species extended considerably backwards; the abdomen is long, generally of a conical form, and terminated in the females of many species by an exserted apparatus for depositing the eggs in the shape of a sword or cutlass.

The legs of the *Orthoptera* are very long, and are employed in giving considerable activity to these insects, in some of which these organs are simply organs fit for walking (*Blatta*); in others the fore pair of legs become instruments for seizing their prey (*Mantis*); whilst in the rest the hind legs are greatly increased in size, supporting strong internal muscles, enabling the insect to effect leaps of great extent; these legs are also employed in some species to produce a loud chirping noise by their friction against the base of the wing-covers (*Locusta*), which noise appears to be the call of the males, by which sex alone it is produced. We have already, in the article GRASSHOPPER, given a more detailed account

ORTHOPTEROUS INSECTS.



Prisopus horridus. W.
(Mexico)

Metallyticus splendens. W.
(Malabar)

Tripetaloceraferruginea. W.
(Malabar)

Scaphura Kirbii. W.
(Brazil)

Schizodactylus monstrosus.
(India.)

J. W. del.

of the modes by which this chirping noise is produced, and which it will therefore be unnecessary to repeat in the present article. The tarsi vary, in the number of the joints, from three to five; generally speaking, the body is long, and often much compressed.

The nature of the metamorphoses of these insects is also another great character by which they are distinguished from the coleoptera, the larvæ and pupæ differing only from the imago, either by entirely wanting, or having only rudiments of wings. The larva and pupa of the great green grasshopper are represented in vol. ii, page 839, figs. 30 and 31. In these states the insect is as active and as voracious as in that of the imago.

If we had cause, in treating of the hymenoptera, to admire the admirable displays of instinct which they afforded us, we are here compelled to admit that the present order cannot bear anything like a comparison in the means of attracting our attention. They, however, amply perform their work in the great labours of the economy of nature, for they are amongst the most voracious of the insect tribes. The cockroach, the mantis, and the locust, are too well known in this respect to require more than the insertion of their names to bring before us the great and occasionally overwhelming ravages which they commit. Their food, for the most part, consists of vegetable substances, and which, being less serviceable for the purposes of animalisation than animal matters, it is necessary that a much greater quantity of food should be taken, in proportion to the size of the insects, than is consumed by the predaceous species which feed on other insects, or upon carrion. Hence, from their great size, the *Orthoptera* may be regarded as the most pre-eminently herbivorous of the insect tribes, and their voracity is excessive. We need only refer to our article Locust for a confirmation of this statement, whilst the article Cock-roach furnishes sufficient proof of the in-door devastation which the insects of this order are capable of performing. The internal anatomy of this order is organised in a manner adapted to their herbivorous qualities. The alimentary canal is greatly elongated, and divided into several chambers or stomachs; four of these have been attributed to the mole-cricket, whose internal structure has been long ago investigated, and more recently by Dr. Kidd, of Oxford. From this circumstance it has been supposed that the *Orthoptera*, analogous to the ruminating quadrupeds, had the power of bringing back into the mouth aliments which had already passed into the stomach. According to M. Marcel de Serres, these chambers are not in fact stomachs, but merely contain a salivary and biliary fluid, which the animal often disgorges when seized. The internal structure of the larva does not differ from that of the imago.

All the known species of this order are terrestrial. Stoll has indeed represented an extraordinary insect, belonging to the order, as an aquatic species, but there is no confirmation of this circumstance.

The species found in our part of the world deposit their eggs but once in the year, which takes place at the end of the summer, when they have assumed the perfect winged state. They perish at the approach of winter, and the species are perpetuated by the eggs remaining unhatched, during the winter, in the earth where they were deposited, the larvæ coming forth in the following spring.

It is difficult to preserve the insects of this order, without considerable attention, in our collections, the body, being moist and fatty, atttracting destructive insects, such as the *Anthrenus*, *Dermestes*, &c. It is on this account that some of the species, which are natives of Africa, are eaten by the negroes, who have thence obtained the name of *Acridophagi*.

The order, excluding the earwigs (order *Dermaptera*, Leach, see Earwig), and including the cockroaches (which Dr. Leach separated as an order under the name of *Dictyoptera*), is divisible as follows:—

Section A. Cursoria.—Hind legs formed for running or walking; wings and wing-covers generally horizontal; females not provided with a horny exserted ovipositor.

Fam. 1. *Blattidæ*.—Tarsi five-jointed; head hidden beneath the shield of the thorax; body flattened and oval, or rounded. (Cock-roaches).

2. *Mantidæ*.—Tarsi five-jointed; head exposed; body long, and generally narrow; fore legs raptorial. (Preying mantis.)

3. *Phasmidæ*.—Tarsi five-jointed; head exposed; body long, and generally narrow; fore legs not raptorial. (Spectre insects.)

Section B. Saltatoria.—Hind legs formed for leaping; wings and wing-covers generally deflexed at the sides; females generally provided with an exserted horny ovipositor.

4. *Achetidæ*.—Antennæ very long; wings and wing-covers horizontal; tarsi three-jointed. (Crickets).

5. *Gryllidæ*.—Antennæ very long; wings and wing-covers deflexed; tarsi four-jointed; ovipositor long, sword-shaped. (Grasshoppers, with long antennæ.)

6. *Locustidæ*.—Antennæ short; wings and wing-covers deflexed; ovipositor short. (Locusts and grasshoppers, with short antennæ.)

The species which we have selected to illustrate this order in our plate of Orthopterous Insects are, 1st, *Metallyticus splendens* (Westwood), from Malabar, a remarkable insect, being the only species of the order exhibiting metallic colours, and belonging to the family *Mantidæ*; 2nd, *Prisopus* (Latreille; *horridus*, Westwood), a singular species of spectre insects (*Phasmidæ*), from Mexico; *Schizodactylus monstrosus*, from India, belonging to the *Achetidæ*; 4th, *Scaphura Kirbii* (Westwood), from Brazil, belonging to the *Gryllidæ*; and, 5th, *Tripetalocera ferruginea* (Westwood), a remarkable insect, from Malabar.

ORYSSUS (Latreille). A very peculiar genus of hymenopterous insects, belonging to the section *Securifera*, and family *Siricidæ*, having the abdomen sessile, the antennæ inserted near the mouth, the maxillary palpi long, and the ovipositor slender, spiral, and internal, in which respect the genus approaches the *Cynipidæ*. There are two European species, which are found upon trees, but they are of very rare occurrence, and of great agility. The description of a North American species is given in the last number of the Zoological Journal.

ORYZA (Linnæus). A genus of useful cereals, belonging to the natural order *Gramineæ*. It is the *Eruz* of the Arabians, and the rice of English authors. In warm climates it is the most valuable necessary of human life, and perhaps it is not beyond the truth to assert, that as great a number of human

beings are supported on rice as on wheat itself. It is the staple corn of the tropics, as the oat is of the northern, and wheat of the temperate regions. The culture, however, is exceedingly unhealthy; for the frequent flooding of the fields keeps them constantly in a swampy state, and favours the production of malaria. Rice has been raised in England on the banks of the Thames, a crop having been gathered in near Windsor. In Italy it is cultivated with success; but artificial irrigation has been carried there to a higher degree of perfection than in any other part of Europe; and without artificial irrigation rice cannot be raised any where. In India and China it is raised on a most extensive scale. Every river is intercepted by a succession of dams to throw out the water, and to form large lakes or tanks for the supply of the rice grounds. Some of these tanks are many miles in circuit; one not far from Madras, says Buchanan, "is eight miles in length, by three in width, and its contents are sufficient to supply with water the lands of thirty-two villages for eighteen months, supposing the usual rains to fall."

Rice is imported into England in large quantities, both from the East Indies and America. Upwards of one hundred thousand bags of rice are now annually imported, and the quantity is gradually increasing.

The Canada rice, although not yet much cultivated, has all the natural capabilities to become a valuable corn. Its grains are large and replete with a fine bland farina. It grows abundantly in the shallow waters of North America, and has been acclimated here; it grows freely in Middlesex and Ross-shire. Attempts are being made, which it is to be hoped will be successful, to cultivate it in Ireland. Pinkerton says, "this plant seems to be designed by nature to become the bread corn of the north."

OSIER. A general name of several sorts of willows, particularly the *Salix rubra* of Hudson, being much used by basket-makers, and for binders in wood-work.

OSMIA (Panzer). A genus of solitary bees, belonging to the family *Apidæ*, and subfamily *Dasygastres*, having the maxillary palpi three or four jointed, the abdomen convex above, and of an oval form. Some of the species are mason bees (having habits very similar to those of the *Megachiles*), and their heads are furnished with two or three horns, which are probably serviceable in the construction of their nests, which are hidden in the ground, crevices of walls, old wood, and even occasionally in the deserted shells of garden snails. Of the latter, some particulars are given by M. Robineau Des Voidy, who has obtained two species (*O. bicolor* and a new species which he names *O. helicicola*) from nests respectively formed in the deserted shells of *Helix nemoralis* and *H. pomatia*. *O. bicolor* lays two eggs in each shell, the female egg being always uppermost; above these are constructed three or four cells of sand separated from each other by a membranous partition. *O. helicicola* deposits ten or twelve eggs, separated from each other by distinct partitions, each being provided with a magazine of honey; but they do not wall in the different strata either with sand or any earthy matter placed above the domicile of their progeny. They sometimes form their nest in *Helix nemoralis*, in which they lay several eggs, closing the entrance with a thick division formed of minute fragments of leaves triturated with the salivated excretion of the insect, and arranged in successive layers. Also, in these two species he discovered a minute parasite, which he named *Eulophus osmiarum*, the larvæ of which, after feeding upon the larvæ of the bees, change into pupæ without spinning a cocoon or quitting the place of their birth.

Other species of the genus clip the petals of flowers, of which they form their cells in the same manner as the *Megachile;* amongst these the *Osmia papaveris*, or the *Abeille tapissiere*, is the most interesting, building its nest with bits of the scarlet petals of the wild poppy; others select for their nest the interior of galls.

OSMITES (Linnæus). A genus of evergreen shrubs, natives of the Cape of Good Hope. They belong to *Compositæ*, are easy of cultivation, and increase in the green-house.

OSTEOSPERMUM (Linnæus). A genus of evergreen shrubs, natives of the Cape of Good Hope, remarkable for the bony hardness of their seeds. They belong to *Compositæ*, and succeed well in the green-house.

OSTRICH (*Struthio*, or rather, perhaps, *Struthionidæ*, the ostrich family). The most remarkable of the feathered race, both for the vast size and swift motion upon the ground which some of them possess, and for the fact that the whole of them, without exception, are destitute of flight, and in some the wings are so very rudimental, as not apparently to be capable of any purpose in the economy of the birds. In Cuvier's arrangement, they form the first family of *Echassiers*, or stilt birds, and they differ greatly from all the rest both in their structure and their economy. There are several genera of the family, and each genus has a separate locality, no two of them being found in the same part of the world. They are: the ostrich properly so called, a native of Africa, and of the adjoining parts of Asia; the American ostrich, which is not found except on the dry plains of South America; the *Emu* of Australia, which occurs only in that country, and chiefly, or, at all events, most abundantly in Van Diemen's Island; the *Cassowary*, which occurs only in the south-east of Asia; the *Apteryx*, which is confined to a peculiar district of New Zealand; and the *Dodo*, which, if it ever really existed, had its locality at Madagascar, and probably on some of the other islands to the eastward of Southern Africa. If the last mentioned one ever really existed, it appears now to be extinct, and to have been so ever since the visiters of distant lands paid much attention to subjects of natural history. That birds so singular in their structure should be distributed over parts of the country so widely separated from each other, all different in their generic characters, and each genus consisting only of a single species, is a very curious fact in natural history. It is remarkable too, that those which lie nearest to each other in geographical position, do not resemble each other the most in their structure. The bird of Australia and and that of South America have much more resemblance to each other than the bird of Africa, which lies intermediately between them. The New Zealand bird is perfectly unique, not resembling the others in any thing but in being wingless, and it is the most wingless of the whole. Of the bird of the African islands nothing can with certainty be said.

Of the greater number, notices have already been given under their respective names as they are above

OSTRICH

Female

Male

enumerated; and the reader who wishes for a short account of them may turn to these names in their alphabetical order, with the exception of the ostrich properly so called, and the American ostrich, or *Rhea*, and thus the present article may be restricted to some notice of them.

The Ostrich (*Struthio camelus*), is one of the most celebrated birds in the whole annals of the feathered race; and, like all birds and other animals which have been famous from remote antiquity, much that is marvellous has been recorded of it. It is the swiftest footed of known animals; the one which lives most habitually in the desert, and it is remarkable for its proneness to swallow a vast number of substances, and also for the great vigour of its digestive powers, though in the latter respect many tales are reported of it which are totally without foundation—such, for instance, as its power of digesting, that is, of converting into animal nutriment all sorts of stones and metals. Now this is not true; for the greater part of every stone or metal is composed of elements quite unfit for entering into the composition of any animal substance; and it is just as absurd to suppose that the ostrich has the power of converting iron or brass into the substance of its own body, as it would be to suppose it capable of converting its own vegetable food into gold or any other metal.

The generic characters of the ostrich are: the bill of mean length, straight, blunt, and depressed at the point, which is rounded and furnished with a nail. The two mandibles are of equal length; the nostrils are oblong, placed a little on the surface and toward the middle of the bill; the head is naked of feathers and colours on the upper part; the legs are very long and very strong and muscular; each of them has only two toes, the internal one very stout, and furnished with a broad claw; the external about half the length of the internal, and without any claw. The legs are stout and fleshy, nearly as far as the tarsal joints, and they are very free in their motions. There are no wings fit for flight, for both they and the tail consist of long and flexible feathers, quite incapable of acting against the air in any kind of flight. The lower part of the neck, the breast, the belly, and the back are black, mottled with white and grey. The large plumes of the wings and tail are of a white colour, with remarkably flexible shafts, and beautiful loose webs of silky texture, which have from time immemorial been used as ornaments in military and state dresses, and in pageants. The intermediate parts of the skin of the bird are covered with soft down, which appears between the plumes. The bill is grey for the greater part of the length, and black at the tip; and the irides are brownish-yellow. When the ostrich, in its full-grown state, stands with its neck at the full elevation, its total height is about seven or eight feet, and, if in good condition, it sometimes weighs as much as eighty pounds.

It is thus a majestic bird in its appearance, and stately in its gait, from the length of its legs and the stretch, and bounding elasticity of its step. But though it is thus the giant of birds by way of eminence, it is one of the most harmless and inoffensive of the whole race. It offers no voluntary attack upon any animal; and its fleetness is such, that no enemy save man, can master it in those open wastes which form its principal habitation. The eggs of the ostrich are contained in very strong shells, and they are of such dimensions, that a single one weighs about three pounds. It has often been said that when the female ostrich lays her eggs, she abandons them to their fate, without giving herself any more concern either about them or about her young. Nothing can be more unfounded as a general trait in the character of the ostrich than this. Like all birds which subsist upon vegetable food, which they procure exclusively by walking on the ground, ostriches are social animals, fond of the company of each other; and we are acquainted with no social animal which deserts or neglects its young, and its doing so would be in direct opposition to the social propensity, and thus the character of the animal would be inconsistent with itself, which never happens as a general habit in any one animal whatever.

That the ostrich sometimes does leave her eggs, and that the heat of the sun acting on the dry sand may, in such cases, assist in hatching them, is no doubt true. But even then, the ostrich, if there is only one in the locality, is never beyond the range of her own vision from the eggs; and if an enemy ventures near them, she hastens to the spot, and defends them with great bravery and resolution. When she does leave them in this manner, we may rest assured that there are physical circumstances in the place where they are deposited, which make the process of incubation go on as safely as if the bird herself were present. Though ostriches are confined to the dry and open plains, their range is very wide. They occur from the dry grounds immediately behind the mountains of Atlas in Northern Africa, southward to the country of the Cape. In longitude their range is still greater. It stretches from the western extremity of the African desert, through the dry and naked parts of Arabia, Persia, and the Indian deserts, nearly to the banks of the Ganges. Of course there are many places within those limits quite unadapted for the pasture of ostriches. There are marshes, woods, and cultivated grounds, and the birds are not adapted for either of these, and not found upon them. But within the range mentioned there are ostriches upon every suitable pasture; though Africa, and especially the margins of the great desert in Northern Africa, are the head-quarters where they are found in the greatest numbers, and of the largest size.

Now, in so wide an extent there may be said to be three distinct kinds of locality in which the female ostrich may have to deposit her eggs. In the first place, there are the situations so far into the dry desert, that there scarcely forms any dew during the night; and here the ostrich can afford to be absent from her eggs, during the whole twenty-four hours, if such an absence should be necessary. For the radiation of heat from the sand during the night would be quite sufficient to keep up a stimulus to vitality in the eggs, until the direct sun of another day came upon them. It is in those situations that the ostrich has most occasion to be absent, because the very circumstance of the absence of moisture, which prevents the chilling of the surface by the evaporation of dew, diminishes the quantity of food which the animal can meet with, and this compels her to range over a far greater extent of surface, in order to preserve her own life. Under such circumstances, she also actually requires more food; for the food requisite to the healthy state of an animal, increases with the increase of its labour.

Instead therefore of setting the brand of an unnatural mother upon the ostrich, we find a very

beautiful provision of nature in the mutual adaptation of her and the desert to each other. Not even the smallest bird, or the bird of the swiftest wing could remain and rear a brood in those more arid breeding places of the ostrich; and thus, but for her, a large portion of surface upon which she can subsist, would be a waste in nature; and therefore in opposition to the general laws and provisions of the system.

In the second place, there are situations, less advanced into the dry desert, where, though the day is exceedingly hot and the air dry, dew forms, and the night is cold, especially toward the morning. When her eggs are in such a situation, the ostrich can afford, with perfect safety to them, to range about for her food during the day. It is necessary, however, that she should come and shelter them with her downy feathers during the night, and this she accordingly does. Here again she is enabled to do so from the physical circumstances of the place, because vegetation is much more abundant than in the drier places, and a less range finds her an abundant supply.

In the third place, ostriches are found in localities without the tropics, and so far out of the desert as that the eggs do not derive so much assistance from the heat of the sun; and in these the bird requires to sit more constantly, and she does it accordingly.

Therefore there is not, in the whole range of nature, a more beautiful instance of adaptation than that which subsists between the ostrich and the desert. The desert is a singular locality in nature, and the ostrich is as singularly formed and fitted for the severe labour which it has there to encounter. In its walking structure, the bird is not excelled by any animal, even by those swift antelopes which are her near neighbours. We find too, that wherever one species of action is required in a very high degree, the organisation of the animal is to a great extent concentrated upon that. Flight would have been of comparatively little use to such a bird in the situation in which it has been placed by nature. Wings for flight, to bear up so weighty a bird as an ostrich in swift motion through the air, would have demanded a waste of muscular exertion, for the supply of which sufficient food could not have been found in the ostrich's country. Besides, wings would have been of no use in the desert, because there is nothing there which a vegetable feeding bird could catch upon the wing; and the height of the ostrich, standing on foot, is quite sufficient to reach the top of the tallest vegetable on her pastures. There is therefore a very fine instance of economy in the wings of the ostrich being so little developed as that they are unfit for flight, because this enables the whole power of the bird, in so far as motion is concerned, to be concentrated upon the legs, and the muscles by which these are moved.

A most essential form of the sternum is obtained by this means. A figure of an analogous sternum, that of the Australian emu, may be seen by referring to page 457, of Vol. I. of this work. From that it will be perceived that the keel, essential to the sternum of a bird of powerful flight is dispensed with; and also that the principal articulation is with the ribs, while the sternum is a sort of breast-plate on the fore part of the body; so that the breast can be brought to the ground without any pressure of important parts, in order to enable the bird to fold its very long legs with perfect security, when it is about to repose on the ground. We have no space to go into the particulars, but whoever chooses to do so, possessed of the proper means of knowledge, will soon perceive that the skeleton of the ostrich is a very fine specimen of animal mechanics.

The system of nutrition in the ostrich is not unworthy of attention. Subsisting upon vegetable matters, which are hard and dry, and from being so requiring a great deal of grinding, the ostrich has a very strong muscular gizzard, firm and compact in its walls. It may be said to have three stomachs, or at all events there is a dilatation between the crop and the gizzard, which must answer some purpose in the economy of the animal. It is no doubt the necessity of some hard substances to act as a second mill-stone in the gizzard in grinding the food, which makes the ostrich so prone to swallow all manner of hard substances, with perfect indifference as to what may be their taste or their smell. The great length of the intestinal canal too, and the size of the cæcal appendage, show that the digestion of this animal is a process of the most laborious kind.

In the matter of sensation, it is probable that the ostrich depends chiefly upon sight. Taste and smell are quite incompatible, either with the finding of the bird's food, or with the swallowing of those substances which assist in the preparation of it. Hearing would also be of comparatively little service in such a bird. The eye is the grand organ upon which the animal depends; and the length of the neck, which corresponds to that of the legs, so that the point of the bill can reach the ground when the axis of the body is in a horizontal position, is well adapted for commanding a very large surface of the desert.

In a state of captivity the ostrich prefers grain to every other kind of food, though it will also eat the leaves of lettuce and other succulent plants. In this state it drinks a considerable quantity; and it is probable that it does so in a state of nature, though the Arabs give a different account of it. There is no doubt that in some of its localities it cannot have very frequent opportunities of drinking, but still there is no ground for believing that it actually abstains from water in cases where it is to be had.

Though not in the least disposed to be pugnacious, and generally inclined to seek its safety in flight, when it has nothing to protect but its own life; yet the ostrich is not unprovided with weapons of defence, which it can use with very considerable force and effect. These weapons are the bill, the feet, and the strong spines of which there are two in each wing. The length of the neck, and the powerful motion which it has, enable the bird to use the bill with great velocity; and we need hardly mention that the velocity of a striking instrument very rapidly compensates for a deficiency of weight or hardness. We find this proved by the fact, that a tallow candle can be shot through a deal board, if it move fast enough, and also from a circular plate of soft iron, not merely cutting the hardest steel, but even setting it on fire, the plate being moved with great velocity, and the steel held against its edge. The feet also derive a very effective power from their length, and the consequent velocity with which the extremities of them can be made to take effect; we have remarkable instances of the powerful kick of a long foot in the giraffe, and the kangaroo, the first of which is said to be capable of stunning the lion, and even of breaking his skull, and the second of serving the wild dog of Australia much in the same manner. Thevenot mentions having seen an ostrich lay a dog prostrate by a single backward

blow given with the foot; and as the bird is very finely balanced upon its centre of gravity, there is no question that, by swinging upon the one foot, and giving the whole momentum of its body to the delivery of the other, it can strike in a very serious manner. Cuvier mentions, after Pliny and his copyists, that the ostrich throws stones behind it in its flight, with as much velocity as if they were discharged from a sling. The same has been said of the common seal, and the fact of discharging the stones is most likely true of both animals, though the cause is the extremely rapid motion in the ostrich, and the slow and wriggling motion, though with powerful organs, in the seal. The error lies in the assumed intention of either the one animal or the other; for there is no reason to suppose that either has the slightest intention of assailing the enemy with this sort of stern battery. When the ostrich runs in stony places, it is quite natural to suppose that the velocity with which it springs forward with the foot as a fulcrum, will make the reaction of the foot project a loose pebble of considerable size with very great force, and of course the pebble thus unintentionally projected may sometimes take effect upon whatever is in pursuit of the ostrich, and thus have the appearance of having been aimed. There are many of the results of animal action which in this way are supposed to proceed from intention, and thus the conduct of animals is confounded with that of man, and the proper understanding of both is vitiated.

Ostriches have been long and generally stigmatised as very stupid animals; and when we consider the obtuseness of all their senses except that of sight, they may appear stupid, as compared with those animals which have all the senses in nearly equal perfection. The stupidity or the acuteness of an animal does not, however, depend upon the number of well-developed senses with which it is furnished, but upon the perfection of those which are essential to its natural modes of life; and as there happens to be no animal which can be fairly contrasted with the ostrich in this respect, it is impossible to come to any definite conclusion on the subject of its stupidity; and the story of its being stupid may be allowed to take its place very quietly in the same category as the alleged desertion of her eggs and young by the female. We often make strange mistakes as to the stupidity of animals; for the ass and the goose are proverbial in this respect, and yet within their proper spheres they are both very tractable and sagacious animals.

The cry of the ostrich is a loud and harsh one, though it is not very often heard; and those who profess to describe it are not quite agreed as to what sound it resembles the most. We find some resemblance between the ostrich and the goose in the sounds which they emit and the attitudes which they assume when danger is very near them. We might perhaps be prepared to look for this from a kind of analogy that subsists between them. They graze on different localities; but still, when in a state of nature, they are both grazing birds, and this is a similarity independently of the difference there may be in other respects; and hence we find that a male ostrich, excited by the near approach of danger, ruffles his feathers, and hisses much after the same fashion that a gander does; and when either of them strikes under this excitement, he strikes with the nail upon the tip of his bill.

The breeding of ostriches in their native plains is a subject upon which there is no little uncertainty and difference of opinion. That the birds are very prolific, and that, like our common poultry, in their native jungles of the East they have no fixed season for breeding, appears to be well ascertained. It is equally well ascertained that the eggs are numerous, though what the number is is not determined; some say fifty, and some not half as many, while others again bring up the number to nearly a hundred. There are various circumstances which tend to embarrass this part of their history. Under many circumstances, the females are gregarious in the breeding time, and place their eggs so near to each other that those of several birds may often be considered as forming only one hatch. Another circumstance is that birds which produce many eggs in a hatch are subject to greater variations in the number than those which produce only a few. The heat too which prompts the bird to hatch, and stops the production of more eggs for the time, comes on with different degrees of rapidity according to circumstances, and this necessarily affects the numbers of the broods.

There is another circumstance in the matter, on which the professed authorities are not quite agreed; and that is, whether the males are monogamous, or each has a number of females. No mention is made by any writer, worthy of credit, of having seen battles of gallantry between male ostriches; and if we were to argue from the habits of most polygamous birds in general, we would consider the silence with regard to such battles as a proof of monogamy. There is, however, an argument on the other side. Most birds which pair strictly, and yet are social, as, for instance, the pigeons, have usually a small number of eggs in each hatch, as, for instance, one male and one female, whereas the eggs of polygamous birds are far more numerous. This is not universally the case, for rooks and many other birds are an exception to it; but it holds in the case of almost all birds which are social in the breeding time, and deposit their eggs upon the ground.

It may seem singular that birds which have been for so long a period objects of great interest and inquiry, should have so many unsettled points in their domestic economy; but when we take into consideration the watchful look of the birds, the extensive horizon which they command, and the impossibility of getting a clear view of them in the natural state without depriving them of life, we find a sufficient explanation of these uncertainties.

The eggs, with the shells of which many must be familiar, are sufficiently large for containing a pint or more. They are of a dull white colour, with yellowish or brownish mottlings, varying a good deal in tint with the state of the atmosphere at the time of their production. They are not always of the same size, but vary in this respect like the eggs of poultry; and it is not understood that the largest-sized birds produce the largest eggs in the one case any more than in the other. They are seldom less than between five and six inches in the longest diameter; and they rarely, if ever, amount to so much as seven.

These birds do not, under any circumstances, construct a regular nest, or seek the cover of tall vegetation for the purpose of concealing their eggs. They merely scrape a very shallow space in the dry sand; and as the eggs themselves approach closely in colour to the sand itself, and to such pebbles as are usually found upon it, they are probably more safe from destroyers, in the absence of the female, than they would be in a formal nest. This seems to be the

provision which nature has made for protecting the eggs of most animals which breed on the ground. There is no parade of a nest, and the eggs so much resemble in colour the surface around them, that even on the dry sand of a sea-beach it is very possible that the first notice one has of them may be the sound of breaking them under the foot.

The time required for hatching the eggs of the ostrich is not known with any degree of accuracy, though it has been said that it requires between forty and fifty days, and rather more in moderate climates, and when the weather is wet, than in the dry heat on the margins of the desert. That it must require a considerable time is obvious, on account of the size of the egg and the hardness of the shell, and also of the degree of maturity at which the young have arrived when they make their appearance. Other circumstances being similar, eggs are the sooner hatched the less perfectly developed the young are when they break the shell. The shortest incubations are those in which the young birds appear quite naked, and incapable of using either the feet or the wings; and it is worthy of remark, that warm nests are always provided for birds of this kind; and they of course require to be fed by the parent birds for a much longer time than those which are more matured on their first appearance. Where the young come into the world in this comparatively rudimental state, two portions of the labour of the parent birds are greater than in other cases, namely, the construction of the nest and the feeding of the young. The abridgment of the time of sitting is, however, some compensation for this; and the warm nest no doubt tends to this abridgment.

There are other circumstances connected with those birds which have callow young, which are worthy of attention. In the first place, they are almost all small birds; for the large ones, almost without exception, have rude nests, or no nests at all; and their young are covered with down or with feathers at the time of their exclusion; and in every instance they are then capable of using their feet, while many of them can immediately find their own food, independently of the mother. In the second place, the birds under consideration generally have their nests where food is abundant, as in woods, thickets, hedges, and other rich places, where insects and other small animals are abundant; and the young are exclusively, in most of the species, and in the greater part in all of them, fed upon those animal substances. Thirdly, the season of the year at which those birds have their young in the nest is the season in which the larvæ of insects come upon vegetation, upon that of the sweet-juiced trees especially, in those myriads, and with that voracious appetite, which would actually destroy the vegetation of the year, were it not for the countless thousands which those birds consume for their own food and for that of their young. We see, therefore, how finely the economy of these birds is adapted for the general good of the whole system of nature. It may seem that rooks, and many of the larger omnivorous birds which build nests in trees, form an exception to what has been stated. But their nests, though they often require a good deal of labour in the construction, and though the young are fed in them for a considerable time, are never so elaborate or so warm as those of the small birds. The habits of the birds too are intermediate. Their charge is the ground larvæ and other small animals, and the eggs of other birds; and this intermediate sort of occupation corresponds with the intermediate style of the economy of their nests.

Many of the birds which build no regular nests, and whose young appear in an advanced state, are to a certain extent omnivorous; and many of them feed chiefly upon small ground animals. There is, however, in all cases a great degree of labour requisite for the finding of their food; and their exemption from the labour of nest-building, and that of bringing food for their nestlings, is the compensation which nature allows them for the severe task imposed upon them in supporting themselves individually.

As the ostrich constructs no nest whatever, and is in some places in a great measure exempted from the labour of incubation, we might naturally expect that the young should be provided for in the egg, until, under average circumstances, they should be able to find their own food when they come out of it. This is found to be the case, and not only so, but there is a very remarkable correspondence between the labour of incubation, which the female ostrich performs, and the care she takes of her young after they make their appearance. If she requires to sit little or none, then she abandons the young, and leaves them to provide for themselves; but if she requires to sit pretty constantly, she takes them under her protection, leads them to their pastures, and guards and defends them with as much boldness and solicitude as a common domestic hen. Thus, in the temperate climate of the Cape, and especially during the rainy season, which is the season of food, and therefore the season of reproduction for the ostriches there, the female bird is an attentive mother; whereas, on the burning sands nearer the equator, she pays little or no attention to her offspring. Whether, under these different circumstances, there is any difference of maturity in the young is a fact upon which we have no direct information; but the analogy would lead us to suppose that such a difference really exists. In that part of it which our information does reach, we have a striking instance of the modification of the same bird, so as to adapt it to differences of external circumstances. Where the ostrich sits closely and tends her young assiduously, there is an abundant supply of food for both, and they can satisfy themselves with comparatively little labour. It is then too that the young stand in need of protection, because the same richness of the pastures which feeds the ostriches feeds their enemies, if not directly, at least through the medium of the herbivorous mammalia. In the burning deserts again, where the labour is great, the ostriches are in a great measure alone; and, though the labour of finding their food is great, they are exempt from the danger of almost every enemy.

We have entered somewhat largely into those points of the economy of ostriches for various reasons. First, because the birds are in themselves among the most interesting, not of the feathered race merely, but of all animals; secondly, because those points have been slightly touched upon by some, and much misrepresented by others; and thirdly, because, from their geographical position, the ostriches may be said to occupy the centre or extreme place of the sun's action upon the earth; and therefore their history well understood may be made a most extensive and valuable index to the general economy of nature on the surface of our globe.

We have already alluded to the locomotive powers

of the ostrich as being very great. On its rapid marches it always extends the wings, the loose and flocculent plumes of which take a hold on the air, and prevent that swinging from side to side of the axis of the body, which would otherwise result from the motion of a long bodied animal with the axis horizontal, and upon two legs only. Those produced plumes, both of the wings and of the tail, perform an office not dissimilar to that which is performed by the swimming paws of the aquatic mammalia. The mode of action and the kind of organ are of course different, because the one animal moves through the air, and the other through the water; but making this allowance, and considering that the organ of progressive motion is a pair of legs in the land animal, and a swimming tail in the aquatic one, there is no inconsiderable resemblance between the two.

When the ostrich is in vigorous health, and unincumbered by any load, it is said to outstrip the very swiftest of four-footed animals, provided they follow its track, and do not cross it on the returns of its loops, as is done by the ostrich-hunters, whether mounted on horseback only, or accompanied by greyhounds. It is further said, that, with the load of two men on its back, an ostrich can run as fleetly as a good saddle-horse at full speed. Adanson, in his account of Senegal, mentions having seen this repeatedly; but we are not aware that it has been verified by the observation of more recent describers. From their disposition to be social in the wild state, ostriches may be expected to be susceptible of domestication; and if they could be domesticated, their great strength, great swiftness, and great powers of endurance, would render them very valuable labourers, especially as carriers on long journeys across the deserts. Their economy in wild nature, and also their haunts, are, however, different from anything which could be either readily or generally obtained in an artificial state, even within the geographical limits of the birds; and though they are far from being exclusively tropical in their localities, we have no reason to suppose that domestication could temper their nature to the endurance of the winters of middle, or even of southern Europe, if exposed to the open air. They have been so far domesticated in climates suited to their nature, as to be kept in flocks within enclosures; and as they cannot fly, of course hedges or walls are quite adequate to keep them in. Some of the boors or farmers at the Cape, living toward the interior of the country, have at times paid a little attention to the partial taming of ostriches, and have found it not difficult to reduce them to such a state of domestication, or rather endurance of the vicinity of man, as that they go about the farms without attempting to desert permanently to the uninhabited deserts. Hitherto, however, they have been objects of curiosity, and not of advantage, for they have been turned to no useful purpose; and their voracity and strength are so great, that, though splendid ornaments certainly, they are very expensive ones. In farm-yards they are said to be absolutely destructive, by trampling to death the ducks and common poultry with their great and heavy feet, and also by swallowing the young. That they do the latter from any carnivorous instinct is by no means probable; for, if true, it seems rather to be a part of that instinct which they have of indiscriminately swallowing all kinds of substances, nutritious, indifferent, and poisonous. If the strength of the ostrich has not been turned to much account in the way of service, the flesh and the eggs have been turned to little more as articles of food. It is true that the Romans, in the days of that depraved and ridiculous luxury which finally converted the rulers of the world into the meanest and most contemptible of its slaves, introduced certain parts of the ostrich at their feasts. Heliogabulus is mentioned as having had the brains of six hundred ostriches cooked for a single feast. In the judgment of reason this can be looked upon as no other than a most profligate waste, something similar to the dissolving of pearls in beverages, where a pinch of chalk and a little bit of calf's-foot jelly would have had the same effect. When, however, we call to mind the prejudice which at that time set the ostrich down as the special emblem of stupidity, it is impossible to avoid admiring the admirable tact with which this imperial, but foolish glutton, suited his mess of ostriches' brains to the contents of his own cranium.

The plumes of the ostrich, though mere ornaments, are of more legitimate use. They have been sought after as ornaments from time immemorial, as we already hinted; and it should seem that there was early noticed in them the superiority of the living clothing of animals over the dead. It is well known that dead hair is very inferior, both in beauty and durability, to that which is obtained from the living subject. The same holds good in the feathers of the ostrich; those which are pulled from the living animal being far more beautiful, as well as durable, than those which are obtained from the dead one. It is to be understood, however, that the hair or feathers taken from an animal very recently killed is to be considered as living rather than as dead; for the durability of such hair or feathers is much greater than that of those which have been cast. Vast numbers of those feathers are sent to all the countries in the northern and middle latitudes, and, in short, to every part of the eastern continent where a native supply is not found from the bird itself. For the supply of the west of Europe those plumes are obtained, in great part, from the northern margin of the Great African Desert; and Mogador, in Morocco, is the chief part from which they are sent.

The skin of the ostrich is used as well as the feathers. It is exceedingly thick and tough, and employed in some of the southern countries for the same purposes as buff jackets were used at one time in Europe. It is formed into a sort of cuirass; and, as Butler says of the doublet of the redoubted hero of his matchless poem, it is,

"Though not sword, yet cudgel proof."

The Rhea (*Rhea Americana*). This bird is usually styled the American ostrich, and it has sometimes been described as belonging to the same genus with the cassowary of the eastern isles, and again as of the same genus with the emu of New Holland. It is, however, perfectly distinct from both of these birds, as well as from the ostrich properly so called. Its characters are: the bill straight, short, soft, depressed at the base, and a little compressed at the point, which is obtuse, and furnished with a nail; the lower mandible is very much depressed, flexible, and rounded at the tip; the nasal grooves are very large, extending to the middle of the bill; the nostrils are on each side of the surface of the bill, cleft longitudinally, and open; the feet are long, very strong and robust, and they have three toes directed to the

front, the lateral ones equal to each other; the claws upon all the toes are of nearly equal length, rounded, compressed, and blunt; the tibia feathered down very nearly to the tarsal joint; and the wings, which are quite unfit for flight, are furnished with plumes of greater or less length, and terminated by a single spur.

As is the case with the ostrich of the eastern continent, there is only one species of this bird, and it is confined to a particular locality, though within the range of that locality it is far from being a rare bird. It is bluish ash-grey on the upper part; the crown and hind head are blackish; a black band begins at the nape, descends the lower part of the neck, which it surrounds, and gets broader on the shoulders; the scapular feathers are ash-coloured, and so are most of the plumes of the wings, but the larger ones are white at the base and blackish in the middle, and some of them are altogether white; the bill and feet are reddish grey; the height of the bird is an inch or two less than five feet, being thus considerably smaller than the ostrich.

This bird is quite unknown in the immediately tropical part of America, its principal locality being in the plains of Paraguay, and, where the ground is adapted for it, it is found in the elevated valleys among the Andes, and along the southern part of the continent as far as the Strait of Magellan. It must not be understood, however, that though the rhea is found in America in latitudes as high as the southern part of the British islands, it is in any way a bird of temperate climates; for, though the country which it inhabits is not very hot, still it is decidedly tropical in its vegetation, and in all its natural characters; and some species of humming birds extend at least as far southward as the rhea.

The extensive plains of the Pampas, to the south-westward of Buenos Ayres, are its head-quarters. Those plains are very peculiar in their seasonal character. For a short time, and but a short time, they are comparatively barren; but for the greater part of the year a luxuriant crop of thistles, and other *compositæ*, alternates with an equally luxuriant crop of clover, each one dying down, and furnishing a rich manure for the other. Human inhabitants are but few in those plains; but the birds under notice, and also wild cattle and horses, are exceedingly numerous. The cattle are very active, and the horses are swift; but it is doubtful whether the rheas are not fleetest of the three.

When tranquil, their gait is sober, their neck is elevated, and the back is curved. In grazing they cut the grass with much neatness. The time of reproduction is in the month of July; and at this season the males send forth cries similar to the lowing of cattle. They form the nest on the ground; it is rather wide, very shallow, and sometimes lined with a little straw. The eggs are between five and six inches in diameter, of equal proportions at both ends; their colour is yellowish white, and they are very smooth on the surface; and a single nest sometimes contains from sixty to eighty eggs. M. Azzara is of opinion that these are the production of many families of the same district; and he states, as an ascertained fact, that a single individual, said to be the male, hatches the eggs, and takes the charge of conducting and protecting the young. It is conjectured that the male selects some eggs from the others, and breaks them, in order that the insects which come to feed on the broken eggs may serve as food for the young birds. But, though this is said, it is by no means probable; and indeed, in all the local accounts which are given of this bird, so much romance is mixed up with the truth, that it is extremely difficult to separate the one from the other. When the young birds are brought up in houses, they are very familiar; they soon become domesticated, and exhibit a great deal of curiosity in examining the different apartments. They also walk in the streets, and stray abroad to considerable distances from their habitations, but they generally return to the places where they are accustomed to be fed. They unhesitatingly swallow pieces of metal and small stones when these come in their way. In the young state the flesh is tender and tolerably well flavoured. Though these birds seem never to drink, they are not averse to take the water. They are excellent swimmers, and often traverse the rivers and lakes out of choice.

The skin of the rhea, like that of the ostrich, is very strong, and the inhabitants of those parts of South America in which the birds abound make use of it for a variety of purposes. The feathers of the wings are also used for ornaments, but they have neither the size nor the elegance of the corresponding feathers of the ostrich. Comparatively few of them are white, and even such as are, are by no means equal in colour to ostrich feathers. The taking of the birds, when nearly full grown, is a favourite sport with the Guachoes of the Pampas. They follow them on horseback, and, as the vegetation is then long, the horse gets on rather more swiftly than the bird. They are captured indifferently with the two instruments of which these people make such dexterous use—the *lasso* and the *bolas*. The lasso is a noose at the end of a long thong of leather; and it is delivered with such certainty, that the Guachoe, riding full speed, can catch the birds by the neck, the body, or the leg, just as he pleases. The bolas or balls, again, are of such weight, that the bird is knocked down by the blow of them.

OSTRYA (Michaux). A genus of hardy trees, natives of North America. The flowers are monœcious, and the genus is ranked among the *Amentaceæ*. These trees are common in our ornamental plantations, and known by the name of hop-hornbeam. They are raised from seeds or layers.

OSYRIDEÆ. A small natural order containing only two genera, viz., *Osyris* and *Exocarpos*, of each a single species. They are trees with flexile twigs, and from the acidity of the leaves the *Osyrus* is called mountain sorrel, or poets' cassia. It is easily propagated by cuttings, but hardly hardy enough to stand our winters without covering. The *Osyris* of Pliny was a marvellous vegetable endowed with the property of curing every disease. But our modern *Osyris* cannot certainly be the plant which he describes, for, excepting a slight astringency, it possesses no sensible properties as a medicine, and is now only used for making besoms. *O. japonica* is occasionally eaten as a salad. *Exocarpos* has received its name from the enlarged receptacles on which the fruit is placed, giving the appearance of being a seed outside of its seed-vessel: a new species of *Exocarpos* is remarkable for bearing its flowers on the margins of dilated foliaceous branches, concerning which it would be difficult otherwise to determine whether they were boughs or leaves.

OTHONNA (Linnæus). A genus of very various

formed plants, some species being shrubs, others undershrubs, or herbaceous, with or without tuberous roots. They are natives of South Africa, and belong to *Compositæ*, are kept as green-house plants, and are easy of management, and propagated by cuttings.

OTTER. See LUTRA.

OURAPTERYX (Leach). A genus of lepidopterous insects, belonging to the family of nocturnal moths (*Geometridæ*), and distinguished by having the hinder wings furnished with a pair of short tails. The type is the swallow-tail moth (*O. sambucaria*), a handsome moth of a pale brimstone colour, about an inch and a half in expanse. It is not uncommon in the neighbourhood of London.

OUTEA (Aublet). A genus of shrubs and trees, natives of both Indies, otherwise called Joutay. They belong to *Leguminosæ*.

OVIS, a most important genus of ruminating mammalia, of which an account will be given in the article SHEEP.

OVULA (Lamarck; BULLA, Linnæus). Bruguière, in the first instance, separated the shells of this genus from those of the genus *Bulla* of Linnæus, with which they were confounded. Lamarck has properly adopted the same association of species, but has divided them into two families; the first consisting of those which have the right side of the aperture wrinkled or thickened; and the second of such as are smooth on the right side; in which he includes the species having the last whorl attenuated, and producing long beaks or rostra at both ends of the shell, as in the *Ovula volva*, commonly called the weaver's shuttle. The genus *Ovula*, as it is now constituted, forms a very natural and well-defined association of species. Its rank in a system of malacology is immediately preceding the genus *Cypræa*, to which it may be considered nearly allied, as the animal differs in no essential characteristic. From the *Cowry* it may, however, be readily distinguished, no spire being formed, and both ends of the shell being continued in uniformity with each, or nearly so, in most species; and another striking distinction is, that the columella (lip) is never plaited, or, as it is sometimes called, toothed. To the genus *Bulla* they also approximate, being, like them, convolute shells; but the right lip, which is constantly folded, or reflected inwardly in adult shells, and either smooth or wrinkled, is a character quite opposite to that of the *Bulla*, in which the lip is straight. The form of the *Ovula* is ventricose like the *Cypræa*, oblong, oval, or sometimes egg-shaped; the whorls convolute, rolled upon their own axis, the outer one very considerably larger, and inclosing all the others; and in some species both extremities are prolonged, and form subcylindrical beaks, particularly in the *O. volva*, in which we have seen examples where this attenuated portion extended several inches from the central point of the whorls. In other species, as the *O. gibbosa*, the conformation of the whorls more nearly resembles that of the *Cypræa*, but they exhibit no spire; the edge of the right lip is always reflected inwards, and either smooth, or somewhat wrinkled; there are no columella plaits; the aperture is longitudinal, narrow, and extending the entire length of the shell; it is also effuse, without any operculum or epidermis. The mantle of the animal envelopes the shell completely, folding over by a continuation on one side; while in the *Cowry* it is expanded on both sides, and sometimes does not meet beyond a certain point, which may be traced in some cases. In a young state the lip is sharp, but at an adult age it turns inwardly. This genus is the first of the six genera into which Lamarck has divided the shells, being spirally evolved on their own axis, viz. *Ovula*, *Cypræa*, *Terebellum*, *Ancillaria*, *Oliva*, and *Conus*. The two first only have their lip reflected inwards. This genus is beautifully figured in a Monograph published by Mr. Gray, F.R.S., to which we refer our readers. These molluscs mostly inhabit the Indian seas and those of the torrid zone. Some species are known in a fossil state. The animal is ably figured by Messrs. Quoy and Gaimard in the Atlas of Plates to their Voyages.

OWL (*Strix*, or perhaps rather *Strigidæ*, the owl family), the common name of all the nocturnal birds of prey. These birds are found in every country; and, though all of them are nocturnal, or rather crepuscular in their feeding, yet they are among the most laborious of birds; and the quantity of food which they consume in proportion to the weight of their bodies, is probably greater than that consumed by any other birds. As is the case with the diurnal birds of prey, taking them in the order of their disposition to prey upon the living bodies of warm-blooded animals, so, in the owls, the head-quarters may be said to be in northerly and cold climates. In tropical countries, indeed, there are plenty of owls, but they are not birds of so bold a character as the owls of the north, just as the vultures of the same countries are not so bold birds as the northern eagles.

There is a very singular adaptation of twilight and twilight bird in this geographical distribution of the owls, and, if properly followed out, it is one which is calculated to throw no small light upon the mode in which all the parts of nature are fitted to each other. In the tropical country the twilight is very short, nearly of the same length all the year round, and under the equator itself there is only about an hour and twelve minutes between sunset and absolute night. In the polar regions again, and even in temperate latitudes, the twilight is much longer. At the poles there is light all night for a part of the year, and bright twilight for a still greater part. Upon a Shetland hill one can read the smallest print with ease at midnight in summer, with fully more ease indeed than it can be read at mid-day in winter if the sky happens to be cloudy. Over all the northern parts of the island of Great Britain, it is pleasant walking light the whole night long; and Nature's night is so short, that hardly have the bitterns and other evening birds ceased to deliver their notes, when the birds of the morning are astir, and pouring forth their morning songs. There is a great difference between those morning songs and the evening notes of the birds; all the latter are harsh and jarring, and there is a monotony in the jar that tends to lull one asleep, in the same manner as is done by the trickling drops in a dripping cave, or the ticking of a clock. The morning song again, whatever be its pitch, is lively and inspiriting, and tends to shake off that sleep which the evening song produces. It may be the cackle of the grouse, the whistle of the plover, the wail of the lapwing, or the glorious note of the lark showered down from the top of the sky, as if to call men to their labours; but, be it what it may, it comes thrilling over the mind like the spirit of the morning, and inspires freshness into such as happen to be abroad.

It would require more space than we can afford to analyse the relations which subsist between the notes of birds, the times at which they are heard, and the effects which they have upon the feelings, and consequently upon the actions, of the human race; but it is certain that this influence is very great, and, if investigated with due care, it would tend to throw much light upon the natural character of nations, especially of those nations which live within and near the icy zones, and whose character and feelings partake largely of that diversity which marks the seasons of the year. There seems little doubt that many of the birds which migrate northward in the early part of the season, help to lengthen the day to the human race. One loves to linger in the balmy air of a summer evening to hear the notes of the nightingale; and one is grateful for being awakened by the same when morning first dapples the east. Our present business, however, is more immediately with the owls, and to them we must confine the remainder of our observations.

Various writers on birds have divided the owls into genera or sub-genera, and described each division by certain characters, which chiefly consist in differences of size, and in the presence or the absence of produced feathers on the head, usually forming a sort of tufts, which have very absurdly obtained the name of horns. There is not much philosophy or use in those subdivisions; because, notwithstanding those differences in external appearance, an owl is an owl, whether it is large or small, and whether it has tufts of feathers on the head or not. If the same fondness for subdivision, and the same disposition to establish species upon small differences of external character which is often applied to the lower animals, were applied to the human race, where its application would be just as philosophical, we should often have three or four species of men in the very same family.

Such being the case, we shall merely mention the general characters of the owls as if they were but one genus, and shortly notice a few of the leading species of which this genus is composed. The first of these will enable us to convey a general notion of what is meant by an owl, and the second will equally enable us to point out in what manner and to what extent owls fitted for different situations and climates vary from each other.

The general characters are: the head large; the eyes very large, directed to the front, and covered by a circular concha or shell of feathers, the posterior margin of which covers the opening of the ear, and the anterior one the cere or naked skin at the base of the beak, and sometimes the beak itself. The irides of the eyes are remarkable for their sensibility. In the dark twilight, or when the bird is shaded, they are of immense extent; but when the light falls strongly upon them, they are so contracted as that no light is admitted, and the bird, unless in so far as it is guided by the sense of hearing, and the sensibility of its feathers, both of which are understood to be very considerable, is bewildered, flies bumping against obstacles, and would be an easy capture if it were worth the trouble. But an owl, though it looks plump in its feathers, is generally nothing but skin and bones in its body; and therefore it holds out but little temptation to those more powerful birds which are on the wing during the day. The skull of the owl is rather of large size, but of tender fabric, and a considerable part of it is taken up by large cavities in which an expansion of the auditory nerve is inserted, and this no doubt tends greatly to increase the sense of hearing. The sense is indeed one upon which owls must in many situations have their principal dependence, notwithstanding the great volume of dim light which the expanded pupils of their eyes admit. This appears to be especially the case with those owls which hunt as they fly; and it is highly probable that the hunting alarms the prey, causes it to stir, so as to be audible, and thus contributes to the success of the hunting. Every one who has attended to the habits of animals must be aware that the cry of a predatory animal excites great agitation in its prey; and that, were not this the case, some of the most powerful of the predatory animals would possess their strength in vain.

Owls, for the most part, feed upon small mammalia, little birds and insects, which they generally catch upon the ground or in bushes; but there are some of the more powerful ones which prey upon grouse and other birds of considerable size, and capture them on the wing during the day.

Owls have the feet of nearly the same form with diurnal preyers, namely, three toes in the front and one to the rear; they have very sharp and crooked claws upon all the toes, but these are not so thick and strong as in the diurnal preyers. The tarsi are in general short, more slender than those of diurnal preyers, but the muscles of the legs are well formed, and in general much protected by feathers. The bill is very crooked, though also much more slender than that of the diurnal birds. The muscles by which it is worked are also greatly protected from variations of temperature, by the produced feathers around the eye. Taking it altogether indeed, though an owl is much less formidably armed than a diurnal bird of prey, it is fully as ready in the use of those weapons which it does possess; and as we shall afterwards see noticed in some of the species, owls can endure a severity of climate before which the eagle herself is constrained to give way. This does not of course apply to all the species, for an owl, like every other creature, is endowed up to its necessity, but not beyond it; and in many countries the owls have no great variation of temperature to endure. As is the case with all animals which are naturally voracious feeders, owls can be tamed. In that state they are familiar, and learn to distinguish those who feed them, though they continue to snap and hiss at strangers. We shall quote a few observations on owls from "The feathered Tribes of the British Islands:"—"The very name of the owl," says the author, "is a name of lamentation, expressive of the sound of its note, which is one of the most melancholy love songs in the whole chorus of nature. Superstition has accordingly laid hold of the bird as one of the instruments by means of which to bind the ignorant in the fetters of fear; and the circumstances attendant upon the owl, although they admit of being turned to better and even delightful purposes, have certainly an aptitude to be so perverted.

"Deep shady groves, hollow trees, crumbling ruins clad with ivy, steeples and churches with their associations of graves and ghosts—all that seem dim to human reason, all that stand monumental of the works of nature, or of man and his works, is linked to the owl by the closest and most general associations. The owls in such places, often heard but seldom seen; when heard, heard in the gloom and stillness of night;

and when seen, appearing with something of judge-like solemnity—made them very readily convertible into a sort of doom-birds.

"The time of their appearance gave farther colour to the superstition. Gloomy days, when the congregated clouds hung low in the sky, but kept up by the strong resistance of the warm earth and the breezeless stillness of the summer air; murky days, when the sun 'was sick to dooms-day with eclipse,' all occasions when the heavens looked black upon the earth, but produced stillness rather than storm, borrowed the attributes of twilight, and so brought out the owl—brought it out by perfectly natural, and, according to the laws of its being, necessary causes, but causes which were not understood; and the event, being striking and mysterious, was remembered, all concomitant mishap was remembered along with it; so that the owl, which came out simply to see if there was 'a mouse stirring,' got the blame of the whole.

"But, notwithstanding, owls are interesting birds, and the sounds which they utter, though deep and monotonous, have music for a well-tuned ear, the part which they act in creation is, moreover, an important part; and from the numbers of vermin which they destroy, there are few birds more worthy of protection in an agricultural country than the owls. The Athenians made them sacred to their patron goddess for defending the labours of the loom; and if we cherished them about our farm-houses, they would do yeoman service in defence of the labours of the plough.

"Nor is the superstitious dread of them without its use, or would the abolition of them be unmixed gain. Mankind are all the better for some checks upon them at those times when they are not watched by their fellows; and the actual presence of the owl may have sometimes restrained the midnight plunderer from his purpose, as effectually as the mere thought of rural wisdom enwigged with office. If so, and there is little doubt of it, the owl was a cheap policeman, keeping back one set of marauders, and exacting, as his fee, the destruction of another." Vol. I. p. 136-37.

We shall now advert to the principal species of the owls. Three of these are represented in the plate "Owls;" and they may be considered as specimens of the owls of the cold, of the warm, and of the middle latitudes. The snowy owl, toward the reader's left hand, at the bottom of the plate, is the typical owl of the extreme north, and among the most formidable birds of the whole race. The one at the bottom, marked Egyptian owl, is from Africa, a country in which there are many owls, some of them imperfectly known. The Virginian owl, at the top of the plate, is a native of the central parts of North America, and it is a powerful bird. We may remark, in passing, that the owls of warm countries are, generally speaking, darker in their colours, more nocturnal in their habits, and have the feet less feathered than the owls of cold countries. The depth of the forests, in some of their haunts, answers nearly all the purposes of a twilight to them; and, as their pastures are richer than in the cold latitudes, they are less powerfully winged, and altogether birds of a softer description. Many of the arctic species are common to the two continents; or, at all events, if they are specifically different, the difference is so small, that, for popular purposes, it is hardly worth mentioning them. For this reason, we shall adopt Wilson's descriptions of one or two of them; because his decriptions, when given from his own observation, never admit of improvement from anybody else.

The Great White, or Snowy Owl (*Strix nyctea*). This is what may properly be styled the monarch of all the owls; and, from its habitation, its powers of endurance, and its bravery, it is one of the most interesting of the feathered race. Its dwelling is in the extreme north, where it finds its food and rears its young among the rocky mountains and isles, despite all the violence of the northern storms. It is found in the north of Asia, in the north of Europe, and in the north of America; and it very rarely makes its appearance even in the most northerly of the Scottish islands, and rarely, indeed, on any part of the mainland, and never in the south. It is tempered to the "thick-ribbed ice;" and, when our navigators made their somewhat Quixotic expeditions in search of an *impassable* passage, from sea to sea, by the north end of America, they found this owl at the very extreme point which they reached, better fitted for the intensity of the climate, by the hand of nature, than they were by all the resources of their art.

Such a bird, found in such countries, is an object of great interest to every one who has the least feeling of nature; and, therefore, after we have copied Wilson's description of it, which is decidedly the best, we shall offer two or three remarks on its general economy.

"The male," says Wilson, "measures twenty-two inches and a half in length, and four feet six inches in breadth; head and neck nearly white, with a few spots of dull brown interspersed; eyes sunk deep, under projecting eyebrows, the plumage at their internal angles fluted, or pressed in, to admit of direct vision; below this it bristles up, covering nearly the whole bill; the irides are of the most brilliant golden yellow; and the countenance, from the proportionate smallness of the head, projection of the eyebrow, and concavity of the plumage at the angle of the eye, very different from that of any other of the genus; general colour of the body white, marked with lunated spots of pale brown above, and with semicircular dashes below; femoral feathers long, and legs covered, even over the claws, with long shaggy hair of a dirty white colour; the claws, when exposed, appear large, much hooked, of a black colour, and extremely sharp-pointed; back white; tail rounded at the end, white, slightly dotted with pale brown near the tips; wings, when closed, reach near the extremity of the tail; vent-feathers large, strong shafted, and extending also to the point of the tail; upper part of the breast and belly plain white; body very broad and flat. The female," continues the same admirable describer, "which measures two feet in length, and five feet two inches in extent, is covered more thickly with spots of a much darker colour than those of the male; the chin, throat, face, belly, and vent, are white; femoral feathers white, long, and shaggy, marked with a few heart-shaped spots of brown; legs covered to the claws with long white hairy down; rest of the plumage white, every feather spotted or barred with dark brown, largest on the wing-quills, where the brown margins are about two inches apart; fore part of the crown thickly marked with roundish black spots; tail crossed with bands of broad brownish spots; shafts of all the plumage white; bill and claws, as in the male, black;

third and fourth wing-quill the longest; span of the foot four inches."

Such is Wilson's description of the appearance of the birds; but he adds an account of the eye, which is so circumstantial, and so eminently characteristic of the eyes of nocturnal birds, that we shall quote it in his own words:—"From the various individuals of these birds which I have examined, I have reason to believe that the male alone approaches nearly to white in the plumage, the female rarely, or never. The conformation of the eye of this bird forms a curious and interesting subject to the young anatomist. The globe of the eye is immoveably fixed in its socket by a strong elastic hard cartilaginous case, in form of a truncated cone; this case, being closely covered with a skin, appears at first to be of one continued piece; but, on removing the exterior membrane, it is found to be formed of fifteen pieces, placed like the staves of a cask, overlapping a little at the base, or narrow end, and seems as if capable of being enlarged or contracted, perhaps by the muscular membrane with which they are encased. In five other different species of owls, which I have examined, I found nearly the same conformation of the organ, and exactly the same number of staves. The eye being thus fixed, these birds, as they view different objects, are always obliged to turn the head; and nature has so exactly adapted their neck to this purpose, that they can, with ease, turn it round, without moving the body, in almost a complete circle."

A bird so furnished, by nature, in the warmth of its plumage, the power of its weapons of prehension, and its capacity of enduring such extremes of cold, is one of the best objects of study; and it is impossible to form any correct idea of the character of this owl without a reference to the countries which it inhabits. In Europe it does not, as we have said, come far to the southward even in the severest weather. In America it ranges more extensively, finding its way not only to Canada, but into the middle states of America, and even sometimes much farther to the southward. The reason of this is the different character of winter in the two continents; for, in America, what would be considered as severe enough for a polar winter, is met with as low down as the United States. This bird is, therefore, strictly speaking, a polar bird; and it takes the lead among those owls which make the nearest approach to diurnal birds of prey, and which, for that reason, are sometimes called *falcon owls*. There are several others much smaller and feebler than this one, and they extend into the very warmest latitudes, the ones which haunt the low grounds there having the tarsi altogether, or nearly, bare of feathers.

Owls of this description are birds of the wilds, and of rocky places, rather than of woods; they are swifter fliers, and more diurnal and given to hawking on the wing than the other owls. One can easily see why this can be the reason with this northern species. During a considerable part of the year there is perpetual sun on its pasture, and for a still greater part there is light the whole night over. The summer action of nature is extremely vigorous there; vegetation sprouts, blossoms are expanded, and berries are ripened, as if it were by magic, while both the air and the waters swarm with insects and other small living productions of the season. These support the summer birds, which resort in vast numbers to the north; and this owl, in concert with the eagles and the more powerful hawks, is a regulator of the numbers of those birds. It must not be understood, however, that the long summer in those high latitudes is a season of atmospheric tranquillity. The places we allude to are, generally speaking, near the sea; they are almost, without exception, hilly and rocky; and in the heat of the season the currents keep the masses of ice in continual motion from place to place: there is, therefore, a great deal of evaporation, and condensation of humidity, alternating with each other, the result of which is dense fogs, which often come on very suddenly, and so close, that they put an end to the labours of diurnal birds of prey. At other seasons of the year the snow-storms are equally violent, and accompanied by winds which blow with the greatest fury, and attended with such thickness of drifting snow clouds, as to be proof against the eyes even of eagles, proverbial as they are for the keenness of their vision.

The autumn, and partially, also, what may be termed the spring, are the seasons of those storms, while the fogs are more frequent during the summer. Both kinds of weather are, however, well adapted to the habits of the snowy owl, which, clothed, armed, and protected as it is, pursues its course, and carries on its avocation, let the fog thicken and the snow drive as they may.

In the season of the fogs, and also in that of the autumnal storms, the snowy owl flies low, and feeds chiefly upon grouse, ptarmigan, and other ground birds, which it captures in great numbers, and gets exceedingly fat. It is so voracious, that it seizes prey indiscriminately on the land and the margin of the waters. Upon the moors its chief prey is the birds that we have noticed; on the sandy islands it consists of rabbits; and when it is absolutely frozen out from the land by heavy falls of snow, it repairs to the water and catches fish, for whose appearance within its reach it waits with all the patient gravity of a devoted angler. It even plays the vulture when occasion serves; for, though carrion of any kind is not so plentiful in the polar latitudes as in the warmer ones, there are seasons at which it is rather abundant. Of the ground birds of the north, there are many which quit that part of the world with reluctance, and not till they are literally driven by the storms. Those storms are excessively violent; and, as the snow thickens the air to dimmest twilight, the affrighted birds lose their way, and also all command of themselves, and vast numbers of them find their graves in the snow wreaths. Their bodies do not putrify there, but are preserved by the frost, until the returning sun of a new season melts away the annual mantle of the ground. Spoils of birds, and also of small quadrupeds, are then disclosed in considerable numbers; and these furnish a supply for the snowy owls, and other predatory birds, until the summer tenants of the northern wilds make their appearance.

During the time that the country is completely sealed up with snow, and the greater part of nature slumbering in the unbroken serenity of winter, the supply of these birds is somewhat different. As every observer of nature in the snowy districts of Britain must have noticed, by the prints of little feet along the surface, the small rodentia of the wilds come upon the surface of the snow to seek the exposed bark of bushes, and other vegetable matters; and it is on these rodentia that the more powerful

owls, and also the eagles of the north, contrive to feed while the snow remains unbroken.

The circumstances which we have mentioned will serve to point out in brief how these birds of the north support themselves at different seasons of the year; and it is impossible to avoid admiring what nature has made in them for preventing any part of the provision of the year from being lost.

The species of owl under notice is very seldom found where there are woods; and therefore its resting-place, and also its shelter, during those extremities of the storm, which even its mantle and wing are incapable of bearing, is in the clefts of the rocks. It is not much of a wanderer; and it is probable that the few which are seen in Orkney, and more frequently in Shetland, reside there all the year round; nor do the northern ones quit their snowy fastnesses until they are reduced to the greatest extremity. When they do, they are usually found upon the snow, or rather upon some jutting stone, or projecting stick, which rises above the surface; and as the bird and the snow do not differ much in colour, the small birds are not alarmed, and thus they are captured with comparative ease. We may add, that this owl, and the other owls which, like it, are of bold character, and prey on the wing, and have no tufts of feathers on the head, are not so much molested by flocks of small birds as the owls of more nocturnal characters are when they come abroad during the day.

Of the division of owls to which this belongs, namely those which have no crests on the head, no very produced feathers round the eye, and the tails of moderate length, we can only afford to give a mere list.

The Little Owl (*S. passerina*) is one of the most common of these, though as a British bird it is rather rare. It is about seven inches long, and twice as much in the stretch of the wings from tip to tip. It is thus a well-winged little bird, and it is as bold as it is powerful. It is found in America as well as in Europe, though its size in the former country is larger, and it is perhaps a little different in the colours. It is rather a woodland bird in America, frequenting the swampy shores and the margins of the waters. In Europe its habits are rather different; for it approaches the vicinity of houses, nestles in holes of walls, usually hides itself in them during the day, and comes abroad on its mousing excursions chiefly in the twilight. It is not, however, confined to that time of the day; for when the sky is gloomy, and the swallows are out in great numbers, it may sometimes be seen hawking after them with considerable dexterity and success. Swallows generally fly in curves; and the little owl, though not perhaps so swift naturally as they are, takes the chord of the arch, and not the arch itself, by which means it is enabled to come up with them. In America it is very common, extending even to the north parts of Canada, and building its nest in the dark and thick pines, not on the tops of the trees, but about midway. The nest contains two white eggs, as is the case with the whole of the genus; and in those parts of the world Wilson says it is rarely seen during the day, though exceedingly active after twilight closes in. Its colours are: olive brown on the upper part, with some white spots on the scapulars and coverts of the wings, and five bars of white passing obliquely over the first five primary quills; the tail is rounded, rather darker than the body, tipped with white, and crossed by two rows of white spots; the inner webs of the wing feathers are also spotted with white; the ear coverts are yellowish brown; the crown of the head, the upper part of the neck, and a circle round the ears, olive brown, beautifully marked with white dots; the front pure white, but ending in long blackish hairs, and there is also a black spot radiating outwards at the inner canthus of each eye; the lower parts are ochre-yellow, streaked with reddish bay; the thighs and feathered parts of the legs, which extend down to the very claws, are pale buff; the irides are pale yellow, and the claws, which are long and very sharp pointed, are black. This is the description of the female bird, which, as is the case in all the species, is rather larger than the male; and the young male, being coloured like the female, and smaller in size, has sometimes been described as a different bird.

The Feathery-footed Little Owl (*S. dasypus*) is rather larger than the one now mentioned. It is brown with white spots, larger on the under part than on the upper. The tarsi and toes are completely feathered. It is found occasionally in some parts of the south of England; but, comparatively speaking, it is a rare bird in this country.

The number of species or varieties described as belonging to this section of the owls is very great; and they are found in all countries, from the northern boundary of the temperate climates to considerably southward of the equator. A full description of all these species would fill an entire volume, and even then it would not be very satisfactory, as the species are not a little confused. Two of the smallest species are the occipital owl of Africa and the sparrow-like owl of Brazil. The first of these is brown, yellow, and white on the upper part, and whitish streaked with rust colour on the under. The front and top of the head are reddish white, mottled over with dots; and the quills are banded alternately with red and brown. The toes, as well as the tarsi, have a downy covering. The total length of the bird is about seven inches. The other species has the head greyish brown, with white dots; the scapulars and wings spotted and banded with white; the tail black, with four white bands; and the front, the throat, and the under part white. It is only six inches in length, and is one of the smallest of the owls, but a bold and active bird for its size. Some other owls, belonging to this division, and chiefly found in the tropical parts of America, have the tarsi naked, and the tail short; while those of the colder latitudes uniformly have the tarsi feathered. The whole of this division are to be considered as the most active and least nocturnal of the owls; and many of the small ones of the tropical countries are found flying about under the shade of the forests during the day as well as in the twilight.

Many owls of the same division have the tail considerably longer, and wedge-shaped. Of these, one of the most remarkable is,

The Hawk Owl (*S. Hudsonia* of Wilson). This is very common about Hudson's Bay; but it is not very correctly named from that country, inasmuch as it occurs equally in the eastern continent. It may be regarded as being, in its locality, a borderer upon the country of the snowy owl of the extreme north. Like that owl, it extends further southward in America than it does in Europe and Asia; and in Europe it is rarely indeed to be met with to the southward

of the Baltic; nor is it at all common in the central states of the American Union.

It is a bold bird, active upon the wing, and among the most diurnal of all the owls; pursuing birds with great boldness in daylight, and sometimes snatching partridges and other game after they have been shot by the fowlers. It has, indeed, some of the characters of a hawk, resembling that species in the smallness of the head, the narrow feet, and the produced tail; but still its feet, and the feathering around its eyes and bill, bring it decidedly within the owl family. Still, however, its general plumage, and especially the plumage of its wings, differs much from that of the more characteristic owls. In them the quills of the wings have their external webs drawn out into a margin of hairs so fine and flexible, that the wing works noiselessly in the air, though of course it takes a hold on that element, which lessens the rate of flight in the bird. This owl wants the marginal fringe to the quills, and thus its flight is firmer, but more noisy. This agrees exactly with its habit, which is to dash boldly upon its prey and seize it on the wing; whereas the downy-winged owls come upon their prey by stealth, and always the more stealthily the more that their wings partake of this muffled or downy character. Wilson gives the following description of this bird as it occurs in the northern parts of the United States. "The male of the species is fifteen inches long; the bill orange-yellow, and almost hid among the feathers; plumage of the chin curving up over the under mandible; eyes bright orange; head small; face narrow, and with very little concavity; cheeks white; crown and hind head dusky black, thickly marked with round spots of white; sides of the neck marked with a large curving streak of brown black, with another a little behind it of a triangular form; back, scapulars, rump, and tail coverts brown olive, thickly speckled with broad spots of white; the tail extends three inches beyond the tips of the wings, is of a brown olive colour, and crossed with six or seven narrow bars of white, rounded at the end, and also tipped with white; the breast and chin are marked with a large spot of brown olive; upper part of the breast light; lower and all the parts below elegantly barred with dark brown and white; legs and feet covered to and below the claws with long whitish plumage, slightly yellow, and barred with fine lines of olive; claws horn colour. The weight of this bird was twelve ounces. The female is much darker above; the quills are nearly black; and the upper part of the breast is blotched with deep blackish brown."

Nearly allied to this species there are several others in different parts of the world, though none of them appear to be so well known as this one. There is one described by Pallas and others, as inhabiting the northern parts of the mountains of Ursal, and other hilly districts lying on the margin of the Polar Sea. It approaches in size to the snowy owl; and it resembles it a little in colour, though the greater length of the tail prevents any danger of confounding the one with the other. The upper parts of it are whitish, marked with large longitudinal spots of brown. The head is large, and so is the face, which is much feathered, of a greyish white, surrounded with black hairs, and a circle of white and black. The quills and tail feathers are barred with alternate streaks of black and whitish. The under parts are whitish, with a brown streak down the middle of each feather. The tail is wedge-shaped, and longer than the closed wings. The bill is yellow, almost entirely concealed by the hairs of the face. The irides are brown. The feet and toes are completely feathered, of a white colour, with brown spots. The claws are long, and of a yellow colour. The entire length of the full-grown bird is about two feet, which is intermediate between the male and female of the snowy owl; but as the tail is much longer than in that bird, the length of the body is less in proportion; and, altogether, the bird is not nearly so heavy. The young birds are differently coloured from the old ones, being mottled with brown, red, and white, and having cross bars of grey on the tail. In this plumage they have sometimes been described as a different species from the mature birds; but the identity has been established upon authority which cannot be questioned. Next to the snowy owl, this is one of the most powerful and vigorous birds of the division which prey on the wing, and occupies the same place among the long-tailed owls as the latter does among those which have the tail short.

Another species resembling this in some particulars is the hawk owl of Southern Africa. It is found in the district of the Cape; but it is a smaller and feebler bird than the northern species which we noticed last. On the upper part it is reddish grey, spotted with white, with spots of the same on the wing coverts and the tail feathers, with the exception of the two middle ones, which are grey. The upper parts are entirely white. The bill, which is very short, is black. The feet and toes, which are small and feeble, are entirely feathered. The tail is very long, and wedge-shaped; and the entire length of the bird is scarcely more than the half of that of the bird of the western mountains. Another African species is the variegated owl of authors, which differs from the one now mentioned chiefly in the colours of the plumage.

It would, however, be almost endless to mention the various owls of which this very numerous division is composed; but there is still one species which deserves notice from the peculiarity of its manners. This is the rabbit owl of Molina, improperly called the Coquimbo owl by Latham, inasmuch as it is found in North America as well as in South. The upper parts of it are varied with yellowish grey and brown, marked with brown spots of larger size. Two circles of white and grey surround the face, and a white band passes over the eyes. The flanks are reddish with brown spots; and the rest of the under part is whitish. The bill is greenish in the middle and blackish at the sides; and the feet, which are thinly covered with hairs, are grey. Its length is about nine or ten inches; it occurs chiefly on the dry plains of warm countries in America; and the chief peculiarity of its manners is, its digging a burrow for itself to the depth of a few feet in the earth, after the manner of a rabbit. Its eggs are represented, contrary to the habit of most of the owls, to amount to not less than a dozen, of a white colour, and nearly round in shape.

The species which we have noticed do not amount to nearly half of the owls of this division which are named in collections; but so little is known of the manners of these, and indeed of the greater part of those which we have enumerated, that little or no information respecting them can be given which would in the least interest the general reader. We shall,

Virginian Eagle Owl.

Snowy Owl.

Egyptian Owl.

therefore, proceed to the next division or section, which approaches most nearly to this one in numbers, which is more nocturnal than this division, and in which the heads of all the species are marked with tufts of hair or feathers, varying in length in the different species, and in some of them bearing a slight resemblance in external shape to the ears of a cat. It is distinctly to be understood, however, that these tufts are not ears in any one case, any more than they are horns, for there is no projection of the skull or of the skin answering.

The great tufted Owl, or Eagle-Owl (*S. bubo*) holds nearly the same rank, and also the same geographical place among the owls with produced feathers on the head, and large discs of feathers surrounding the eyes, as the snowy owl does among those which are without these appendages. Like that species, it is decidedly a bird of prey, levying very large contributions upon game and other birds, as well as upon hares, rabbits, and other small and feeble mammalia.

As is the case with the other two, it is found in both continents, or, at all events, the species met with in America, and that met with in the east, so nearly resemble each other, in size, colour, and habits, that a single description will serve quite well for the two. This owl abounds in some places pretty far to the north; but it is not decidedly an arctic bird, like the snowy owl. In Europe it is more abundant in the north, on the mountains, and in the mountain forests of Lapland and Russia, than it is in coming farther to the south. It is found, however, in countries pretty far south; and as it is a bird which dashes about with bold and powerful wing, it may sometimes pass into Africa in the course of its migrations, reaching the mountains of Atlas from the mountains of Spain, as is the case with several birds of cold climates. In the mountains of western Asia, it most likely extends seasonally along the Caucasus and adjoining mountains; and it has certainly been seen as far southward as the confluence of the Volga with the Caspian.

In America it is resident in every part of the United States, where its manners, or at all events its haunts, appear to be a little different from what they appear to be in the east. The dark and dense forests among the swamps are its favourite residence, in which it remains silent for the day, but utters very loud and dismal cries during the night. This part of its character cannot be better described than in the words of its American historian. "This noted and formidable owl," "says Wilson, "is found in almost every quarter of the United States. His favourite residence, however, is in the dark solitudes of deep swamps, covered with a growth of gigantic timber; and here, as soon as evening draws on, and mankind retire to rest, he sends forth such sounds as seem scarcely to belong to this world, startling the solitary pilgrim as he slumbers by his forest fire,

'Making night hideous.'

Along the mountainous shores of the Ohio, and among the deep forests of Indiana, alone, and reposing in the woods, this ghostly watchman has frequently warned me of the approach of morning, and amused me with his singular exclamations—sometimes sweeping down and around my fire, uttering a loud and sudden, Waugh O! Waugh O! sufficient to have alarmed a whole garrison. He has other nocturnal solos, no less melodious, one of which very much resembles the half-suppressed screams of a person suffocating, or throttled, and cannot fail of being extremely entertaining to a lonely benighted traveller, in the midst of an Indian wilderness."

Young birds, squirrels, rabbits, rats, mice, partridges, and different kinds of small birds, are its principal prey; and in proof of its voracity in devouring these, we may relate the following anecdote from Wilson:—"A very large one, wing-broken, while on a foraging excursion, was kept about a farm-house for several days, and at length disappeared for several days, no one knew how. Almost every day after this, hens and chickens also disappeared, one by one, in an unaccountable manner, till, in eight or ten days, very few were left remaining. The fox, the minx, and the weasel, were alternately the reputed authors of this mischief, until one morning the old lady herself, rising before day to bake, in passing towards the oven, surprised her late prisoner, the owl, regaling himself on the body of a newly-killed hen! The thief instantly made for his hole, under the house, from whence the enraged matron soon dislodged him, with the brush-handle, and without mercy despatched him. In this snug retreat were found the greater part of the feathers and many large fragments of her whole family of chickens."

These birds are not migratory in the United States, but remain in the country all the year round; and as there is a bird very much resembling this in Mexico, which is also resident there, they have been described as two different species, and neither of them the same as the European one. The one of the United States has the crest, and also the markings somewhat different from the European one, but it is very doubtful whether these differences be anything more than climatal; and this is probably the real cause of difference between those animals of the two continents, which resemble each other in their general characters. The American one has the tufts longer and broader than the European; but as we are quite ignorant of the use of those tufts in the economy of the birds, we have no clue whatever to the climatal course by which their form or size may be modified.

In Europe the bird is more migratory, which is not exactly in accordance with the general habits of birds in the two continents. It is chiefly in the north in the berry season; and it very rarely comes to any part of the British islands, excepting Shetland, Orkney, and the extreme north of Scotland. Sometimes, however, it does visit the English shores; and when it does so, it is either to the northward of Flamborough Head, or to the southward of the Thames, as the line of the coast in both these places is most likely to intercept a heavy bird when migrating southward, and beaten from the direct line of its migration by the north-east wind. It is not a little remarkable that, while the birds which migrate from the north most frequently take the English coast at one or other of the places we have named, those of the eastern migration more frequently land on that portion of the coast which lies between these.

When this singular bird, for both its appearance and its voice are singular, visits a strange country, and flies by day, as it often does, it seems to strike kites, crows, and other wing birds with perfect astonishment; for they appear to descend and crowd about it for no other purpose than that of wondering at it. This tendency which other birds have to be

attracted by it is sometimes turned to considerable account; for the keepers of preserves of pheasants and other game occasionally display it in confinement, to attract other destroyers of birds and eggs.

When it migrates to a distance, it gets into lofty flight; but when it preys its flight is low, and its note is deep and dismal. By means of this note, it is understood to alarm the birds and other animals upon which it preys, to such an extent as to make them disclose themselves victims to its rapacity. That rapacity is very great; and, in the nesting time especially, the quantity of prey which these birds consume is immense. All owls are, indeed, ravenous and frequent feeders; and as the young remain longer in the nest than those of very many birds, they lay a heavy contribution upon such animals as serve them for food. Under some circumstances this may be an evil; but if we consider that these owls chiefly resort to the wilds of nature, the probability is that the good which they do may predominate upon the whole. Some countries are so completely overrun by small ground rodentia, that when these descend from the mountains they would produce desolation were it not that such birds as the eagle-owl accompany them and thin their numbers. In Norway this is especially the case with the lemmings. In ordinary seasons these little animals keep in the forests the whole year round; but they sometimes invade the plains like a torrent; and when this is the case, the eagle-owls are of great service to the people, from the great numbers that they destroy. These owls are therefore looked upon with great favour by the people of that country; and it is possible that the mythological favour bestowed upon owls in general, as birds of wisdom, arose in a great measure from their service in the destruction of small mammalia. We need hardly mention that an owl of some species or other, perhaps the little owl of the south, which has only a few hairs on the feet, was the bird of Minerva; and there are some singular attentions paid to the owl, or, at all events, to the spoils of it, by some of the tribes of American Indians, which have a singular coincidence with the favour shown to the birds in ancient mythology. "Among the Greeks," says Bartram in his Travels, "the junior priests or students constantly wear a white mantle, and have a great owl-skin cased and stuffed very ingeniously, so well executed, as almost to appear like the living bird, having large sparkling glass beads, or buttons, fixed in the head for eyes. This insignia of wisdom and divination they wear sometimes as a crest on the top of the head; at other times the image sits on the arm or is borne on the hand. These bachelors are also distinguished from other people by their taciturnity, grave and solemn countenance, dignified step, and singing to themselves songs or hymns in a low sweet voice as they stroll about the town."

In Europe, the eagle-owls construct large nests in lofty trees or in rocks, but the eggs seldom exceed two in number. The American ones generally build in trees; and in the United States they do not begin till the month of May. The nest is usually placed against the fork of a tree; but if there is a hollow at a sufficient elevation, the preference is given to that as requiring less labour in building. The eggs are described as being four in number, of a pure white colour, nearly as large as the eggs of a common fowl, and round. The spoils of a number of birds are generally found in the nest after the young have quitted it.

The colours of those formidable owls are various shades of brown, tawny, and rust colour; and the male has some white on the breast, while the upper colours are brighter than those of the female. Taking it altogether, and whether we regard it as consisting of a single species varied by climate and locality, or several species in the different countries where it is found, the eagle-owl is one of the most interesting of all the owls; and from the powers with which it is endowed, and the extent over which it is distributed, there is little doubt that its use in the economy of wild nature is very important, though it is not much wanted in countries where the surface generally is cultivated by man.

Long-tufted Owl (*S. otis*). This is a resident owl in the British islands, and one of the finest in the country. It is not so common, or, at all events, so frequently seen as our native tuftless owls; though the latter circumstance at least is a good deal owing to its less familiar habit. It is strictly a woodland bird, and loves the shade at all seasons of the year, and thus it is most abundant in evergreen forests, though these conduce to its concealment. But though a woodland bird, it is not a mountaineer. It is never found beating over the upland and exposed moors, nor does it haunt the woods of the high glens. It is thus a bird of very different character, not only from the smooth-headed owls of the polar regions, but from the eagle-owl. Accordingly it is not found far to the north, and may be considered as a bird of Middle Europe. It also occurs in the American continent, chiefly in the thick forests over the swamps.

It is a bird of moderate size, the female measuring about one foot three inches in length, and three feet four in the stretch of the expanded wings. It is thus a well-winged bird for its size, and consequently a powerful flyer, though, as we have said, its range of flight is within the forests. When it flies its wings are very noiseless, and it glides along with little apparent resistance from the air. The ground colours of the plumage are rich, and the markings beautifully diversified. The upper part is orange, marked with black streaks, and finely sprinkled with delicate touches of black, grey, and white, becoming paler in the shades towards the sides, and thus giving a very pleasing relief to each feather. The under part is buff colour, marked with lines and arrow-head spots, something like the markings upon several of the diurnal birds of prey. The quills of the wings are brownish-orange, crossed by bands of blackish-brown; and the tail feathers are grey-orange, barred and spotted with black. The feathers of the tarsi and toes are the same as the ground colour of the tail, and without any markings. The tufts, which the bird can move at pleasure, are about an inch long each, composed of a variable number of feathers. The eyes are very bright reddish-orange: and the large conchæ with which they are surrounded give them a very fiery and formidable aspect when the bird glares with them from the deep shade.

The female is the more interesting bird of the two, as will be explained when we come to speak of her nesting habits. She differs a little from the male; and as the young of these owls are in considerable request with those who are fond of birds, we shall add the description of her. The tufts larger than the male, the front feather in each being the shortest, and the others gradually increasing in length backwards.

Their colours are black at the bases and in the middle, and dull yellow at the edges. The irides are vivid yellow; the inside of the circle of the face is white, and the cheeks are of a rusty colour. At the internal angle of the eye there is a streak of black; the bill is blackish horn-colour; the forehead and crown are dark brown, speckled with minute spots of white and pale rusty colour; the outside circle of the face is black, and finely marked with small curving white spots; the back and wings are dark brown, sprinkled and spotted with white, pale, ferruginous, and dusky; and the primaries are barred with brownish-yellow and dusky, darkening towards the extremities; the secondaries are more elegantly barred, and sprinkled with similar markings; the tail is of the same length as the wings, rounded at the extremity, and finely barred and marbled with dull white and pale rust-colour on a deep brown ground; the breast and throat are beautifully clouded with cream, black, white, and rusty; and the belly is finely streaked with large arrow-heads of black; the thighs and legs are plain pale rust, feathered to the claws, which are large and sharp, and of a blue-black colour; the insides of the wings are brownish-yellow, and there is a large spot of black at the root of the first quills.

Both in the old continent and in America these birds are fond of possessing themselves of the nests of others. It is only in particular situations that they dispossess the common rook, because the nests of rooks are usually too much exposed for suiting the habits of the owls. The magpie has its nest in places of greater concealment than the rook; and, therefore, though it makes a little show of fight, and a vast deal of chattering, it must sometimes resign its castle to the more powerful arms of its downy invader. Wilson found one that had taken possession of the nest of a night heron in a swamp near Philadelphia; but, after it had once taken possession, it does not appear to have offered much violence to the noisy colony, for a night heron continued to sit in another nest upon the same tree. In many places this conduct of the long-tufted owl is quite harmless to the other birds, inasmuch as their young have quitted the nest before it comes to take possession. The average of the eggs is about four, and never more than six; they are perfectly white, and nearly spherical. The young remain a long time in the nest; and, for some time after they have quitted it, they continue on the branches, so that the finding of food for them is a great labour to the parent birds. They very early evince a pugnacious disposition, by hissing and snapping with the beak, ruffling the feathers, and making themselves as ugly as possible. The old ones are also pugnacious; and, if their wings are crippled, they throw themselves on the back, and fight stoutly with beak and claws.

The barred Owl (*S. nebulosa*) is an American species, bearing some slight resemblance to the one last mentioned, only it is without tufts on the head, differs in colour, and approaches in many respects to the hawk-owls. They nestle in trees, though not so much in the depth of the forests as the tufted owls. They are consequently more seen, and probably also more numerous. Their nests are rudely built of sticks, and concealed among thick foliage. Their eggs are large, and, like the rest, white. The female bird differs more in size from the male than in most species of animals, being sometimes nearly one half longer. These are more diurnal than the tufted owls, often flying about during the day, and uttering a cry resembling that of the hawk. They sometimes seize partridges and young rabbits; but mice are their staple supply, and in the capture of these they render some service to the farmers. The male bird is described as being about sixteen inches in length, and thirty in the stretch of the wings. The upper parts of the body are of a pale brown colour, spotted with transverse markings of white; the wings are crossed with alternate bars of pale brown, rather darker in tint than the upper parts; the head is very large, smooth, and mottled with spots of white, dark, and pale brown, which extend transversely; the eyes are dark blue, large, and the pupil is not visible; the face, or radiated circle of the eyes, is grey, encircled by a margin of white and brown spots; the bill is of a yellow ground, tinged with green; and the breast is transversely barred with brown and white bands; long streaks of brown, on a yellowish ground, extend lengthwise along the belly; the vent is yellowish white, and the thighs and legs are of the same colour, and feathered nearly to the claws, which are remarkably sharp, and of a dark horn-colour; the tail is rounded, crossed with six broad bars of brown, and a like number of narrow white, and curved below; the back and shoulders are of a chestnut colour; at each angle of the eye there is a broad speck of black; long black hairs terminate the plumage of the radiated circle round the eye; and the bill is surrounded by others of a more bristly texture. The female bird is about twenty-two inches long, and four feet in the stretch of the wings. The chief difference in colour from the male bird is, purer brown on the scapulars, more white on the wings; the tail is also longer, the bill much larger, and of a finer yellow. In treating of this species, Wilson gives so beautiful a description of the various feathers upon owls, that it ought to be known by every reader, now that the observation of birds, in a state of nature, has become so very general. "The different character of the feathers of this, and, I believe, of most owls," says Wilson, "is really surprising. Those that surround the bill differ little from the bristles; those that surround the region of the eye are exceedingly open and unwebbed; these are bounded by another set, generally proceeding from the external edge of the ear, of a most peculiar small, narrow, velvety kind, whose fibres are so exquisitely fine as to be invisible to the naked eye; above, the plumage has one general character at the surface, calculated to repel rain and moisture; but, towards the roots, it is of the most soft, loose, and downy substance in nature, so much so, that it may be touched without being felt; the webs of the wing-quills are also of a delicate softness, covered with an almost imperceptible hair, and edged with a loose silky down, so that the owner passes through the air without interrupting the most profound silence."

The Short-tufted Owl (*S. brachyotos*). This species is very different in its characters from the long-tufted one, and also from the barred owl of America; and it follows more on the character of the eagle-owl, though it is not near so large, nor quite so northerly in its geographical position. Its plumage altogether is shorter and firmer than that of the others, and it is weightier in proportion to its size. It is found on both continents, though perhaps, as is usual, it differs a little in colour, and it is more a woodland bird in America than in the east. This,

by the way, is a difference in character between very many of the birds of the two continents, as, that which is a field-bird in Europe is a forest-bird on the other side of the Atlantic. But this is a matter of necessity, not of choice; because North America was originally almost wholly a wooded country, and it remains so to a very great extent still. As a British bird, it rarely, if ever, nestles except in the extreme north, principally in heaths and tufts of grass. It also lodges in such places; and, when driven from its lodgment during the day, it flies to a short distance, and then alights, turns round, and reconnoitres the disturber, with apparent astonishment that the *siesta* of so sage a bird should be interrupted in so daring a manner. In winter it often ranges to the southward, and, contrary to the habits of most owls, it is found in flocks, as Bewick mentions, twenty-eight being seen in one corn-field in the month of November. As compared with most owls that come into temperate latitudes, it is a sturdy and stern bird, looks with great gravity, and catches mice with much dexterity. When it is in a state of complete repose its tufts are not observed, but it erects them when its attention is excited. These tufts consist of very few feathers, and are not perceptible on the dead bird without very close examination. When the weather is clear, it remains concealed in a tuft, or perched on a stump, watching for whatever prey may come within its reach; but, when the weather is very dark, it flies out, though by very short flights at a time. On such occasions it gives chase to any bird that may happen to rise; and it is highly probable that, in the moors, it feeds a good deal upon ground birds and their young. Mice are, however, its principal food, especially in rich places and the neighbourhood of thickets; and its vigilance and strength are such that it captures great numbers. The length of the male is fifteen inches, and the stretch of the wings about three feet four inches. The general colour of the upper part of the body is dark brown, and the plumage is broadly margined with pale yellowish brown; the irides are rich golden yellow, embedded in a border of deep black, which radiates outwards at all points except towards the bill; here the plumage assumes a whitish colour; the bill is large, and of a black colour; the ears are margined with a semicircular streak of black and tawny yellow spots; the tail is rounded, and of greater length than is usually to be met with in owls; it is barred with five dark brown bands, and a similar number of yellow ochre; several of these last are dotted in the centre with specks of dark brown, and all are tipped with white; the quills are also barred with deep brown and yellow ochre; the breast and belly are yellowish in the ground, and streaked with dark brown; the legs, thighs, and vent, are dull yellow; the three primary quills are tipped with black; the legs are feathered down to the claws, which are exceedingly sharp, black, and curved to about a quarter of a circle. The female is larger than the male, and has more white on the fore part of the body, and the markings on the upper plumage not so rich.

The Scops-tufted Owl (*S. scops*). This is the smallest of all the tufted owls which ever appear in any part of Britain; and its visits are so few and far between, that it can hardly be regarded as a British bird. It belongs to the eastern migration, and is a very beautifully-marked creature. South and middle Europe and Africa are the principal places of its residence, and perhaps it is more abundant in the south of Austria than in any other country. Its length is only about seven inches, but it is a well-winged little bird, and very active and daring. Its southern locality is shown by the fact of the tarsi and toes being almost entirely bare of feathers, so that the tendons would get benumbed, and the bird would be unable to find its food, were it exposed to a severe climate.

The upper part of it is fine reddish ash, clouded with waving spots of black and brown, streaked with longitudinal lines of black, and very delicately crossed by very fine touches of the same colour; the under parts are of the same colours, but clearer in the tint, and the part of the legs which is feathered is reddish; the tuft consists of eight little feathers, which stand up, forming a sort of coronet; the bill is black, and the irides yellow.

The number of tufted owls in the warmer parts of the world is very great. They occur in every part of Africa, excepting the deserts. There are also many in India, in the Oriental Isles, and in Australia. America, and the American islands, are amply supplied with tropical owls, many of which have produced feathers on the head. These are in general feebler birds than the owls of the north, and their history is at the same time very imperfect. Some inhabit the woods, and others the bushy wastes; those which have the latter locality usually constructing their nests in the bushes, or in holes of the earth. Of those which frequent the open plains, and lodge in burrows, it is probable that many occupy the nests and holes of some of the smaller burrowing mammalia, and even dig into the ground to eat them. The dry plains of South America, and indeed of most tropical countries, are so completely honeycombed by the labours of small ground animals, that an owl can be at little loss for a hole to creep into anywhere.

To enter into a formal enumeration of all the named species of those owls of which notice is made in the descriptive catalogues would be a tedious task, as well as an unsatisfactory one. We shall therefore mention only one or two as specimens.

The African tufted Owl (*S. Africana*) is a native of the country of the Cape. It is about fourteen inches and a half in length. The upper parts are mottled with brown and black; the forehead and summit of the head are brown, with a small white spot on the tip of each feather, and the tufts have brown on their outer margins; the face is greyish, surrounded with a white circle and then a black one; the disc round the eye is deep yellow, radiated with blackish, and bordered with white; the under parts are brown, with cross bars and spots of white; there are some white spots on the turn of the wing; the feathers on the legs have zig-zags of black; the bill is blackish, and the irides orange. Another African species, occurring farther to the north, is the *White-cheeked Owl* (*S. leucotis*). It is found in central Africa, and is smaller than the former, being only nine inches in length. It is yellowish grey on the upper part, with the shafts and fine lines across the feathers black; the upper part of the head is yellow, streaked with dark brown; the tufts are marked in the same manner; the discs around the eyes are white, surrounded with black; the under part is coloured somewhat like the upper, only the

belly is whitish; the bill is yellow, and nearly concealed by white hairs, which are directed to the front. Besides these, there are many other African species, of which nothing can be said farther than that they are of certain sizes, shapes, and colours.

Of the owls of South America, which are very numerous, one of the most striking is the *Black-caped Owl* (*S. atricapilla*). It is a native of Brazil, between nine and ten inches in length; and the most remarkable character of the plumage is the black cap which marks the top of the head, and the tufts. The upper parts are mottled with yellow, brown, and black; the nape is white, with zig-zag lines of black; there is a half-collar of russet, varied with black; the feathers of the face are greyish, with black mottlings; and there are some white spots in the wings; the irides, the beak, and the feet, are yellow.

Of the Asiatic owls with tufts on the head we shall mention only one species, the *Oriental Owl* (*S. Orientalis*), which is a native of Sumatra, and probably of the rest of the Sundee Isles. It is rather a large species, being nineteen or twenty inches in length. The upper parts are blackish brown, crossed with zig-zag streaks of red. The tufts go off behind the outer angles of the eyes, extend outwards, and then turn upwards at the tips. They are composed of long black feathers, surmounted at the middle by shorter ones, which are streaked with brown. The face whitish, rayed with black. The under parts white in the ground colour and cross-barred with brown. The breast and flanks russet, the bill and claws whitish yellow, and the toes yellow. There are still two owls which claim the attention of students of British birds more strongly than any which have been yet mentioned. With us these are both very numerous; and they address themselves to our familiar observations, each in its peculiar way,—the one by the sound of its voice, and the other by its near residence to the abodes of man, its familiarity, and the great service it renders agriculturists by destroying mice in stack-yards and barns. The one of these is the tawny or brown owl, the other the barn or white owl.

The tawny Owl. (*S. stridula*). In many parts of Europe, and in Britain especially, this is the owl, by way of eminence, which makes the nocturnal forests so dismal with its loud and lamenting cry. In aspect it is one of the most sage-looking of all the owls; and in addition to many other names, the screech-owl, among the rest, it is called "Peter," in some parts of the country; though after what Peter it is named we pretend not to say. Its head is very large, even in the solid part, and the feathers are immensely produced, especially those on the head. The legs are also of large size. The bird stands up with the line of the body nearly perpendicular; and as the body is very lanky and the legs stout, it nearly bears some resemblance to a person of small stature, with goodly spectacles across an aquiline nose, furnished with a surprising complement of wig, and altogether as demure as a judge.

The character of the tawny owl may be briefly stated as follows: its length is fifteen inches, and its weight is about nineteen ounces. The bill is light brown, the irides dusky; the feathers round the bill are white and narrow; but those between the bill and the eyes have black shafts. The general plumage of the bird is deep tawny. This colour is darkest on the head, brightest on the breast; and in some parts it is spotted with black. The belly is tawny, the feathers of which have white margins, and a black streak down their shafts. The exterior webs of the outer scapulars are white, and some of the exterior larger coverts of the secondary quills are dotted with a white spot on their outer webs; and these form two obscure markings of white. The quills are crossed with light, tawny brown, and dusky bars; and the light colour gradually changes to white at the base. The two middle feathers of the tail, and the rump, are plain tawny; and the others are alternately barred more or less with tawny and dusky. The legs are thickly covered with feathers, or rather down, of a grey colour, speckled with brown. The claws are dusky. This is the description of the female; but it may also serve for the male; for the plumage of both sexes is exactly alike, except that the female is generally less tawny. From this latter circumstance they have been described by some as different species; but this has long since been proved to be a mistake. The only distinction between the sex that is worthy of being noticed is their difference in size. In this particular the male is considerably the smaller; his length does not exceed thirteen inches, and he seldom weighs more than from fourteen to fifteen ounces.

This species is very common not only in England but in all parts of Europe, and it is said to be met with in Newfoundland and in some parts of South America, though not in the north of that continent. In every country it is an inhabitant of the woods, and rarely makes its appearance far over the open grounds. It is understood to be an exceedingly hardy bird. In confinement it never drinks, though it eats plentifully. But no positive conclusion can be drawn from this, as to what may be its conduct in a state of nature. Its soft feathers have but little water-proof quality; and hence a rainy day reduces it to about half the bulk which it appears to have when dry. On such occasions it looks very woe-begone; and yet the rain seems to have no great effect upon its health, and a very temporary one on its plumage; for if it gets soon wet it gets as soon dry again. In strong sun-light its eyes are the weakest part of it; and yet they appear to be annoyed rather than injured, for it can look at the sun, though it cannot find its prey, or even its way on the wing, while the sun shines strongly. Sometimes, however, it remains dozing in the sun; but if it is attacked on such occasions it is very easily killed or captured. The greater part of the authorities are of opinion that it is the only British owl which hoots; and while it does this it distends the throat to the size of a pullet's egg. Its screeching cry is even more disagreeable than its hooting; and this cry, associated with the gloomy places in which the bird is usually found, and the times at which it is heard, has made it be very generally considered as a bird of evil omen. It is very rapacious in its feeding, and while it prowls about the hedges, and over the fields and covers near woods, it destroys great numbers of young game. Mice, however, are its most general food; and these it is said to skin with considerable dexterity. In the case of the larger prey, at least, it tears in pieces before it begins to eat; and both its bill and its claws are well adapted for the purpose. When pressed by hunger, which is not, however, often the case, as it keeps on rich places, it sometimes comes out voluntarily, if there is a cloud over the sun, and alights on the ground, hopping about there in search of young birds; but it never ventures far from trees, and when it is alarmed it seeks its safety in these.

The nest is usually made in the hollows of trees, in the ivy upon ruins, or in close bushes; but sometimes also it hatches its brood in a barn or granary. When it does this, the owner is very careful not to have it disturbed, in consequence of the vast number of mice which it captures for itself and its young. It continues to feed there for a long time; and if they are taken and confined in the open air, so that the old birds can visit them, they are sure to do so every night, and to bring a plentiful supply of food along with them. It is also very bold and furious in the defence of them. It should seem that, notwithstanding the largeness of its eyes, and the peculiar way in which they are adapted for nocturnal vision, it gets the first notice of its prey by the ear; for, when there are owls in the neighbourhood, if the squeaking of a mouse is tolerably well imitated, the owl will soon make its appearance, and come so near as to be easily shot. The shooting of it is a matter of wantonness, however; for its dead body is not of the smallest use, neither is it very ornamental, though it is sometimes displayed on the walls of rustic buildings.

In whatever situation it rears its brood, it never takes the trouble of making any formal nest, and indeed it has but little time for such a purpose; because the finding of its own food, and of the vast quantity which the young require, compels it to be one of the hardest-working of birds. As is the case with several of the other owls, this one not unfrequently appropriates to itself the nest of some other bird, such, for instance, as that of a rook or a jay; but it is not understood to eject the original builder, but simply to take possession after her purpose has been served. They build rather late, and are understood to do so because they thin the broods of various other birds in making adequate provision for their own. The pigeons are the birds which are understood to suffer the most in this way; and therefore the owl is destroyed with considerable assiduity whenever it makes its appearance in the presence of pigeon-houses. When the young first make their appearance, they are covered with light coloured down, and are very ragged and ill-looking creatures; but, as they advance in age, they improve. When first taken from the nest they are exceedingly shy, but their appetite soon subdues them; and if they are fed from the hand, they are not long in knowing their feeder, and come for their allowance with expressions of apparent gratitude. Even the old birds may be tamed to a certain extent, and may be retained in a captive state by removing the pinion of one wing, which of course throws them off their balance, and renders them incapable of escaping by flight. Even then, however, they are apt to hide themselves in holes, and not come abroad till the evening, at which time the sounds which they utter are exceedingly disagreeable, and altogether they are both unseemly and filthy birds.

In some respects too they must be considered as birds associated with ruin, though not with desolation. Places which are rank and foul suit them better than such as are kept with neatness, because they afford the largest supply of those animals upon which they chiefly subsist. "The screech-owl shall dwell there," is one of the pathetic and characteristic predictions of ruin to places which at one time were fair to look upon, and full of improvements, in a state of vigorous health and active enjoyment. But still, dismal as is the voice of this owl, and much as it is associated with darkness and gloom, and that exuberance of vegetation which mantles up deserted places in fertile places, there is no doubt that, from their numbers and there wide distribution, they perform a very important part in the economy of wild nature.

The Barn Owl, or White Owl (*S. flammea*). This owl is as much a favourite as the preceding is an object of aversion. It is, if not the most common, at least the most familiar of all the British species; and it is very generally distributed, though some of the foreign ones differ a little from that with which the inhabitants of the country are so familiar in our islands. It also occurs on the American continent, though its appearance there is perhaps a little different from what it is in Europe, and its manners are not so well known. It has frequently been confounded with the brown or woodland owl, under the general names of screech-owl, howlet, and various other names. The following are the characters of it: the male bird is about fourteen inches long, and three feet six inches in the stretch of the wings; the bill is of a whitish horn-colour, and considerably longer than is usual among its tribe. The space encircling the eyes is remarkably concave, and the radiating feathers meet in an elevated projecting ridge, bending from the bill upwards. Situated between these there is a thick tuft of bright tawny coloured feathers, which are hardly visible, except the ridges are separated. The face is white, encompassed by a narrow margin of velvety feathers, very thickset, and of a reddish cream-colour at their extremities, pure silvery white on their under parts, and shafted with black; the upper parts of the body are of a bright tawny yellow colour, richly adorned with whitish and pale purple dots, and beautifully spotted here and there with larger drops of white; the feathers of the back and wing coverts terminate in oblong spots of white, which are margined at the tip with black; the head is large and inflated; the sides of the neck are pale yellow ochre, sprinkled with small tints of dusky, and the first and second quills are of the same colours, thinly barred, and profusely sprinkled with dull purplish brown touches; the tail is two inches shorter than the tips of the wings; it is very slightly forked, of a pale yellowish colour, barred with five bars of brown, and thickly spotted with the same colour; the entire under parts are pure white, interspersed with little round spots of black; the thighs are similarly coloured, and the legs, which are long, are thinly clothed with short white down, which extends almost to the feet, which are dull white and profusely tuberculated; the toes are thinly covered with white hairs; the legs and feet are of large dimensions, and uncommonly clumsy; the turn or shoulder of the wing is tinged with bright orange brown. The old bird is whiter than the young one; some are without the spots of black on the breast, and the under colour is pale yellow; and in others a pure white.

We shall afterwards notice some of the particulars which are supposed to constitute specific differences between the European owl, and the owls, similar in manners and not much different in any respect, which are found in India, in Australia, and in some other remote countries. But it does not appear that there are any differences in the habits of the birds which are worthy of attention. In some of those remote countries they are mostly found in wild situations; but this may arise more from the nature of the country than from that of the birds. In Southern Africa,

for instance, they are said to nestle in the rocks, and to form a sort of nest of twigs and leaves, in which they deposit eggs to the number of seven or eight. In Europe, however, they are most abundant in the neighbourhood of human dwellings; their nests are in holes of walls and trees, or under the eaves of buildings; and they are contented with the natural shelter of such places, without being at the trouble of constructing any formal nest. In Europe too their eggs are far less numerous, being from two to four, and very rarely the latter number. The young remain a long time in the nesting place, and during that time the old ones are most assiduous in supplying them with food. They issue out alternately on the hunt, beat over the fields with the regularity and vigilance of spaniels; and when they see a mouse stirring, or any other prey suited to their purpose, they instantly drop down upon it, and as instantly secure it.

It is highly probable that no animal whatever regularly approaches the habitations of man, and remains there, without being of some singularly essential service to him. There is little doubt that this is the case with the barn owl, and there is as little doubt that if the encouragement of the bird were in proportion to its merits, it might be rendered a highly ornamental as well as a useful bird. Much light has been thrown upon this subject by Mr. Waterton of Walton Hall, a gentleman of some eccentricity, but possessed of most commendable zeal in the discovery of natural objects, and most delightful and glowing eloquence in the description of them. Mr. Waterton is well known for one of the most graphic and glowing books that was ever produced by a human pen, namely, his "Wanderings in the Wilds of Guiana," in which he encountered hardships, and met with adventures beyond the ken of ordinary mortals; and which, were it not for his known acuteness and veracity, might fairly be set down as the fictions of a traveller. There can be no doubt, however, that Mr. Waterton rode triumphantly from the flood of Essequibo, upon the back of a cayman, in presence of admiring men of all colours, who had contrived to draw out this American leviathan with a hook; and there can be as little question that the same delightful enthusiast in the wonders of nature out-Herculised Hercules, in grappling with the full-grown coulacanara in its den, lodging the fanged monster in his wallet, and causing it to "bleed like an ox," on the following day. These matters are beyond all scepticism; and it will readily be admitted that one who could ride the cayman and take the coulacanara captive might do what he listed with any owl that ever winged the air.

About the year 1814, Mr. Waterton resolved to establish a colony of owls, among the ivy which adorns the ancient gateway of his delightful mansion. The old house-keeper was up in arms at the prospect of such neighbours, whom she considered as of unearthly aspect and voice; but the wrath of an old woman is nothing to a man who has rode a cayman and caught a coulacanara; and, therefore, the adventurous Lord of the Manor of Walton willed that the barn owls should have a *locus standi* in the ancient gateway; *sic voluit, sic fecit*—the colony of the owls was instantly established. Nor did they fail in gratitude to so gifted and so considerate a patron. They increased and multiplied as if Walton Hall had been the very Goshen of barn owls. Their progeny speedily filled the ivy, and extended into the trees in the vicinity. They felt quite at home, secure under so kind a protector, and probably demeaned themselves with more gratitude of heart than if they had been mewed up in cages, and fed upon the stale offal of beeves, instead of the recent and racy carcases of well-fed mice. They were, in short, very speedily on terms of the greatest familiarity, and received visiters both at their nesting places and their perches without the least apprehension. In consequence of this feeling of security, they allowed their habits, both out-door and domestic, to be studied with an ease and certainty which could not have been exercised under any other circumstances. In consequence of this, it was ascertained that, as is the case with the Peters, they repose with the axis of the body nearly in a vertical position. Neither are they sparing with their music, which, though a little discordant to some ears, is doubtless the best they can afford. They utter their stridulent cry morning and evening, and at some seasons the live-long night, despite the varying phases of the moon, which cannot, of course, be presumed to have much influence upon such sapient birds. During the course of eight years which, though short of twice a tithe of the beleaguering of Ilium ere it yielded to the Greeks of its time, they had not once hooted; and on this part of the subject Mr. Waterton is at issue with that great Boreal Theban in birds and beasts, Sir William Jardine, of Jardine Hall, who maintains that barn owls do hoot; but as, by his own confession, he shot them in the fact, nobody could, of course, bring the individuals to the *experimentum crucis*. Mr. Waterton's owls, however, did not submit to indignity in that passive manner which is evinced by some owls in human shape; for, upon any insult being offered to them, they hissed like serpents, and snapped like rat-traps. They also were in the habit of uttering a snoring sound; but the cause of this snoring was the very antipodes of that which lulls to sleep, being the complaint of the young when hunger wrung their stomachs, and every body knows that hunger is the least sleepy affection, both of man and beast. The researches of Mr. Waterton into the natural history of this domesticated colony of owls are of great value; and they are not of greater value in any other respect than inasmuch to show that snoring, on the part of a barn owl, is anything but a concomitant of sleep. It is only done under the sleepless feeling on the part of the young to which we have alluded; and, therefore, any one who wishes to have an owl for a bed-fellow, has nothing more to do than give it due infarction for supper, and it will sleep as sound as a top, until the craving of its maw sets it snoring in the morning.

In endeavouring to prevent any deficiency of their numbers, those owls are labouring for the production of more owls early and late; and in the general locality to which we have alluded, they drudge at their family duties in the fogs as late as the month of December. This philo-progenitation, though it may not tally exactly with the dogmas of the phrenologists, is a sort of constructive proof that the owls know the economy of the world, and that the world could not be carried on without them; and Mr. Waterton's observations afford other proofs that, without the diligent fagging of their beaks and claws, mice might, perchance, shake the stability of the system of the world, as Homer, in his Batrachamyomachia, once alleged they did, in the case of the croakers of the fens, When the owls have their broods astirring, Mr. Waterton estimates that from four to five mice are brought

to the owl's nest every hour; and not only during the night, but absolutely during the day. The quids which they cast up, after no more digestible part of the mouse remains, average a bushel in sixteen months; and each individual pellet of the casting contains the skeletons of about half a dozen mice. If, therefore, every one were to be as zealous in the cause of owls as our delightful naturalist of Walton Hall, cats, and all the discordant din of their cat-continuing operations, might cease; though how this might affect the plague of black beetles, is well worth the consideration of the domestic naturalist. Owls, cats, and black beetles, hang so equally in the balance, that it would require a conjuror to say which of them would kick the beam. For philosophic men in such cases, however, there is always a *point d' appui*, upon which no mistake can be made—as each man is entitled to select that wisdom which is most germain to his own. There is no doubt, however, that barn owls are exceedingly useful birds in their way; and, perhaps, the best mode of arriving at a rational conclusion with regard to their utility would be, to leave the point at issue to the decision of those farmers which can best judge whether a barn owl is useful about their premises or not.

That they are useful we firmly believe; and as they are very handsome birds in the markings of their plumage, they are really ornamental. One should love them, because they do not pass away before the progress of cultivation, but rather increase in numbers as richness and cultivation in the fields increase.

There are several other owls very much resembling in their manners, and situated in every variety of temperate and tropical latitudes, to which we might, perhaps, have alluded; but the species of which we have given some notice, afford specimens of all the more striking varieties, and to them we shall, therefore, restrict our notice of "the birds of wisdom."

OXALIDEÆ. A natural order, containing three genera, viz., *Averrhoa*, *Biophytum*, and *Oxalis*, of which there are above one hundred and twelve species. The *Oxalis*, or wood-sorrel, and its typical allies, are herbaceous, or suffruticose (rarely arborescent) plants, with alternate compound leaves, sometimes simple by abortion, and occasionally, but very seldom, opposite or nearly whorled. The inflorescence is axillary, seldom solitary, and the flowers are regular and united. The calyx consists of five persistent sepals; corolla of five deciduous petals, and spirally contorted before expansion; stamens ten, borne on awl-shaped filaments, often monadelphous at the base; the anthers are two-celled and innate; the germen is free and five-celled; the styles five and distinct, variable in length, with pencil-formed stigmas. The fruit is capsular, seeds few; when young they are enclosed in an integument or arillus, which at maturity bursts elastically, and expels the seeds.

The *Averrhoas* differ from the *Oxalidaceæ* by their arborescent character. *A. bilimbi* is the cucumber-tree of Goa. *A. carambola* is the camrungo of Hindoostan, and also bears an eatable fruit, but which are mostly used green for tarts or stews. The leaves of this tree are sensitive. The leaves of the *Biophytum* are also irritable.

OXEYE DAISY is the *Chrysanthemum leucanthemum* of Linnæus, a British weed often seen on arable land.

OXINOE. A genus of molluscs, established by Rafinesque, but we have no certainty respecting its difference from the *Sigaretus;* it is, however, asserted by Rafinesque to be an external shell; but if the branchiæ are disposed as he asserts, the distinction is much more considerable: not having the animal before us, we cannot venture to pronounce a judgment.

OXLIP is the *Primula elatior* of Jacquin, a common British plant found on the borders of fields.

OXYBAPHUS (Ruiz and Pavon). A genus of herbs, chiefly creepers, natives of South America, belonging to *Nyctagineæ*. These plants thrive during our summer in the open air, but require to be taken up in winter and replanted in the spring.

OXYCOCCUS (Linnæus). This a British bog plant, and the *O. palustris*, or cranberry, of botanists. The flowers are octandrious, and the plant is now arranged as one of the *Ericeæ*. There are several closely-allied bog or moor plants indigenous to northern latitudes. *Vaccinium myrtillus* is the bilberry; *V. uliginosum*, the bleeberry; *V. vitis Idæa*, the cowberry; our present plant is the cranberry. *O. macrocarpus* is the great-fruited cranberry; and various other *Vacciniums* are known as whortleberries. The fruit of all are eatable.

OXYLOBIUM (Andrews). A genus of evergreen shrubs, natives of New Holland, belonging to *Leguminosæ*. They thrive in loam and moor-earth, and are increased by cuttings or seeds.

OXYPORUS (Fabricius). A genus of rove-beetles (*Brachelytra*), having the maxillary palpi filiform, and the labial terminated by a large crescent-shaped joint; the body is short and thick; the antennæ thick, perfoliated, and compressed. The species are handsomely coloured, and of considerable rarity; they frequent decaying agarics, boleti, &c. The type is the *Staphylinus rufus*, Linnæus.

OXYSTOMA. Is the fifth family of the second order *Asiphonobranchiata;* second class *Paracephalophora*, and the varieties or species of the genus *Janthina* constitute it. These shells are described in their alphabetical arrangement.

OXYTELUS (Gravenhorst). A genus of rove-beetles (*Brachelytra*), and the type of the subfamily *Oxytelides* (see BRACHELYTRA). The species are very numerous, of a black colour, and frequent dung and fungi.

OXYTROPIS (De Candolle). A numerous genus of European herbaceous perennials, bearing papilionaceous flowers, and belonging to *Leguminosæ*. Some of the species are admitted into the flower-garden for the beauty of their flowers, and where they are easily increased by division or seeds.

OYSTER (OSTREA EDULIS, Linnæus and modern authors—Common Oyster). Oysters inhabit the European and other seas in countless masses; the are generally so well known as nutritious and palatable delicacies, that no description of them is necessary in that respect. Medical writers appear to differ respecting their medicinal virtue, but the greater number agree as to their being wholesome, and generally adapted to most constitutions.

Most of the coasts of England produce oysters in great abundance; but the coasts of Essex and Suffolk are chiefly celebrated for their excellence. The oyster fishery is regulated by a particular court, and a long course of custom has established some very curious laws in this branch of commerce. In the month of May the fishing commences by sepa-

rating what is termed the spawn from the cultch, the former being returned to the beds to preserve the stock for future seasons. After this month it is felony to carry away the cultch; and it is besides punishable to take any oyster between whose shells a shilling will rattle when the valves are closed. The reason of heavy penalties being inflicted on the destruction of the cultch appears to be, that when this is removed, the ouse increases, and muscles and cockles breeding in the beds destroy the oysters by occupying the places where the spawn should be cast. There is also some penalty for not destroying the *Asteria* (star-fish) found in the neighbourhood of oyster-beds, as they are very destructive to these fish by inserting their rays as the shells lie open, and devouring the animals within, a circumstance noticed by the accurate and ancient naturalist Oppian, in the following lines :—

> The prickly star creeps on with fell deceit,
> To force the Oyster from his close retreat.
> When gaping lids their widen'd void display
> The watchful star thrusts in a pointed ray,
> Of all its treasures spoils the rifled case,
> And empty shells the sandy hillocks grace.

The principal breeding time of oysters is in April and May, when they cast their spawn, or *spats* (as it is called by the fishermen), upon rocks, stones, shells, or any other hard substance that happens to be near the place where they lie, to which the *spats* immediately adhere till they obtain their film or testaceous crust, resembling drops of greenish tallow, and the substances, of whatever nature they may be to which they adhere, are called *cultch*. From the spawning time till about the end of July, the oysters are said to be sick, but by the end of August they become perfectly recovered. During these months they are considered out of season, and bad eating. This is known on inspection by the male having a black and the female a milky substance in the gill. Oysters are commonly considered in season after that time till the ensuing year, in the months with an *r*, beginning with September.

Oysters are not reckoned in high condition for the table till they are about a year and a half old, so that the brood of one spring are not taken for the market, till at least the September twelvemonths afterwards. When younger than these happen to be dredged, they are always again thrown into the sea. The fishermen ascertain the age of oysters by the broader distances or interstices among the rounds or rings of the convex shell, which in all bivalves indicate the annual increase.

Oysters are taken from their native beds by dredges, formed of a net held open by means of an iron scraper, drawn over the beds by a rope attached to a boat. As soon as they are thus removed from their beds, they are stored in pits formed for the purpose, furnished with sluices, through which, at the spring tides, the water is suffered to flow. This water, being stagnant, soon becomes green in warm weather, and in a few days afterwards the oysters acquire the same tinge, which renders them of great value in the market; but they do not acquire their full quality, and become fit for sale, till the end of six or eight weeks.

The oysters in the pits are of course always lying loose; but on their native beds they are in general fixed, from the time they are cast, by their under shell; and their quality is said to be materially affected by their being laid in the pits, with the flat shell downwards, not being, as it is supposed, able, in that position, to retain sufficient water in the shell for the animal's support.

With regard to the locomotive powers of the oyster, upon which much speculation has been exercised, every one at all acquainted with the structure of the animal must have observed that this cannot take place, as is usual with many other bivalves, by means of the foot, for such an appendage is altogether wanting in the oyster.

The Abbé Dicquemaire, who was a close and accurate observer of the habits and manners of these, as well as other marine animals, assures us that oysters possess the faculty of moving themselves, which is effected by the singular effort of ejecting water with considerable force from their shells, enabling them thus to start to a limited distance backward, or laterally, on one side. He says that any one may amuse himself with the squirting and motions of oysters, by putting them in a plate placed in a horizontal position, which contains as much sea-water as is but just sufficient to cover them.

The oyster has been considered destitute of motion, and every species of sensation, by most authors; but the above-mentioned naturalist states that it is competent to perform movements, consonant to its habits, either of comfort or defence; and instead of being destitute of sensation, it is even capable of deriving knowledge, or instinctive reason, from experience.

When removed from situations constantly covered by the sea, from want of experience they open their shells, lose the nourishment of the water contained in them, and in a few days die. But, when taken from similar situations, and laid down in places from which the sea occasionally retires, they feel the effect of the sun's rays, or of the cold air, or perhaps, apprehending the attack of an enemy, they learn to keep their shells closed till the tide returns.

Oysters breathe by means of branchiæ or gills. They draw the water in at their mouth, which is a small opening in the upper part of the body, drive it down a long canal that constitutes the base of the gills, and so out again, retaining the air for the necessary functions of the body. Thus their ejecting the water seems to serve the double purpose of aiding the motion of such as are free, and of supplying the animals with air. These observations are principally derived from the Abbé Dicquemaire, in Philosophical Transactions; *Haak on the Breeding of Colchester Oysters; and Tuke on the Generation and Ordering of Oysters, in Spratt's History of the Royal Society.*

As an article of luxury, oysters were known at a very early period of time. The civilised Athenians held them in great esteem as a dainty food. They were not common at Rome, and consequently brought very high prices; yet Macrobius assures us that the Roman pontiffs never missed having them every day on their table. Apicius, the third of that name, was excessively fond of oysters, and used to pay for them a most enormous price. Those of the Lucrine Lake, and Abydos in the Hellespont, being esteemed by far the best, were sent as delicate presents to men of high rank. The Emperor Trajan, when carrying on war against the Parthians, received from this Apicius several baskets or barrels of them; and Pliny has not thought it beneath the dignity of an historian to record the names of such persons as

were celebrated for their parks or preserves of oysters.

The edible oyster of Britain was deemed superior to that of all other countries, and was famed from the time of Juvenal, who flourished at the beginning of the second century. In satirising the epicure Montanus, he writes :—

> "He, whether Circe's rock his oysters bore,
> Or Lucrine Lake, or distant Richboro's shore,
> Knew at first taste."

Sergius Orata appears to have been the first inventor of the stews, or layers of oysters, similar to those of our present time. He derived great profit from them, as an article of commerce, to pamper the luxurious taste of others, rather than to gratify his own appetite. Orata gained much credit for his Lucrine oysters, for, says Pliny, the British were then not known.

Leuwenhoeck, whose microscopic investigations have led to so many interesting discoveries in natural history, gives the following observations respecting the oyster :—"In the clear liquor around the animal, many minute round living animalculæ have been found, whose bodies being conjoined, form spherical figures with tails, not changing their place otherwise than by sinking to the bottom ; being heavier than the fluid, these have been seen separating, and coming together again. In other oysters animalculæ of the same kind were found not conjoined, but swimming by one another, where they seemed in a more perfect state, and were judged by him to be the animalculæ or semen of the oyster.

"A female oyster being opened, incredible numbers of small oysters were seen covered with little shells, perfectly transparent, and swimming along slowly in the liquor ; and in another female the young ones were found of a brown colour, and without any appearance of life or motion."

In the month of August oysters are supposed to breed, because young ones are then found in them. Leeuwenhoeck, on the 4th August, opened an oyster, and took out of it a prodigious number of minute oysters, all alive, and swimming about nimbly in the liquid, by means of certain exceedingly small organs, extending a little way beyond their shells, and these he calls their beards.

In these little oysters he could discover the joinings of the shells, and perceived that there were some dead ones, with their shells gaping. These, though so extremely minute, "were seen to be as like the large oyster as one egg is to another."

As to their size, he computes that 120 of them in a row would extend an inch, and consequently that a globular body, whose diameter is an inch, would, if they were also round, be equal to 1,728,000 of them. He reckons 3,000 or 4,000 are in one oyster, and found many of the embryo oysters among the beards, some fastened thereto by slender filaments, and others lying loose. He likewise found animalculæ in the liquor, 500 times less than the embryo oyster.

A very curious fact rests upon the evidence of M. de Lavoge, who recently remarked, on opening an oyster, a shining matter or bluish light, resembling a star, about the centre of the shell, which appeared to proceed from a small quantity of real phosphorus. On being taken from the animal, it extended to nearly half an inch in length, and, when immersed in water, seemed in every respect the same as the phosphorus obtained from bones ; but, as the oyster was perfectly alive and fresh, the light could not proceed from any decomposition of the shell of the animal. How and to what purpose was it then produced ? Future observation may possibly throw a fresh light on this luminous property.

The space allotted to us will not permit our enlarging much more on the history of the oyster. We must necessarily, however, add a few more observations respecting this delicacy and very important branch of British commerce. We have before us a well authenticated account of the quantities annually sold at Billingsgate alone, and it exceeds all reasonable imagination. The beds occupy portions of the sea, in shallow parts, extending for miles square ; and, in some places, the depth of stratum is very considerable. Various companies are formed who send the produce of the season to market ; and each has a particular name to indicate the quality. The price varies considerably, but the quality but little, when the oysters are prepared for sale by subsequent attention, or after-feeding, as it is termed. Many persons have different modes of fattening oysters ; but none is positively asserted to be the best. Well-salted spring-water frequently changed agrees better with the fish for the short time occupied before its consumption, than any admixture of oat-meal or other farinaceous matter, frequently added by the London retail fishmongers. The sale of oysters at Billingsgate is regulated by the city laws, and an inspector appointed to each boat, as its cargo is sold off. A very trifling due is claimed by the city, but it averages a large income in the aggregate ; and the trade produces some of the best sailors in the world : the risks they incur would daunt any other race of men than the British tars, whose courage and perseverance in the eminent risks their dangerous profession exposes them to, has rendered our sea-girt isle the admiration and envy of every other nation. A sailor may be said to be an animal *sui generis* in the scale of creation ; but to his prowess we owe our greatness principally, as one of the greatest and most enlightened nations of the world. Some idea may be formed of the extent of oyster banks or beds by the following extract from an observant and veracious person, who states, that "of all the natural phenomena on an extensive scale, which arrested his attention during a visit to America, exciting his admiration of the ways of Providence, none equalled the oyster banks on the seaboard of Georgia. The land from the sea is completely alluvial for about the distance of twelve to eighteen miles, and in general consists of uncultivated marsh lands, through which an iron rod might be thrust to the depth of eighteen or twenty feet.

"A great number of large creeks and rivers are found meandering through these marsh lands, and, owing to the sinuosities invariably resulting from running water, the bends of these rivers would, in a short time, cut away the adjoining land to such an extent, as would make the whole seaboard a quagmire. But it is a remarkable fact, that wherever the tide bends its force, its effects are counteracted by walls of living oysters, which grow upon each other from the beds of the rivers to the very verge of the banks. These hillocks are often found in bunches among the long grass growing upon the surface of the soil. They are in such abundance, that a vessel of a hundred tons might load herself in three times her own length. These banks are the favourite resort of fish and birds,

as well as of the racoon and some other quadrupeds, which feed upon oysters, both by night and day. Bunches of them, sufficient to fill a bushel, are found matted, as it were, together, and the neighbouring inhabitants will light a fire upon the marsh grass, roll a bunch of oysters upon it, and then eat their contents. This barrier of oysters, like rocks of coral, must offer the strongest resistance to the force of the tide." We will merely add, that the oyster affords one of the most striking instances of the wisdom and goodness of God towards man, in providing for his wants an inexhaustible store of nutritious food; proving also the constant conclusion to be drawn, that the good things allotted to man's use immensely exceed the noxious ones, and, by their abundance, seem to point out that which must be best for his consumption.

OZOTHAMUS (Dr. Brown). A genus of soft-wooded shrubs, natives of Van Diemen's Land. They bear syngenesious flowers, and of course belong to *Compositæ*. They were called *Eupatorium* by Labillardière. They succeed well under green-house management.

PACHIDENDRON (Willdenow). A genus of succulent plants, natives of the Cape of Good Hope. They are closely allied to the genus aloe, and were united to that genus by Mr. Haworth. Like the aloes they have hexandrous flowers, and belong to *Hemerocallideæ*. Their chief distinction is their arborescent part, and they thrive in lime rubbish soil, with moderate watering. They are increased by offsets.

PACHYTA (Megerle). A genus of longicorn beetles, belonging to the family *Lepturidæ*, having the body short, the elytra broad and sub-parallel, entire at the tips. These are handsome beetles, of which there are three or four inhabitants of this country, including the *Leptura collaris*, Linnæus, which is about one third of an inch in length, of a black-blue colour, with the thorax and abdomen red. They are found in flowers.

PÆCILOPODA, (Latreille). An order of crustaceous animals belonging to the great division of *Entomostraca*, having the legs of variable form, the anterior, of an indefinite number, being formed for walking, or prehensile, whilst the posterior are lamelliform or pinnated, and either natatory, or serving as organs of respiration (*branchiæ*). It is, however, especially by the absence of jaws and under jaws that they are distinguished from the other crustacea, these organs being either replaced by the basal part (*coxa*), of the six pairs of fore-legs, which are furnished with minute teeth, or the oral apparatus, consisting in an external siphon, in form like an inarticulated rostrum, or in other suctorial instruments whose structure is not well determined. The body is generally covered either entirely, or for the most part, by a shield-like carapax of a single piece in the greater number, but bipartite in a few, and always exhibiting a pair of eyes when the organs of sight are present. Two of the antennæ (*chelicera*, Latr.) are in general cheliform, and perform the office of pincers; the number of the legs is generally six pairs, in some, however, there are only five pairs, whilst a few have eleven pairs. They are generally parasites, living upon the bodies of other aquatic animals, especially fishes.

This order comprises two principal sections or suborders :—

1. *Xyphosura*, Latreille, in which the carapax is bipartite, the suctorial apparatus wanting, and its place supplied by the dilated bases of the fore-legs. Typical genus *Limulus*, or king crabs. See LIMULUS.
2. *Siphonostoma*, Latreille, in which the mouth is more or less evidently suctorial, and the carapax composed of a single piece. There are two families, *Caligidæ* and *Dichelestionidæ*. (*Lernæiformes*, Latreille.)

PÆDERIA, (Linnæus.) A genus of evergreen shrubs, natives of the Mauritius and China. Their flowers are pentandrous, and their berries are transparent. They belong to *Rubiaceæ*; grow rapidly in the stove, climbing and supporting themselves on other plants, and are increased by cuttings.

PÆDERUS, (Fabricius.) A genus of small but handsome rove-beetles, *Staphylinidæ*, belonging to the sub-family or tribe *Stenides*, (see BRACHELYTRA,) having the attennæ inserted before the eyes, filiform or gradually thickened and longer than the head, the body long and narrow, the jaws toothed internally, and terminated in a point, and the tarsal fourth joint bifid. The type is the *Staphylinus riparius*, Linnæus, about a quarter of an inch long, of a red colour, with the head and tip of the abdomen black, and the elytra blue. These insects are found upon the margins of water and in other damp situations, their motions being in general very quick.

PÆLOBIUS (Schonherr). As restricted by British entomological authors, this genus of water beetles (*Dyticidæ*) comprises but a single species, *Dyticus Hermanni*, Linnæus, which has an exposed scutellum, the legs gressorial, and the body very convex. It is nearly half an inch long, and of a reddish brown colour, with the surface of the elytra black. It is a local insect, but occurs in some abundance in some of the ponds round London.

PÆONIA (Linnæus). A very conspicuous genus of herbaceous and suffruticose plants, chiefly natives of the northern parts of the world. The flowers are polyandrous, and belong to *Ranunculaceæ*. The roots are, for the most part, thick and fleshy, and the flowers are large and of the most brilliant colours. There are five half-shrubby species, introduced from China; and a great number of herbaceous sorts, obtained from Siberia, and other parts of the northern hemisphere. The shrubby sorts are increased by cuttings or layers, and the herbaceous species and varieties by division of the roots. The pæonias were highly esteemed by the ancient Greek physicians, but their praises are too extravagant for sober repetition. Among other superstitions, they believed it to be of divine origin, an emanation from the moon, and that it shone during the night, &c. Modern times are not, however, free from some remnants of these absurdities. "The anodyne necklaces," says Burnett, "still sold to prevent convulsions in children, and to ease dentition, are made of beads turned from the root of the common pæony."

PAGURUS (Fabricius). A remarkable genus of long-tailed crustacea (*Macrura*), distinguished by the slender texture of the shell or carapax, and the fleshy structure of the abdomen, which is generally twisted on one side and bag-shaped. The two fore-legs are terminated by a didactyle claw, the four following by a simple point; but the four posterior, which are smaller than the others, are armed at the end by a small pair of didactyle claws; the basal joint

of the footstalk of the lateral antennæ is furnished with a spine or elongated point.

These crabs are of very common occurrence upon the shore, and are known under the name of the hermit-crabs, from their singular and solitary mode of life, which is passed entirely in old and forsaken univalve shells, exhibiting a most beautiful instance of that connexion which is always found to exist between the structure and functions of animals; hence it is that we see the reason why the abdomen of these crabs is of a soft and fleshy nature, since, if it were hard and shelly, like that of the lobster, it would be impossible for it to accommodate itself to its tortuous abode, whereby it is enabled to escape from those dangers, to which it would be exposed from the boisterous element in which it resides, if it were not thus amply secured from harm. The species of which this genus is composed are very numerous, and are found in all parts of the globe. The following extract from Mr. Bennett's Wanderings in New South Wales will be read with interest, as it contains a satisfactory account of the habits of these animals:

"A great number of the *Paguri*, hermit, or soldier-crabs, of different sizes, were running about the beach; two large specimens that I found had each taken possession of the *Dolium perdix*, or partridge shell, to which they were as firmly attached as if in their natural habitation. The smaller kind inhabit *Murices*, *Trochi*, *Neritæ*, *Helices*, *Lymneæ*, *Cerethii*, and the univalve shells. In some instances I saw large shells of *Harpa*, &c., inhabited by very small animals of this kind, moving their heavy and cumbrous dwelling slowly and with difficulty: there were some of a red, and others of a sea-green colour, but the larger were invariably of a beautiful lilac. May not this change of colour depend upon their age? The *Paguri* feed upon dead animals, fish, and all kinds of offal, as well as vegetable matter, such as skins of plantain, remains of cocoa-nuts, fruits, &c. I have often observed a number of these creatures, of various sizes, congregated about a dead and putrid fish; and it is ludicrous, on disturbing them in the midst of their feast, to see them marching away, fumbling and overturning one another in the hurry, causing a clattering noise to proceed from this collision of their borrowed coverings, and, should they not be able to escape capture, they draw themselves closely into the shell, closing the aperture so firmly, by closing the claws over the entrance, as to render it impossible to extract them without breaking the shell to pieces. Thus secured, they remain immovable and apparently dead, and may be kicked or thrown about without giving any indications of life; but danger past, they emerge partly from the shell as before, and move briskly away. The natives use them occasionally, but rarely, as food."

The manœuvres of these creatures, when their habitations have become too small for them, are not less ludicrous. Crawling slowly along the line of empty shells, &c., left by the last wave, and unwilling to part even with their incommodious domicile until another is obtained, they carefully examine, one by one, the shells which lie in their way, slipping the tail out of the old house into the new one, and again betaking itself to the old one, if this should not suit. In this manner they proceed until they have found a habitation to their liking, which, as we learn from Mr. Bennett, is by no means proportioned to their size.

There are several British species of this genus figured by Leach in his "Malacostraca Podophthalma Britannica," the commonest and best known being the *Cancer Bernhardus* of Linnæus, (*Pagurus Streblonyx* of Leach,) which is of a moderate size. Its claws are armed with short spines, and are somewhat heart-shaped, that on the right hand side being the largest. This genus constitutes the type of a family of long-tailed crabs (*Paguridæ*), which comprises the following genera—*Birgus*, *Pagurus*, *Cœnobita*, and *Prophylax*. The type of the genus *Birgus* (which is generally distinguished by the harder consistence of their teguments, orbicular tail, and reversed, heart-shaped carapax,) is one of the largest crustaceous animals. It is the *Cancer latro* Linnæus, or the *Baerskrabbe* (purse crab) of Rumphius, and is an inhabitant of Amboyna, and was found in abundance by Mr. Cuming in Lord Hood's Island, in the Pacific, living at the roots of trees, and not in forsaken shells. When disturbed, it puts itself into a threatening attitude, and retreats backwards, making a noise with its claws. It has been long asserted that it climbs the cocoa-trees; and Messrs. Quoy and Gaimard, in proof of the correctness of this assertion, fed this species for many months on cocoa-nuts; Mr. Cuming also discovered that it climbs the *Pandanus odoratissimus*, a kind of palm-tree, or feeds upon the small nut which grows thereon.

PALÆMONIDÆ (Salicoques, or Carides, Latreille). A very extensive family of long-tailed crustacea (*Malacostraca macrura*), of small or but moderate size, having the intermediate antennæ inserted higher than the lateral, the footstalk of the latter being entirely covered by a large scale; the body is arched, and of a slight consistence, the front being often produced over the head into a long and serrated spine; the antennæ are always porrected, the lateral pair being generally very long and slender, and the intermediate pair often terminated by two or three threads; the outer pair of foot jaws considerably elongated and slender, rather resembling palpi; the external plate of the natatory caudal apparatus is always divided into two parts; the central plate is long, narrow, and pointed; the false or abdominal prolegs consist of five pairs, and are long and generally foliaceous.

This family is well exemplified by the shrimp and prawn, as well as by other species which, in various parts of the world, are much eaten either by being simply boiled, or salted and potted. The genera are very numerous, and are distinguished by the number of filaments of the intermediate antennæ, the number of didactyle claws, the annular structure of the tibiæ of some of the legs, &c. The chief genera are *Atya*, *Crangon* (which see), *Alphæus*, *Hippolyte*, *Pandalus*, *Palæmon*, and *Athanas*. The genus *Palæmon*, Fabricius (the type of which is the common prawn, *P. serratus*, Pennant), is distinguished by having three setæ to the internal antennæ, the four anterior legs didactyle, the second pair being larger than the first pair, which are folded back, the wrist inarticulate, and the front of the carapax very much elongated and toothed.

PALINURUS (Fabricius). The spiny lobster. See Astacidæ.

PALIURUS (Tournefort). A genus of deciduous shrubs; natives of the south of Europe and Nepal, belonging to the order *Rhamneæ*. The Christ's thorn (*P. aculeatus*) is a prickly shrub, but its flowers are ornamental. They succeed well in any garden soil, and are increased by layers or cutting of the roots.

PALLADIUM. We are indebted to the late Dr. Wollaston for the first accurate account of this mineral. That distinguished philosopher found it associated with platina and iridium. It is of a white colour, and nearly resembles platina in its external appearance. Palladium is mostly found in the gold districts of South America, but its scarcity and consequent high price forbid its extensive use in the arts.

PALMA CHRISTI is the *Ricinus communis*, or castor-oil plant of Linnæus. A well-known flower-garden annual.

PALMÆ. A natural order of magnificent and remarkable plants containing forty genera, and one hundred and thirty species already discovered and described, though it is well known that many more exist in the yet unexplored wilds of South America and other tropical countries.

"Palms," says Dr. Von Martius, "the noble offspring of Terra and Phœbus, are natives of those countries, where the rays of the latter are daily beaming. In all such climates they are to be found, with this limitation, however, that in the southern hemisphere they do not overstep the thirty-fifth degree of latitude, nor in the northern the fortieth. Most species are found fixed and confined within narrow bounds; for it comes to pass, that wherever a district is characterised by striking peculiarities of soil or climate those species exist which are not found elsewhere; but few extend over a large extent of surface, as the *Cocos nucifera*, *Acrocomia sclerocarpa*, *Borassus flabelliformis*, &c. It is probable that the number of palms existing on the face of the earth will be found by future travellers to amount to as many as a thousand species. Most of them love the margins of springs and streams, but few establish themselves on the shores of the ocean, and a yet smaller number ascend into the alpine regions of their country; some collect in large forests; some are scattered singly or in groups in woods or on plains. Palms have followed the footsteps of man, to whom their fruit yielded food, drink, and oil; their stems—houses, arms, utensils, flour, and wine; and their leaves—cordage, and roofs for habitations. In cultivation, their soil should be slightly saline: they are only propagated by seeds."

The palms are arborescent monocotyledons, with generally simple cylindrical lofty stems, occasionally, but very rarely, branched. The pinnati-sected leaves are large, petiolated, and crowded at the extremities of the trunk; the leaf-stalks partly embrace the stem, are invested with stipulaceous reticules, and cover the stem, when they fall, with successive scars. The structure of the stem is decidedly endogenous. The inflorescence as in catkins, or racemes, furnished with bracteolæ, and often enveloped in a large spatha. The perianth is small and of six pieces, disposed in two series equivalent to calyx and corolla; the stamens are rarely three in number, most frequently six; the styles are three; stigmata simple; germen superior, three-celled, two or one often abortive, and the cells are one-seeded; the fruit is either a berry or a drupe.

The cocos, or cocoa-nut bearing, is one of the most useful of the palms, as affording a wholesome kernel, milk, and cream. The sap is a wholesome beverage, and which, when fermented, yields an ardent spirit. The *Phœnix dactilifera* is also a most valuable fruit-tree, and indispensable to the natives of the countries where it is naturally found or cultivated. The other genera are mentioned under their respective names.

PALPUS (in the plural, Palpi). The articulated organ attached at the back or side of the lower jaw of many insects. See Insect.

PANAGÆUS (Latreille). A handsome genus of coleopterous insects belonging to the family *Carabidæ*, and sub-family *Harpalides*, having the two basal joints of the tarsi of the males alone dilated, the head very small compared with the rest of the body; the eyes large and globose; the jaws very small, and the thorax suborbicular. They are mostly of black colours, ornamented with red or yellow spots, the type being the *Carabus crux major*, Linnæus, so named from the elytra exhibiting a black cross. It is found abundantly in the fens in Huntingdonshire. There is another British species, *Pan. quadripustulatus*. Some of the exotic species are of large size.

PANDANEÆ. A small natural order containing only two genera and twenty-one species. They are very remarkable plants, with the habit of the pine-apple, but much more robust and tree-like. From the position of the leaves developed in spiral order, they are called the screw-pine. The stem rises to a considerable height, bearing a thick tuft of rigid foliage presenting the habit of palms. New births of roots are gradually produced from the joints of the stem, higher and higher up every year, which in time fix themselves in the ground; the first or oldest roots in the mean time dying away, so that at last the head of the plant is supported by the younger roots arranged like a series of buttresses all round. *Pandanus odoratissimus*, as well as the other species of the genus, says Burnett, exhibit *a strange semblance of instinct*, in the development of aerial roots at different distances on their stems, by which their life is prolonged, and the fate common to most of the arborescent endogena for a time avoided. It is very curious to observe the *device of nature* to strengthen the stem, and to prolong the existence of these handsome plants. Being endogenous (*endon*, inside; *gcinomai*, to grow), all growth proceeding from within, the older and harder formations are outermost. But the diameter of the first-formed stem, being comparatively small, could not bear the weight of the head afterwards formed, were it not for the propping roots which descend from the more elevated part of the stem. This is the *pandang* of the Malays, and is found in all the warm countries inhabited by these people. The staminiferous flowers are delightfully fragrant, and are said to yield one of the richest perfumes known. The soft bases of the leaves and the pulpy part of the fruit, although unpleasant, are eatable, and the Asiatics feed on them in times of scarcity; at other times they give them to their cattle as fodder. The soft spongy roots are made into corks; the fibrous leaves and stem are made into mats and baskets by the Tahitians, who stain them of different colours; they are also used for thatching and for cordage, and made into a coarse kind of sacking for exportation of dry goods, as coffee and the like. The *Faquahine*, which Mungo Park found in the interior of Africa, the fruit of which, he says, when ripe, explodes and inflames spontaneously, by which many serious accidents have occurred, has been ascertained by M. Beaufort to be a species of *Pandanus*, and he confirms Park's description.

The species grow well in our stoves, potted in

light loam, but have never been brought to flower under such treatment.

PANIC GRASS is the *Panicum colonum* of Linnæus, which, with many other species, form one of the largest genera belonging to the order *Gramineæ*. The species are mostly natives of tropical countries. The *Panicum miliaceum* is the millet, an agricultural plant, the grain of which is both dietetic and medicinal. Millet is also much used for feeding poultry.

PANORPIDÆ (Leach). A family of neuropterous insects, belonging to the section *Filicornes*, and having five joints in all the tarsi, and the front of the head produced into a long and narrow beak. The species are comprised in the Linnæan genus *Panorpa*, in which the antennæ are setaceous and inserted between the eyes; the body long, the head vertical, and the prothorax very small. There is very considerable diversity in the appearance of the sexes of some of these flies. The family comprises the genera *Nemoptera* (which see), *Bittacus*, *Panorpa*, and *Boreus* (which see). The typical genus *Panorpa*, Linnæus, is distinguished by having the four wings of equal size; the ocelli three in number; the abdomen of the male long and jointed, and terminated by a remarkable instrument like a pair of pincers, so that this part of the body bears considerable resemblance to the tail of the scorpion, whence these flies are termed scorpion-flies; the abdomen of the female is long and pointed at the tip; the legs are of moderate length. The type of the genus is the *Panorpa communis*, Linnæus, which is rather more than half an inch long, of a black colour, with the beak and tip of the abdomen red, and the wings spotted with black. It is very common, and is found in hedges and grass. There are several other nearly-allied British species.

PANURGUS (Panzer). A genus of bees, belonging to the family *Apidæ*, and sub-family *Andrenoides*, Latreille, having the mandibles destitute of teeth; the terminal joints of the antennæ in the females form a sort of spindle-shaped mass of a nearly cylindrical form; the hind-legs are very hairy, and the wings have only two sub-marginal cells. There are two British species, the type being the *Apis ursina* of Linnæus. They are of rare occurrence, and their economy is unknown.

PAPAVERACEÆ. A natural order containing twelve genera and above sixty-five species. The poppies and their typical allies are annual or perennial herbs (rarely under-shrubs), with milky juices, varying in colour from white to yellow, orange, and crimson. The roots are fibrous, stems round, with alternate simple leaves, either on footstalks or sitting, and without stipules. The flowers are solitary, regular, and on long peduncules. The calyx is of two deciduous sepals, the petals four or some multiple of that number. The stamens are eight, twelve, or sixteen, &c., commonly indefinite and collected into four groups, one near the base of each petal, and hypogynous. The filaments are filiform and free; the anthers innate and two-celled. The germen is free and symmetrical, formed of two or more united carpels, sometimes stipitate or sitting, in general one-celled. The style is short, or wanting; and the stigmas two to four, or many, radiant and persisting. The fruit is a one-celled capsule, opening by valves or pores. Seeds numerous.

The twelve or thirteen genera included in this type form a very natural group. In properties they are as accordant as in form, being universally narcotic, although they differ in the degree in which the sedative principle is evolved.

The poppies are, many of them, very ornamental plants; but their chief importance results from the narcotic powers of their milky juices. They are all more or less soporific; but the inspissated secretions of *Papaver somniferum* and its varieties are believed to afford our chief supplies of opium, although it has been asserted that the best Turkey opium is procured from the *P. orientale;* and other species are believed to be resorted to for the preparation of the drug in Persia and other oriental countries. That the *P. somniferum*, however, yields it in abundance has been proved by crops grown in this country, and the preparation here of English opium, which is reported to have been equal to that imported from India or the Levant, indeed to yield a larger quantity of morphia than that of foreign growth.

The opium trade is one of considerable importance. In 1829, says Burnett, nearly 50,000 pounds were imported into this country, of which 42,804 came directly from Turkey; 25,000 pounds were re-exported; so that the annual consumption in the United Kingdom varies from about 20,000 to 25,000 pounds. Its value in bond is seventeen or eighteen shillings per pound, and the duty is four shillings. In England opium is little used, excepting as a medicine; but in Turkey and China it has escaped from the control of the physician, and is used largely as a luxurious stimulant, and a substitute for spirituous liquors to produce intoxication. The importation of opium into China is expressly forbidden by law, not, however, on commercial or political, but on moral grounds; but as this drug is as necessary to a Chinese mandarin as claret or Burgundy wine to an English gentleman, the contraband trade is extensive, amounting to fourteen million Spanish dollars yearly; and from it alone our Indian government derives an annual revenue of 1,800,000*l.* sterling. Some extraordinary cases are on record of the effects produced by the continued use of opium, the ecstasies it occasions, and the deplorable condition to which it, in a short time, reduces the infatuated men who eat it; and yet, from reports collected by Professor Christian, life does not appear to be shortened, nor disease produced.

The seeds of the poppies are very numerous, each capsule containing about 32,000. They have a nutty flavour, and form a nutritious food. They abound with a bland oil, which, when expressed, may be used as a substitute for olive oil in culinary and other processes.

The *P. rhœas* is the corn poppy of Britain, and is a noxious weed among wheat. In some seasons it is much more abundant than in others, especially on light soils; its appearance, however, depending on the state of the soil when the wheat is sown; if laid in heavy, not a poppy seed will vegetate; but if light, and the farmer neglect to roll or tread the land firmly with sheep, his crop will be nearly choked with poppies, and charlock also, in the following summer.

Besides the *Papaver*, or poppy, eleven other genera are united in the order. viz., *Argemone*, *Meconopsis*, *Hunnemannia*, *Sanguinaria*, *Bocconia*, *Macleaya*, *Rœmeria*, *Eschscholtzia*, *Glaucium*, *Chelidonium*, and *Hypecoum*.

PAPAW TREE is the *Carica papaya* of Linnæus, an East Indian plant, having the altitude of a tree, but the stem and foliage of an herb. It belongs to *Cucurbitaceæ*, bearing large fruit like a melon, but by

no means so good. The species grow freely in our stoves, but are infertile in consequence of the plants being unisexual.

PAPER MULBERRY is the *Morus papyrifera* of Linnæus, and *Broussonetia papyrifera* of Ventenat. A common plant in our shrubberies, known as the paper-mulberry, and propagated by layers.

PAPILIO (Linnæus). The butterfly. See the articles DIURNA and BUTTERFLY.

The genus *Papilio*, as restricted by modern authors, comprises only those species which have all the legs perfectly developed, the chrysalis girt round the middle, as well as attached by the tail (as represented in the plate of British butterflies), the palpi of the perfect insect very short, and scarcely extending beyond the forehead, with the third joint very indistinct. The species of which this genus is now composed are remarkable for their size and the splendid variety of their colours. They are found for the most part in the tropical regions of both hemispheres, three species only being inhabitants of Europe, namely, *Papilio Machaon*, *Podalirius*, and *Alexanor*.

Those species which have red spots on the side of the thorax formed the Linnæan division *Equites Trojani;* whilst those which wanted this character were named *Equites Achivi*. In many species the posterior wings are furnished with a pair of tails, whence these species are named swallow-tailed butterflies. The caterpillars are very variable in their forms, so that from a consideration of the structure of these insects in their preparatory states, it will be necessary still further to subdivide this very natural group into minor divisions or sub-genera. When alarmed, these caterpillars protrude from the upper side of the neck a fleshy forked horn-like protuberance, emitting at the same time a very disagreeable odour. The body is naked and destitute of hairs or spines.

As the two British species of this genus are the largest of our butterflies, and consequently objects of considerable interest, not only on this account, but from their beautiful appearance, we have represented them in our plate of British butterflies.

PAPILIO MACHAON (Linnæus), is of a yellow colour with a black border to the wings, in which are yellow lunules; the posterior pair tailed, with six blue spots and a red ocellus at the anal angle. It varies very considerably in size, some specimens being three inches, and others three inches and a half in the expansion of the wings. The caterpillar is green with black rings spotted with red. It feeds upon the fennel and carrot. It is by no means rare in the fens of Huntingdonshire and Cambridgeshire, where the writer has had the pleasure of seeing it in the living state.

PAPILO PODALIRIUS (Linnæus), is about the same size as the preceding, of a paler yellow colour with black longitudinal bars, some of which are abbreviated; the posterior wings are tailed, with blue lunules and a red and black spot at the anal angle, and a red streak on the underside. This species has long been a reputed British insect, but doubts have been thrown upon its right to be considered an indigenous insect. The writer hereof has, however, been informed both by the Rev. F. W. Hope and H. R. Read, Esq., that they have severally taken a specimen of this butterfly; the latter at Eton about 1826. This specimen has been figured by Mr. Curtis in his British Entomology.

PARASITA (Latreille; or, more correctly, ANOPLURA, Leach). An order of apterous insects, belonging to the class *Ametabola* of MacLeay, but placed amongst true insects by Latreille, having six legs, being destitute of wings, having only simple tubercles or ocelli for eyes, and the mouth either suctorial or mandibulated; the body is broad and depressed, without any terminal threads or filamentous appendages as in the *Thysanoura*. This order is composed of the Linnæan genus *Pediculus*, which see.

PARASITIC INSECTS. This name is applied to those species of insects which, in some manner or other, subsist upon or within the bodies of other insects, which they in general ultimately destroy. On examining, however, somewhat more minutely the proceedings of these parasites, it is easy to discover that there are various kinds of parasitism if we may be allowed to coin a term to express the parasitic connexion between these insects. In the *Ichneumonidæ*, for instance (which see), the connexion is such, that the female parasite deposits her eggs upon, or introduces them into, the body of another insect, upon which the young, when hatched, prey. In the *Pediculidæ*, on the other hand, the connexion consists in a residence upon the outside of the body of another animal, upon the humours of which the parasite feeds, without causing the death of the animal attacked; whilst in another class, namely, the cuckoo bees, and wasps, the egg is merely deposited in the already-provisioned nest of another working species nearly allied in general structure to the parasite, so that the food stored up serves either for the parasite or the insect in whose nest it is placed, the former, however, is generally developed before the latter, and, consequently, by devouring the supply of food, starves the latter to death.

Having already in various articles, given more detailed accounts of these variations in the parasitic habits of insects, we shall here merely refer the reader thereto.

PARNIDÆ (Leach). A family of coleopterous insects of small extent and minute size, belonging to the section *Pentamera*, and sub-section *Rhypophaga*, having the antennæ very short, and clavate with a large lateral ear-shaped lobe; the legs are formed for walking; the tarsi moderately long and slender, with strong claws; the body oblong and convex, and clothed with a silken pile; the thorax is generally acute at the posterior angles. There are two genera, *Dryops* and *Parnus*, the species of which frequent the muddy banks of ponds, &c., creeping slowly about the roots of aquatic plants. The type is the *Parnus [prolifericorius*, Fabricius, which is about one fourth of an inch in length, and of a dark brown colour.

PARROT (*Psittacus*, or rather *Psittacidæ*, the parrot family). An exceedingly numerous and highly characteristic family of birds, belonging to the order of climbers, or those with zygodactylic feet; and from this structure, being chiefly forest birds, though some of them alight on the ground and find their food there. But the greater part are tree birds, remarkably dexterous in climbing, in which they use the bill, which is very powerful and peculiar in its shape, as a sort of third foot, or hand; for the foot of a true parrot is a grasping instrument rather than a walking one, and as such it partakes more of the nature of a hand than of that of a foot.

With the exception of a single species found in North America, and which is represented as being

much less abundant now than formerly, there are no parrots without the tropic in the northern hemisphere. It is different in the southern one; but still, though parrots occur in Australia, in Southern Africa, and in South America as high as the fifty-second degree of latitude, which answers to that of the middle of Europe, in the northern hemisphere, the country there is tropical in its vegetation, and on this account we might be prepared to expect that it should be tropical also in the character of its vegetable feeding birds, and indeed in the greater part of its living productions. That the vegetable and the animal kingdoms should be adapted to each other in every country, whatever may be the character of the country, is a law of nature from which there is never any deviation, unless in so far as man interferes with the natural state of things, by introducing artificial modes of culture.

The parrots are almost exclusively vegetable feeders; and the kernels of fruits, and the buds and flowers of trees, are the chief sources on which they depend for their nourishment. Thus they are fitted for a peculiar locality, namely, one in which there shall be for the greater part of the year a constant succession of food for them; and they could not naturally exist in those countries where the woods are for several months of the year not only flowerless and fruitless, but also leafless. The forest birds of temperate countries may be said to dwell in the forests rather than to subsist upon them. This is true of those birds of considerable size which build the highest, and congregate in the greatest numbers at the same place. The rook, for example, is in no other wise indebted to the forest in which it builds, than for dry sticks to construct its nest; and the picking up of these is a great improvement to the cleanliness and general condition of the forest. It is the same with the heron, and with all our larger birds which nestle and roost in trees.

In the tropical forests the case is very different; for the trees there supply both habitation and food to an immense number of birds; and, though different species of these feed on different substances, the parrot family may be considered as feeding upon the trees themselves; and therefore they are forest birds in a more strict and exclusive sense of the word than any other family which we can name. It is true that they are not confined to the tree, for the greater number of them are well winged and powerful flyers; but still their flight is chiefly from tree to tree, and, while the tree continues to afford an adequate supply of nourishment, the parrots climb and scramble over it with very dexterous rapidity, and scrutinise every twig with the same perseverance as ruminating animals show in browsing their pastures.

Though very many of them are noisy birds, and they are exceedingly numerous, there is really less known of the parrots in a state of nature than there is of almost any other family of birds, and especially of any family which is so numerous. The character of the tropical forests causes this, from the difficulty with which masses of such tall and thickly matted vegetation can be entered, and the impossibility of seeing what is going on, even after an entrance has been made. We know that they do inhabit the forests, that their principal food is vegetable, that they nestle chiefly in the holes of trees, and that they are very noisy withal; but these matters, which amount to very little, constitute almost the whole of their history in wild nature, as known to man.

In their natural state, many of them are social birds, often issuing from the trees in large flocks, and laying the cultivated fields under pretty severe contribution. Social birds are almost always susceptible of being tamed in nearly the same ratio as they are social, and the parrot family do not form an exception to this. Some of them are much wilder than others, and all of them are inclined to make very wanton use of their bills, in tearing to pieces furniture and other wooden substances; but many of them are capable of showing a very considerable degree of attachment to those who feed and are otherwise kind to them. Generally speaking, also, they suffer less from confinement in cages than most other birds, because their climbing propensities enable them to take a great deal of exercise even in a confined space. Their plumage too is not easily ruffled; it is less so indeed than that of perhaps any other birds; and thus if a parrot is properly fed, and enjoys wholesome air in not too cold a temperature, there is seldom any thing the matter with it; and, under such circumstances, it may be kept under confinement for a great many years.

Since a general intercourse was established between Europe and the tropical countries, more live parrots have been introduced than of any other tropical birds, or indeed of any other tropical animals whatever. In addition to the brilliant plumage and lively manner of most of the parrots, many of them are easily taught to pronounce words and sentences, and also to whistle tunes with clearness and precision. Some of those writers who endeavour to give an apparent interest to their style, by elevating the animals to a rank resembling, if not equalling, that of man, have supposed that there is some sort of speculation in these birds; and that they suit not only their natural attitudes and sounds to the circumstances under which they are placed, but do the same with those words and sentences which they are artificially taught to imitate. There is of course no truth whatever in the analogy which is thus attempted to be established. The parrot of course understands not one word of what it utters, and therefore, when it appears to give appropriate answers to questions, or to make remarks applicable to the occasions on which they are uttered, it merely obeys the circumstances under which it is placed; and it is our ignorance of many of those circumstances which makes us fancy that the bird suits the word to the occasion. Though this sort of prejudice has been held by many, it has never been strong enough for becoming general with the public; for, on the other hand, "parrotting" has become the name of that repetition of mere words by human beings when the repeaters are utterly ignorant of the meanings of those words. We shall afterwards, most probably, have occasion to remark that there has been a good deal of this parrotting in the attempted natural history of the parrots themselves, a circumstance which is perhaps unavoidable, on account of the very little which is known of the natural history of the birds, or of the differences of habit between those which are different in appearance.

Still, the facility with which parrots can be made to speak, to sing, and to whistle, renders them very amusing birds; and is a proof that, though all their resources are of course purely animal, they are better endowed in this respect thanmany other birds. Their

habits in a state of nature would naturally lead us to suppose this, for a parrot in the woods is a very hard-working creature; and in order that it may find its own food, and in so doing keep down that luxuriance of the tropical fruit by which it would otherwise be checked by the very excess of its own growth, it has harder labour to perform than almost any other bird which feeds upon vegetable matter. Any one who looks at a stately tree, in that season when it is naked of leaves, and the ramifications can be seen to their ultimate terminations, must be aware how perfectly beyond all the powers of arithmetic the buds of such a tree are. But the trees of tropical forests are much taller than ours: and, though the palms and several others rise with a single bud, and have only a crown of leaves, or more strictly speaking fronds, still there are stately branchers which cover thousands of square miles in the tropical countries. Many of the most luxuriant of these grow in marshes, in the water of slow running rivers, and even in the sea, so that they are not accessible in any way but through the medium of the air, and, except on the trees themselves, there is no resting place for the foot of any inhabitant of the air. Such places are the grand haunts of the parrots, because in them there is a constant supply of water and of heat sufficient for any kind of vegetable growth, and thus they know no winter. Such places are the head-quarters of many tribes of the parrots; and they are understood to breed at least twice in the year, without any absolutely fixed season for the operation. Little, however, can be known of their economy in such places, for the ground is impassable, the air is pestilent to human beings, and a traveller who should attempt to explore such a forest would never return to publish the tale of his adventures. It is understood, however, that even those species which quit the woods seasonally in flocks, at least for part of the day, live in pairs during their breeding times; and that, generally speaking, sitting on the eggs and the feeding of the young until able to provide for themselves, are the only domestic labours of the birds. As was hinted, they nestle in the holes of decayed trees. There are many such in these forests; because if there was not a decay proportionate to the growth, the forest would soon monopolise everything else, and end by choking itself. It is highly probable that the parrots contribute not a little to the ridding of those forests of the dead trees, by enlarging the holes in their trunks, and so letting in the rain, by which the tree is very speedily reduced to dust. This is an exceedingly probable inference from the disposition which they show to gnaw and divide into chips every piece of wood which they can reach. This is not done for the purpose of gratifying their appetite, for none of them show the least disposition to eat wood. It is, however, so very general among them, and they themselves are so numerous, that they must practise it in their natural state, and it must answer some purpose in nature corresponding to the exertion which it calls for on their part. It is clearly not a habit acquired in confinement, neither is it the result of any attempt on their part to regain the state of freedom. Parrots, if properly fed, are less impatient of confinement than almost any other birds; and when a parrot has free range of an apartment, it very soon begins to exercise its powerful mandibles upon the chairs and other furniture. We naturally look upon this as wantonness; but animals have no wanton habits. The law of material nature is upon them in everything they do; they have no power of resisting that law, and therefore every natural operation which they perform answers some natural purpose, whether that purpose happens to be known to us or not.

Many accounts have been given of the loquacity of parrots; and some of them are very amusing, as showing the power of imitation and the perfection of execution hereafter to be noticed. We shall content ourselves with little more than a single one, which we give from personal observation. The writer of this article, had a friend who received a green Amazonian parrot from a naval officer, who had just returned from the command of a frigate on the West India station, during the time when the West Indian seas were so much infested by pirates. This parrot had been taken from a piratical vessel made prize of by the frigate; and as it was docile, and actually communicated some useful hints in the scraps of Portuguese which it repeated, and sung and whistled in loud and clear strains, it soon became a favourite on board the frigate, and was not long in learning all the pipings and words of command which were most frequently repeated.

On the evening of its arrival, its new master had a dinner party, and, the parrot being a stranger, was placed on a pier table at the lower end of the room. From the time of its landing it had continued quite silent; and, as the giver had not said one word of its powers, it was supposed to be a dumb parrot. The party sat down to dinner with a good deal of glee and hilarity, and the bird began to show more activity. In a short time it piped the boatswain's whistle, till all the apartment rung again; and almost immediately after the pipe, it called in a hoarse stentorian voice—"Steady! take in a little there," which somewhat astonished the party, as they were taking in their dinner and wine. During the afternoon it kept calling, "One point below!" "Thus." After a while it treated them with a very tolerable repetition of the Portuguese hymn, and concluded by a violent fit of swearing in the same language. The age of this specimen when it came into the hands of the gentleman alluded to was not known, neither is the writer acquainted with the sequel of its history, but it was a very amusing bird, though quite wayward and untractable.

Though there are considerable differences between the sections and genera, into which the describers of them in detail have divided the parrot family, yet there are certain general characters which belong to the whole, and point them out as being more distinct and true to a family likeness than perhaps any other family of birds. The number of species is so great, and so little is known of them, except differences of size, shape, and colour, that the details could not be made intelligible, or in the least interesting to any ordinary reader; we must therefore confine our observations to a comparatively small number.

Their general characters are: the bill short, thick, swelling, very hard and strong, compressed, convex in the outlines of both mandibles; broad at the base of the upper mandible, but compressed toward the tip, which forms a hook over the end of the lower one, very hard and sharp, and more or less awl-shaped at the point; it is also provided with a cere at the base; the lower mandible is short, recurved upwards at its extremity, and obtuse; these mandibles close with great force, and the lower one is provided with a set

of very powerful muscles, and has a sort of lateral grinding motion, as well as a shutting and opening one: in general, the lower mandible has a sort of tooth-like points; the nostrils are pierced in the cere, and they are open and round; the feet are in general short, with the tarsi very stout, but shorter in the generality of the number than the external front toes; the toes are four in number, two to the front and two to the rear, the former united by a small membrane at the base; the latter entirely free, and the outer toe of each pair longer than the inner one; the wings are generally of mean length, but very strong, and capable of rapid flight; the first three quills are nearly equal in length, and, like all the plumage of the birds, they have remarkably firm webs: generally speaking, also, the feathers on the upper part of the body are large and firm, and appear like a covering of scales, often of the finest gloss and the richest colours.

Among birds so numerous, differing so much in their size and forms, and extending fairly round the globe in its equatorial parts, it is difficult to give a general description of their manners. Most species of them are very abundant; and in those forests which form their principal habitats, the quantity of vegetable matter which they consume and also destroy, would appear perfectly incredible to any one accustomed to the habits of birds of temperate countries only. In these forests each one tumbles to the ground many times the quantity of food which it really eats. A few build their nests in the tops of the loftiest trees, where they work the branches and twigs together with a good deal of art; but the greater part place them in the holes of trees. The eggs vary from two to four, and are of a white colour in most of the species. The female sits very constantly; but at those times when feeding or exercise requires her to go out, the male is always at hand to take her place. The young are understood to eat buds and little soft fruits which are brought them by the parents. It is generally understood that the leaves of common parsley, which most animals can eat with impunity, are a mortal poison to parrots.

In their native forests they are exceedingly noisy birds, but it does not appear that any of them have much tendency to attack any other bird or animal. The groups nearest to which they are placed in the systems eat eggs and insects; but it does not appear that the parrots have this tendency, nor are they quarrelsome with each other. There is little doubt that the manners of parrots in their native woods differ greatly from those which they display when kept in a state of captivity by man. Numerous as they are, they belong to wild nature, and their use to man is limited. It is true that the young birds generally, and also the old ones of some of the species, are eaten by the human inhabitants of some of their localities. But there are few human inhabitants in such places; and it is no very easy matter to come at the parrots unless when they flock out upon plantations near the woods; and upon such occasions their carcasses do not repay the damage they commit.

From the scanty information which we have respecting them, the classification of these birds is in a very imperfect state; and though various ornithologists have formed elaborate systems of them, those systems are hardly intelligible to ordinary readers, and not of much interest or use to anybody. As is the case upon subjects where the truth cannot be obtained, every one has proposed a method of his own, and with very few exceptions, it may be said, that one of them is just as good as another.

It is not possible to form even a geographical arrangement of them which can be applied to any useful purpose; for we find great dissimilarity in the more essential points between species which inhabit the same locality, and great likenesses between those which live at each others antipodes.

In all their varieties, whether of genus or species, parrots are, strictly speaking, day birds, going to their repose at sunset, and being up with the sun again in the morning. As already hinted, the whole may be said to live upon vegetable food. In the greater number this food is the kernels of fruits, of which the birds appear to care little for the pulpy pericarp, or portion which we term fruit, how highly soever we may esteem it for its flavour. Fruits which have large seeds inclosed in a hard shell or nut within the pericarp, are the favourites with them. They find these upon many of the palms, upon the wild almonds, and upon various other trees; and the dexterity which they show in opening the valves of even the hardest of these shells is truly wonderful. It is not done by mere random force, but by an application of the bill as perfect as if it were guided by human science, or even more so. When the shell and kernel are divested of whatever external covering they may naturally have, the whole is brought against the hook of the upper mandible on the one part, and the end of the tongue on the other, into the very best position for enabling the application of the lower mandible to separate the valves. This is done, of course, by the simple touch of the tongue in the bird, for the horny part of the bill has no sensibility, and it is impossible that any use can be made of the eye or any other organ of sense. Notwithstanding this, it would be impossible for man, using both his eyes and his hands, to place the substance to greater advantage for the action of the instrument; and thus the parrot is enabled to break the shell and get at the kernel, with the very minimum of labour. When the shell is broken, the tongue still keeps the kernel against the hook of the upper mandible, and thus allows the lower one to be opened, so that the fragments of the shell may be rejected.

For the accomplishment of the double purpose of this curious bill, it is not only provided, as formerly stated, with very strong muscles, but there is a provision made for preventing that concussion which arises from its powerful and frequent action, from being communicated to the brain. This is obtained by the upper mandible being articulated with the bones of the cranium, and not united. In consequence of this, the upper mandible is susceptible of some motion on its base; and this motion not only prevents the concussion from being propagated to the brain, but enables this organ to exert a much more powerful effect than it would have, if the upper mandible were so firmly united at its base as to be incapable of motion. As the bill is actually constructed, the upper mandible partially descends to meet the lower one, and thus no power whatever is lost, and so the bird is enabled to take even its hard food with ease compared with what other birds have to undergo. This is a very general provision in Nature's mechanical structures, for we meet with it in the feet of swift-leaping animals, in wings, and, in short, in every organ of powerful motion. If the organ is to be ex-

erted with more than ordinary vigour, there is always some flexibility provided in its base by peculiarly shaped bones, the cartilaginous substances of which slide upon each other by cartilage or ligament, which confines the shock to the single organ, and prevents it from being so propagated as to affect the vital parts of the animal. This is a provision of Nature which mankind would do well to imitate as far as possible in all those machines which work with great power, in order to prevent the machine from being shaken to pieces by the violence of its own working, which can be much better done in this way than by any addition of mere mechanical strength.

Some of the family, which live more habitually on the ground than the typical parrots, have not the bill of the same large size or powerful construction; and these are understood to feed, in great part at least, upon succulent and bulbous roots. They still have the feet zygodactylic, a character which is not departed from in any of the family; but they have much less motion of the joints by which the lower end of the tarsus is articulated to the toes than the climbing parrots have. In these this articulation is so loose, that when the birds attempt to walk on a level surface, the foot is so much turned out, that the tarsus appears to be applied to the inner edge of it, and not to the upper side as it is in those birds which are more characteristic walkers. This turn outwards in the foot is eminently characteristic of a climbing instrument; for we meet with it in all the ape and monkey tribes; and the joint is always the looser and more oblique, the more constant the climbing habit is in the owner. This of course enables the animal to have a much greater range in the action of the prehensile part of the organ, than if the joint were firm, because, by means of it the foot can be turned in a greater number of directions, and especially laterally outwards, which is the most favourable direction for the foot of a bird which scrambles among the branches. The ground parrots, which are rarely if ever upon trees, have feet of a different construction. In them the tarsi are much longer in proportion, and the articulations of the toes together are firmer. They are also much more slender in proportion to the weight of the birds, and neither the muscles which give motion to the toes, nor the connecting tendons by means of which the action of those muscles is carried to its proper place, are nearly so powerful. So much power is not indeed required; for the ground parrot has only to walk, whereas the tree parrot has often to suspend itself in all positions by a single foot, often by a single toe, and to perform many operations in seeking its food while it hangs in these positions. It is impossible to avoid admiring the admirable perfection with which in these cases, and, indeed, in every case where we have the means of observing, the degree of power in an instrument is adapted to the necessity that there is for this power, no matter how fine the shade of distinction and habit may be; for we find that the shades of adaptation are always equal to it. It would be endless, however, to point out all the peculiarities of a race of birds which are so varied in their forms and their manners, though so constant to their general type, and of which all the members are equally well adapted to the places which they hold in nature. Those who have examined the tropical forests, mention that there appears to be a species of parrot adapted for each of the more conspicuous kinds of trees which are to be met with in those forests. Thus, if the tree is a palm, or any thing else which has a single stem, and can afford nourishment for a bird only at or near the top of that stem, then the species of parrot set over it to consume the surplus of its fruit, is an air bird, capable of flying over the forest in search of such trees; and when such is the case, the body of the bird is lighter in proportion to its lineal dimensions, and its tail is generally very much produced, which assists it in ascending and descending. On the other hand, the short-flighted parrots, which inhabit trees which are very much branched, and bear fruit in the axillæ of the leaves of the smaller twigs, have the bodies stouter in proportion to the dimensions, the tail shorter, and the feathers more firm and scaly. Parrots of this last description inhabit regions which are more perennially fertile than those inhabited by the former, whose more produced flying feathers and lighter bodies, and, generally speaking, also their more vigourous make, fit them better for ranging into a new locality when food fails them in the old one, and also for making daily excursions of considerable length over the fields in the vicinity of those trees wherein they roost during the night. It is these discursive ones which are most destructive to plantations in the neighbourhood of the woods; and as they invariably make their excursions in large flocks, and destroy much more than they eat, their visits are always peculiarly annoying to the planters. We shall hereafter have occasion to allude to some of the species which are troublesome in this way. The tree parrots with short tails, which are the characteristic ones, are also those that can be taught to articulate words in the greatest number, and with most distinctness. Their range on the wing is considerably more limited than that of the long feathered ones; but still, though their flights are usually short, their wings are powerful. The wing of no parrot is, however, constructed after that fashion by which a bird can be kept in the atmosphere for a very great length of time. In order that a wing may be adapted in the most perfect manner for this purpose, there is an element necessary in addition to strength of muscles and firmness of feathers, namely, the power of taking a hold on the air by the fibrous terminations of the webs of the feathers, especially those of the under sides of the wings. Parrots of long flight are a little better furnished in this respect than short-flighted ones; but still all of them have hard feathers as compared with those of birds which range greatly through the air.

We have said that there is some confusion in the systematic arrangement of these highly interesting birds; and that the ablest systematists are at issue with each other on the subject. There may, in some instances, be faults on the part of those systematists; but the grand difficulty, of which none of them can get the better, is the want of information, not merely with regard to the shapes, colours, long or short tails, large or small bills, naked or feathered cheeks, or any of the other peculiarities which are usually made grounds of specific distinction, but with regard to the use of the birds in the economy of nature, and how the use of one varies from that of another. Buffon, whose eloquence tended so powerfully to draw the attention of mankind to natural history, and whose errors in fact, and more especially in hypothesis, have tended so much to distract that attention, that it is not easy to say whether upon the whole he did more good or harm to natural history, made a sort of geographical division of the parrots. His primary separation was into the parrots of the eastern continent

and those of the western. Each of these he again divided into seven families, placing the cockatoos at the head of the eastern grand division, and the maccaws at the head of the western. Such an arrangement, however, possesses no advantage; because, though there is not perhaps exactly the same species in the east and in America, yet in each continent there are some species approaching much more nearly to those of the other than some of those of either continent approach each other. This arrangement must therefore be abandoned, as indeed every arrangement which is merely geographical must be, unless cause is shown in the different characters and productions of the countries which are contrasted. Now Buffon had some crotchets on the subject of the differences between the physical condition of the eastern and the western continents, which cannot be admitted into any system, the object of which is either the establishment or the promotion of scientific truth.

Perhaps one of the best arrangements of the parrots is that made by Kuhl, who divides the whole family into six divisions. These agree pretty nearly with the common names which have been given to the birds in English, which is always an advantage when it can be adopted. These divisions, according to Kuhl's arrangement, are maccaws which have the tail long and wedge-shaped, and the cheeks naked of feathers. Of these we have already given a very slight general notice in the article ARA, though without enumerating any of the species. The second division are the long-tailed parrots, some of which have a naked space round the eyes, and some not; and those which have such a space are not unfrequently styled maccaw parrots, as being, in this respect at least, and also in the general form of their bodies, something intermediate between the maccaws and the true parrots. The members of this division, which have the cheeks naked in part round the eyes, are, almost without exception, natives of South America, and especially of Brazil, the grand head-quarters of the maccaws; though one at least is found in Western Africa. Those which have the cheeks completely feathered round the eyes are, without exception, natives of the eastern continent, over which they take a very wide range, being found in Western Africa, in tropical Asia, in the oriental islands, and in New Holland. The third division consists of birds which are of smaller size, having the tails very short, and either round or pointed. They are confined to the eastern continent and the isles of the Pacific. The fourth division consists of the parrots properly so called, which have the tails of moderate length, or rather short, and, generally speaking, squared over at the termination. Birds of this division seem more widely distributed than any of the rest. They are plentiful in tropical America; they occur also in Western Africa; they are found at the Cape of Good Hope; they are found in the West India islands; and also throughout the isles of the east. These are the parrots properly so called, or the true parrots by way of eminence; and, as we already hinted, they are found on richer pastures than any of the rest; they are perhaps not so elegant in their forms as some of the others, but, taking them altogether, they appear to be birds of greater resource, are more docile in confinement, and many of them can be made to articulate better. The fifth division in this mode of arrangement comprises the cockatoos, which have the tail squared over, the cheeks covered over with feathers, and a crest of feathers on the head, which they are capable of erecting or flattening at pleasure; they are almost, if not altogether, natives of Australia. The sixth division, according to Kuhl, have the tail even, and the cheeks naked, and are without any crest. From this enumeration of them, it will be seen that very little information can be conveyed by these divisions, which are perfectly artificial, and each of them embraces birds differing as much in their habits as some which are placed in different divisions.

When we take the more modern attempts at a natural division of this family of birds, we are not better off; because there is introduced into them the QUINARY hypothesis, or that which supposes things to have been created in fives, forming a sort of circle, in which the end comes round and meets the beginning, in a way which the abettors of the hypothesis appear to be incapable of explaining, and which, in all probability, they do not exactly understand. If, therefore, we wish to understand anything correctly about the parrots, we must really go to the common names under which we group them, and to the study of the species for such information as that may afford. On the plate PARROTS there will be found figures of four species, characteristic of an equal number of those divisions into which the family is usually separated; and all that our limits will permit us to add will be short notices of only a few of the species; for their numbers are so great that even the list of them would far exceed our limits.

MACCAWS. Besides the name *Ara*, to which we have already alluded, these birds have been called *Macrocercus*, from the large naked space on the cheek and around the eye, or rather perhaps from the great length of the tail; and in this sense of the word it is usually restricted to the larger ones, which are exclusively American, and less confined to the depths of the forests than the tree birds. They have the bill rather short, and much compressed laterally, but deep as seen in profile, and of great power. The upper mandible is very much hooked, with the tip descending far over the extremity of the under one, which is also particularly strong, and so formed that its cutting edge acts nearly at right angles against the upper. The parts that act against each other are very much ruffled, so that the bill is very powerful as a crushing instrument; it keeps a firm hold of those nuts and other hard inclosures of kernels upon which the birds feed. The wings are in themselves rather more than of mean length, and they are very much pointed; but the tails are so long that they take off from the apparent length of the wings. The tail is also very much staged or graduated; and all the upper plumage of the birds is remarkably firm. The tarsi are very short; but both they and the toes are strong and admirably formed for climbing. They are decidedly tree birds; but they are pretty discursive in their flights from one part of the forest to another. They nestle in the holes of trees, and the hatch is said to consist of only two; but how many are produced in the year is not known. In a state of nature the voices of maccaws are very loud, harsh, and discordant; and, as they can be taught to articulate with difficulty, and then only a few words or syllables, they are not so much in request as the true parrots with short tails, or as some of the smaller of the long-tailed species. They are handsome birds, however, and very hardy; and, therefore, notwith-

standing the offensive noise that they make, they are often tolerated as ornamental birds out of doors, where they are very bold in defending themselves.

The Great Green Maccaw (*M. militaris*) is one of the largest species, and far from being the least handsome. It is not, however, the very largest of the whole; for some of them exceed it, though the excess is more in the length of the tail than in the size of the body. The bill is dark-coloured, generally very deep blackish brown, and remarkable for its strength; the claws are also black, and very strong and worked; the colours are fine in the tint, and decidedly marked; the naked parts round the eyes and on the cheeks are flesh-coloured, marked, especially toward the under part, with slight longitudinal curves of blackish brown feathers. The eyes show very remarkably in this species; for the iris consists of a double circle, the external one bright yellow, and the internal a sort of sage green. The front is very rich crimson in rather a narrow band; and the feathers on the chin are reddish brown, passing gradually into bright green, which is the general colour of the breast and belly. The plumage on the upper part is a varying colour, appearing green in some lights and azure in others, both of which are very lively. The rump and upper coverts of the tail, and also the quills and greater coverts of the wings, are bright blue; the tail feathers are scarlet on the upper part, with the exception of a portion at the tips; and the under sides of the wings and tail are orange-yellow.

This bird is an inhabitant of tropical America, extending from Mexico to the base of the Andes; and, though it cannot be called a mountain bird properly speaking, it inhabits at greater elevations than many others of the tribe, being met with on the secondary hills at considerably more than half a mile above the sea. These birds are very numerous; and, though they breed each pair apart in the hole of a tree, they assemble in flocks at those times when they have not young, which are generally the times when their forest pastures are least productive. As long as provision is to be found upon these, they subsist upon it, eating indiscriminately the fruits and the succulent flowers, which latter, upon some of the tropical trees, contain a good deal of nourishment; the honey with which the nectaries of many such flowers abound is, however, the probable inducement which the birds have to tear the flowers to pieces. Many birds are fond of sweet substances; the parrots, taken as a family, are especially so; and some of the small species which inhabit the rich perennial forests of the eastern world are understood to feed much upon the honey of flowers. When their supply in the forest fails they are said to sally forth in very numerous flocks, at which times they attack the plantations of the inhabitants, especially those of Indian corn, upon which they commit very serious depredations. Upon these their predatory excursions, they conduct themselves with great vigilance, and always place one sentinel or more upon the tops of lofty trees. These sentinels, which are relieved by turns by others of the birds, are said to keep a sharp look out, and to detect the appearance of danger, while it is still far distant from the plunderers. Upon perceiving it they give a very loud alarm call, which is at once responded to by the rest, and the whole are instantly on the wing, and soaring above the reach of any ordinary missile weapon. January and February are the times during which they make their appearance upon the plantations in the central parts of America; and when the rains set in they betake themselves to the forests, and live upon the bounty which nature there so amply provides for them. As game, these birds would be of comparatively little value; for their flesh is black and hard, and unsavoury to the taste; and those inhabitants who are near their haunts have no alternative but to submit to their depredations with as good a grace as they can.

Scarlet and Blue Maccaw (*M. Macao*). This is also a large species, and remarkable for the brilliancy of its colours. It measures upwards of two feet and a half in length. The prevailing colour is scarlet, the wings blue, and the wing-coverts variously marked with yellow; the tail bright red, with blue margins to the feathers; the naked parts of the cheeks are white and very much wrinkled; and the upper mandible of the bill is also white. They inhabit the same part of the world as the last-mentioned species, namely, the tropical parts of South America. They do not, however, inhabit exactly the same localities; but dwell deeper in the forests, make the different species of palms their principal residence, and feed in great part upon the fruit of these. They are never found in so dry situations as the former species; and they do not commit the same extensive depredations upon the planted fields. It is also said that they do not flock so often; though, when they do, their flocks are exceedingly clamorous. They always choose high perches; and, when reposing, they are generally on the summits of the highest trees. They are rather discursive during the day, ranging about for several miles; but as night begins to set in they return to their habitual resting-places, as regularly as the rooks. They build in hollow trees, and line their nests with feathers. The eggs in each hatch, for there are understood to be two in the year, are two in number, about the size of the egg of a pigeon, and mottled something like those of a partridge. The time of the incubation is not distinctly known; but it is well ascertained that both parent birds are remarkably attentive to their offspring. They sit alternately, so that as one goes out to feed, the other invariably takes its place; and, after the young are hatched, the old birds nurse them with great attention, until they are able to provide for themselves. The feeding of the young, like their own feeding, is wholly conducted in the light of day; and at night, and also when he rests during the day, the male takes up his perch very near the nest. By means of this constant habit of theirs, the nest is not difficult to be discovered; only it is very often over the damp and swampy grounds, where the footing is bad and the forest very much tangled. The young birds are susceptible of being tamed, though they never become very tractable; and they may be made to articulate a few words, but not distinctly. Comparatively speaking, they are hardy birds in confinement, and live to a great age. When the old ones are confined they are exceedingly mischievous; and, if kept in a room, their chief occupation consists in pulling the furniture to pieces; and, so hard is their bill, and so dexterous are they in the use of it, that they can draw nails with it, if the heads are such that they can get a proper hold of them. Their flesh, like that of the former species, is hard, dark-coloured, and unpleasant to the taste of a European; but still the Indians, the negroes, and even the poorer white inhabitants of South America, contrive to use it

in considerable quantities as an ingredient in their soups. It is reported, that, when they feed upon certain poisonous plants, the manchineel, for instance, their flesh becomes poisonous, though the fruit does not hurt them. It is probable, however, that this is exaggerated in the same manner as the deadly qualities of the manchineel tree itself have been exaggerated. There is no doubt that both the fruit and the juice of this tree are exceedingly acrid; and that a portion of the concentrated juice, inserted into a wound, would produce death; but there is no truth in the old story of the odour given out by the tree and the water dripping from it being poisonous. It is certain, however, that the juice of this tree was at one time made use of, by the French colonists in America, for the purpose of inflicting a most barbarous torture upon their slaves. The scourges, with which they lashed those unfortunate creatures, were prepared by being steeped in the juice of manchineel; and thus every blow inflicted by the scourge caused the same agony as if that scourge had been red-hot iron. Acridity appears to be the leading character of all parts of the manchineel; and therefore it can hardly be supposed that these maccaws, which have soft fleshy tongues, and, as one naturally supposes, a pretty keen sense of taste, would feed upon it. In the case of all those marvellous stories, which are told about birds and other animals eating poisonous substances, and becoming poisonous themselves in consequence of so doing, it is necessary to exercise a due degree of caution before we give credit to them.

Aracanga Maccaw (*M. Aracanga*). This species bears considerable resemblance to the last-mentioned; and the two have sometimes been confounded with each other under the common name of red and blue maccaw. Red and blue are certainly the prevailing colours of both; but the red upon this one is of a different tint from that on the former, inclining more to crimson than to scarlet. The authorities are not agreed as to the size, some describing it as smaller than the scarlet and blue species, and some as larger. We believe the specimens of it differ very considerably in size, and that the principal difference of dimensions is in the length of the tail, which, in healthy birds, is about twice as long as the body, that is, rather more than two feet in length. When the bird is in bad health, this member is shorter, and has not the firm and decided character by which the full vigour of the bird is indicated. In such cases, also, the general plumage loses the greater part of its gloss, and the bird is, altogether, very inferior in appearance. The bill is very large and powerful, like that of the preceding species; but the upper mandible, instead of being white, is pale lemon yellow, with the exception of a dusky spot at each angle of the gape; and the under mandible is black, or nearly so. The naked space on the cheeks is covered with pale pink skin, puckered and wrinkled, so that it has something the appearance of scales, but without any longitudinal arches of small feathers; the feathered part of the head, the neck, the scapulars, the back, the breast, and the belly, are dark red; the middle coverts of the wings are bright yellow, tipped with greenish blue; the bastard wings and the quills are deep azure; the rump and upper and under coverts of the tail are of the same colour, but considerably paler, and with a shade of purple; the tail is very handsome, consisting of four middle feathers of deep red, a red and blue one on each side of these, and the remaining ones altogether blue. This, however, is the marking of the upper side only, for the under side of the tail is wholly deep red, which contrasts beautifully with the pale blue of the under tail-coverts.

This bird is found in the same localities as the one last mentioned, and, from the accounts, it appears to be equally abundant. In all its habits, indeed, it bears so close a resemblance to the former, that a description of the one will serve for that of the other, with the exception of the particulars which we have stated. As is the case with all the maccaws, this species is not impatient of captivity, provided that it is duly fed. It is a magnificent bird both in size and in plumage, but it is a bird of comparatively little resource, and susceptible of only a very slight degree of education. For this reason, it is not at all adapted for being a pet bird; and in the house it is intolerable, both on account of the use which it makes of its powerful bill in the work of destruction, and of the loudness and harshness of its screaming. In large collections, however, where birds or other animals are kept, or professed to be kept, as much as possible, in a state of nature, it is highly ornamental; and there are few birds in the collection of the Zoological Society of London which draw more attention on account of their mere size, form, and plumage, than a specimen of this maccaw. It should seem that the colour of this species is not absolutely constant, for specimens have been mentioned in which the shoulder and lower part of the neck had a yellowish tinge. There is, indeed, a good deal of uncertainty about the describing of any of the parrot race entirely from their colours; and yet, in the species which are nearly allied to each other in size and in habit, the colours are almost the only means of distinction that can be made use of. Hence the description, how carefully soever it may be drawn up, can seldom be made anything more than an account of a single individual; and it very often happens that this account will not apply to the very next individual with which one meets.

Blue and Yellow Maccaw (*M. ararauna*). This is a handsome species, though very different in the colours of its plumage from those which have been mentioned. It is also susceptible of a little more education, and therefore it is the maccaw which we most frequently meet with about the houses of those who are fond of keeping ornamental birds. It can be taught to articulate, though very sparingly, and with little distinctness. It is, however, much more obedient to the calls of those about it, and shows more sensibility to kind treatment than most of the maccaws; nor does it appear to be so incessantly fond of pulling to pieces everything that comes within its reach. Like the others, it is a native of the richer parts of intertropical America, Brazil, the valley of the Amazon, and the forests interior of the settlements along the southern shore of the Caribbean Sea. It is fond of rich and marshy places, where it roosts generally on the tall palm trees, and lives in great part on their fruit. As is the case with its congeners, it generally keeps in pairs, or, at most, in the little family pack, for a short time after the young are capable of using the wing. This appears to be a general habit with all birds which reside in the perennially rich places of the tropical forests. It sometimes happens, however, that the rains fail, or

Imperial Parrot.

Prince Maximilian's Macaw.

Cockatoo.

Crested Parrakeet.

are later in coming than usual, and at such times the forest supply gives way, and their closest inhabitants are compelled to range abroad for subsistence. This is sometimes the case with the blue and yellow maccaws; and when it is the case, they assemble in flocks, take a lofty flight, and give notice of their approach by the loudness of their scream. They are birds of very powerful wing, and have much command of themselves in the air. Their wings are very pointed, and their tails are exceedingly long, stiff, and wedge-shaped; hence they are enabled to leap about in the air with the same apparent ease as if they were leaping from one solid perch to another. They less frequently invade the plantations than some of the species already mentioned; but when they do, they are equally destructive. When they alight on their journeys, in order to rest for the night, or for a time, it is always on the tops of the loftiest trees; and they never alight without wheeling round and round in the air, as if in order to ascertain if any danger is near, before they take their repose; and while they are reposing, it is generally understood that they have a watch set, which never fails to give timely warning in case of necessity. In the construction of their nests, and the whole of their domestic economy, they bear so close a resemblance to the other species of maccaws, that it is not necessary to enter into any particulars. Perhaps, indeed, there are no birds so similar to each other in their domestic habits as all the species of the maccaws. They all nestle in the holes of trees—have two hatches in the year—two birds in each hatch—and are remarkably watchful both of the eggs and the young.

This, though not the largest of the maccaws, is a large species, measuring upwards of three feet in length, two feet of which is occupied by the tail. The bill, which is very large and strong, is altogether of a black colour, and remarkably hooked and pointed in the upper mandible; the culmen of that mandible, which begins to curve down immediately at its junction with the forehead, measures more than three inches in length; the lower mandible is very short in proportion, but it is exceedingly firm and strong, and toothed at the extremity; the naked skin on the cheeks, which extends in a narrow line along the base of the bill, and in a point toward the ear-cover, is white, but under the eye it is marked by slender curved lines of black feathers, having their curvature directed downwards; the irides are yellowish white, so that the eyes of this species appear less conspicuous than those of many of the others; but still, from its vigilance, and the readiness with which it perceives an enemy, or a proper resting-place, there can be no doubt that its sight is very keen; above the narrow white band the forehead is green, passing gradually into blue about the middle of the top of the head, and then the whole of the upper part is a very rich and beautiful blue; on the neck this blue is rather narrow, and the outline is broken on the scapulars, but, from the turn of the wings backward, it is well defined; on the rump, and some of the smaller coverts of the wings, there is a greenish tinge; and indeed the whole upper plumage varies a little toward green in some lights, with the exception of the primary quills and tail-feathers, which have a shade of purple; all the under part is rich brownish yellow, with the exception of a band of black, which immediately surrounds the base of the lower mandible, and extends back about half way as far as the naked white space on the cheeks, giving the bird, when seen in profile, something the appearance of having three mandibles, a large one above, a large one below, and a smaller one in the middle; the yellow which marks the under part of the body extends also to the whole undersides of the wings and tail, so that, seen from above, the bird seems entirely blue, and, seen from below, as entirely yellow; the feet are dusky, but the scales, from their being picked out with white edges, give them a mottled appearance.

Green Brazilian Maccaw, or Maracana (*M. Severus*).—This is a small species, and may perhaps be regarded as forming a transition from the larger maccaws, or maccaws properly so called, to the maccaw parrots. Its cheeks are naked, its forehead purple brown, and the rest of the body plumage green. The wings and tail-feathers are blue on the upper side, and dull red below. It is not larger in the body than a pigeon, being only about seventeen inches in length. It is a native of Brazil, where it occurs in numerous flocks, which do a great deal of mischief to the coffee plantations; though it is the pulp of the coffee berry which it eats, and not the seed or part which is used in commerce. It is much more familiar than the larger maccaws, and visits the cultivated grounds much more frequently. It is also a bird of very inferior wing, and capable of taking only short flights. It is easily kept in a state of domestication, and very fond of being petted; but it is jealous and bad tempered, showing great hostility to strangers, and especially to children. If any one is made to share the attention bestowed on it, it is worked into a paroxysm of rage, attempts to fly at them, and bite and scratch, and never rests satisfied while those who are in the habit of caressing it pay attention to any other living creature. Its jealousy extends even to the other members of the parrot family, and it is seldom satisfied if any of the rest of them are in the room with it. Thus, though it is rather a handsome bird, it is unpleasant to keep in a collection among others; and as its powers of articulation are very limited, it is of no great value even to the curious, when kept singly. When, however, it enjoys the whole attention of those who fondle it, it can be amusing; and it expresses satisfaction in a peculiarly soft sort of murmur, and occasionally utters a sound having some resemblance to a laugh.

Prince Maximilian's Maccaw (*M. hyacinthus*), is another Brazilian species, of rather larger size, and rich in its plumage. It is about twenty-eight inches in length; and this may be reckoned about the average size of the maccaws properly so called. Its general plumage is very rich hyacinth blue; the quills and tail-feathers are violet blue, with green reflections. There is a yellow spot at the angle of the gape, and the naked skin round the eyes, and also the feathers on the chin, are the same colour. The bill and feet are black. This species is darker in the general tint of its plumage than most of the maccaws; but it is at the same time rich and beautiful, and a graceful bird in its form. Some idea of it may be formed from the figure on the plate—Parrots.

Tricoloured Maccaw (*M. tricolor*). The name of this species is by no means happy, inasmuch as several of the other maccaws, indeed most of them, have three colours in the plumage, and generally colours which contrast strongly with each other. The present one

has the top of the head and the lower parts of the cheeks red, the hind neck yellow, the coverts of the wings brownish red, and the quills blue. The tail-feathers are bright crimson, bordered with blue and tipped with the same, except the two middle ones, which are bright blue and tipped with crimson. The naked skin on the cheeks is marked with small lines of reddish feathers, and the under part is clouded with the same. This species is about twenty inches in length, and occurs in various parts of tropical America, but its manners are little known.

Illiger's Maccaw (*M. Illigeri*), is a Brazilian species, measuring about eighteen inches in length, and very different from any of the rest in the markings of its plumage. The forehead is orange-red, and the remainder of the head and the neck greenish blue; the larger quills and the tips of the tail-feathers are bright blue; the remaining part of the tail-feathers are purplish red on the upper part, and yellowish on the under: the general plumage is green, and the bill and feet are blackish.

There are many other species of maccaws to be met with in collections; and probably there may exist in the forests of central America many species which have not been hitherto observed. There is, however, so much similarity among all the maccaws, excepting in size and colour, that when the manners of one are known, a tolerable index is obtained to the manners of the whole. In the country which they inhabit, they are exceedingly numerous and highly characteristic; and as they are very voracious, and feed almost exclusively upon fruits of some kind or other, their numbers are sufficient evidence of the vast abundance in which wild fruits of some kind or other are found in those forests at every season of the year. They do not range so far in latitude as some of the lighter species with tails somewhat differently formed, to which we shall afterwards have occasion to allude; but still they range from the upper part of the valley of La Plata to Mexico, and from the eastern extremities of Brazil to the slopes of the Andes. The centre of their territory may be regarded as being the river Amazon, the line of which lies near the Equator, and whose valley slopes so gradually toward the sea, that the effect of the trade winds, and of the air which those winds put in motion, is felt almost to the base of the mountains, or at least to that mighty forest which lies immediately to the east of them, and probably contains a greater abundance and luxuriance of wild fruit-trees than any other forest on the surface of the globe. The great rivers which empty their waters into the Amazon, the chief of which come from the south, contain in their valleys immense forests of a similar character; so that no place could be mentioned where the food of birds constructed like the maccaws exists in such plenty. The birds are well fitted for the part which is thus assigned them. They are by much the largest of the parrot family, and they are more completely armed at all points than any of the rest. It is true they are not good walkers; but with them walking is not necessary. Their food is found on the trees; and when it falls to the ground, they abandon it to the small mammalia which gather their food beneath the shade of the trees. Their wings are, in all the species, powerful instruments, and firmly and neatly formed for flight. They are not proportionally so long as the wings of those birds which have to take extended migrations, or to chase their food on the wing; but they are what one would call cleaver wings, equall fitted for forward flight, for turning, and for ascent an descent. In those movements, especially the up an down ones, the powerful tail is of great use to thea Their feet are also of first-rate character as climbin feet; and their bills are of stronger make and firme consistency than those of any others of the rac Taking them altogether in their adaptations to wil nature, they unquestionably stand foremost in th parrot family; though many of the others are far mo docile and engaging in their manners, and on tha account better fitted for being kept as ornaments. is in wild nature, however, that we must look for th proper characteristics of every bird or other anima and perhaps there is not in the whole living creatio a finer specimen of adaptation than we meet with i these birds, nor is there a country which presents s extensive and inviting a field to the student of N ture as that which the maccaws inhabit, and mak gay with their colours, and keep in incessant din wit the loudness and harshness of their cries.

Maccaw Parakeets. There is some little unce tainty in the application of the word parakeet. Its g neral signification may be considered as a diminutive the word parrot, and the parakeet generally has the ta longer than the parrot, and pointed, or wedge-shape or with the middle feathers very much produced. Th birds brought together under this name are of a mixe character, and do not, like the maccaws, form a distin section, occupying a particular locality. In one other of their species they are found both in th eastern and western continent; though those the west may perhaps be considered as resemblin the maccaws much more than those of the east d Like the maccaws, the parakeets are found only the most fertile places of the world, though they hav a much greater range than the maccaws. In Am rica, for example, there is one at least which range as far to the north as the southern part of the Unite States; while in South America there are othe which reach as far southward as the Strait of Mage lan. In the eastern continent we do not find the so far to the north; but they extend to the souther extremity of the land, and are chiefly dispersed ov the islands. Even in this hemisphere, however, the do not inhabit such high latitudes as in America; b they do so simply because there are no such high la tudes on land for them to inhabit.

None of these birds have the cheeks so complete bare of feathers as the maccaws; but the Am rican ones have them more naked than those of th east; and they farther approach the maccaws in ch racter by being less susceptible of education than th eastern parakeets, or parakeets properly so calle We shall mention a few of the species without muc reference to the subordinate sections into which it ha been attempted to divide them; because those se tions are by no means clear or satisfactory.

Psittacara is the name usually given to this gen or sub-division, and it is nothing more than a com pound of the generic names of parrot and maccaw.

Noble Parrot Maccaw (*P. nobilis*), is an America species, and the one which resembles the maccaw most nearly in its plumage. It is, however, smalle than the greater part of the maccaws, and it is a bir which, taken altogether, has a feebler and softer ai The feathers are not nearly so firm in their texture and on the under part they have the appearance down and not of scales; the upper mandible too

not nearly so strong nor so much hooked; and the head is not so thick and firm, because the muscles that work the jaws are not so large. This species has been called the Guiana parrot; but this appellation is an incorrect one, inasmuch as it is found pretty generally distributed over the warmer parts of the American continent, and reaches farther to the south than most, or perhaps than any of the maccaws. It is but a small bird, being only twelve inches in total length, of which the tail occupies a full half; the upper mandible and naked space round the eye are yellowish white; the lower mandible is grey; the head as far as over the eyes light blue, the feathers bearing some resemblance to hairs. The whole of the upper part and under part are tolerably bright green, with the exception of the turn of the wing, the under wing-coverts, and the under side of the tail-feathers, where the wings are bright vermilion-red, and the tail yellow with a slight tinge of green. It is understood that this species lives on the kernels of hard fruits, which it is very dexterous in breaking, though its bill is upon the whole less powerful in proportion to its size than the bills of the maccaws. Those who are fond of tracing gradations from one race of animals to another, are generally disposed to class this bird as something intermediate between the maccaws and the American parrots properly so called; but its bill and feet are differently constructed from those of the true parrots; and its air and expression, and also its docility, are totally different; while, on the other hand, its size is smaller, and its general shape more elegant. So far as is known of its manners it agrees with its expression, for it is a wild and clamourous bird in its native haunts, and not capable of articulating or of affording any sort of amusement in a state of captivity.

Patagonian Maccaw-Parrot (*P. Patagonus*). This is the least tropical of the whole of the parrot race, being found in that country after which it is named, even down to its southern extremity. It is olive-brown on the upper part with exception of the rump, which is yellow; the forehead is blackish, the head brown, the cheeks and wing-coverts olive; the rump, the upper tail-coverts, the sides of the belly, and the vent-feathers yellow; the quills brown with purple reflections; the tail-feathers olive brown, the breast brownish mottled with black: the middle of the belly reddish, and the bill and feet ash-colour; its length is eighteen inches. It will be seen from the description of the colours, that this parrot, which inhabits a colder latitude than the rest, though still a latitude which is tropical in its vegetation, has its colours much more broken than those species which live near the equator; and this is part of the character of a bird of temperate climates. In noticing the remaining species, which we shall do as briefly as possible, we shall omit the term maccaw for the sake of brevity, though it is of course to be understood that all those which have the cheeks more or less naked partake a little of the maccaw character. The greater number of the American ones which remain to be noticed are small birds in comparison.

Golden-crested Parakeet (*P. auricapillus*). This is a Brazilian species, and one of the largest of the long-tailed ones, being about ten inches in length. The general plumage is green, the forehead red, and the top of the head yellow; the quills are blue on their external surfaces, and so are the principal coverts; but the under sides of the wings are purple-red; the tail-feathers are greenish yellow at their bases, and blue in the greater part of their length; the throat and breast are yellowish mottled with purple; and the belly, the vent-feathers, and the rump are purple; the bill and feet are ash-colour.

The scaly Parakeet (*P. squamosus*), is another Brazilian species, smaller than the last-mentioned, being only eight inches in length. It is green on the upper part, with blue reflections on the quills of the wings, and with the under sides yellow; but the under coverts of the wing, and also the bastard wing are red; the rump and belly, and also half-collar on the neck are bluish, with orange margins to the feathers, which makes them appear distinct from each other, as if they were scales—whence the name; but the name is an inaccurate one, inasmuch as the feathers have nothing of a scaly character.

Party-coloured Parakeet (*P. versicolor*). This species is described as being found in the forests of Guiana. It is about nine inches in length, and gets its name from the varied colours of the throat; the head is brown, the upper part green; the forehead and collar blue; the primary quills blue externally, with green reflections, and the bastard wing red; the ear-coverts are grey; the neck, throat, and breast are variable brown, with the margins of the feathers lighter; the rump and tail-feathers are purple-brown, the flanks green, and the bill and feet blackish.

There are several other species of parakeets in South America with the cheeks more or less naked, and the tails, generally speaking, broad and spreading for about half their length, and wedge-shaped for the other half. The feathers being, generally speaking, twelve in number, the middle ones always the longest and of equal length with each other, and the point of each feather standing separate from each other when the tail is spread. The tail with which we are familiar in Europe, bearing the most resemblance to this, is that of the magpies; and though these birds are very different in their habits, and also in their food, from the magpies, and are zygodactylic, whereas the magpies are not, they resemble each other in many of their attitudes and also in their styles of flight. Being smaller birds than the maccaws, and more habitually on the wing, they are found in more open places; in consequence of this they are more destructive to plantations than some of the larger ones are. In tropical America they are of course tree birds, but some of them frequent districts in which trees are few, and they nestle in the holes of rocks. This is the case with the Patagonian species, which is a hardy bird, and inhabits the mountains to a considerable elevation. The flocks of them are sometimes immense; and, as at the time when they flock they are very bold and daring, the inhabitants slaughter them in great numbers as plunderers of their gardens and fields. It is unnecessary to enter at length into the details of the species, because it would be little else than a repetition of mere colours. There is, however, one species which it would be injustice to pass over without notice, because it is the only one which is found in the temperate latitudes of the northern hemisphere. This species is,

The Carolina Parakeet (*P. Carolinensis*). The name Carolina is very improperly applied to this bird, because, even when it was most plentiful in North America, Carolina was not the chief place of its residence. On the Atlantic shores, according to

Wilson, it seldom occurred to the northward of Maryland, whereas in the great central valley of the Mississippi, it ranged as far northward as the shores of Lake Michigan, which is actually on the Canadian side of the water-shed. Wilson describes it as occurring in no scanty numbers, and as being resident during the whole year, and capable of standing the severest weather. He distinctly mentions having seen them near the banks of the Ohio, in the month of February, "flying about like pigeons and in full cry." Audubon says, that they are not so numerous in the north-western states now as Wilson describes them to have been in his time; and that, though there are a few in the country north of the Ohio, they do not occur in numbers until the confluence of that river with the Mississippi is arrived at. Some have attempted to account for this as a fact, by the cutting down of great numbers of the old and decayed trees in which the birds built their nests. There are still, however, a sufficient number of such trees in the north-west territory for accommodating any number of these parakeets; and therefore, if the numbers have fallen off, and the birds also withdrawn to more southerly habitations, the cause must be sought somewhere else. We know that the Americans have exterminated the wild turkeys from very many parts of the United States; but they have done so in inconsiderate zeal for *pot-fowling*, a purpose for which the parakeets of North America are certainly not the very best adapted.

If we take the average circumstances which have occurred in other countries, and have influenced the appearance or the disappearance of races of birds, we can really see no circumstance in North America which could render the north-western part of the United States a less comfortable country for those parakeets at the present time than it was thirty years ago. The population is not certainly yet so dense as to be any annoyance to them, and they cannot be driven southward by the greater severity of the seasons, for clearing and cultivation improve the climate in all other parts of the world, and it would be strange indeed if they produced an opposite effect in America. We have of course no disposition to question the authority of Audubon, who, we dare say, repeated very faithfully what was told him; but the fact is so much at variance with the physical circumstances, that it would require some sort of explanation. It is true that, regarding them as great plunderers of orchards, the American settlers have been very zealous in the destruction of these birds; and the birds, like the rest of this division of the parrot family, are so fearless that one may continue firing away upon the flock until immense numbers of them are destroyed, without those which remain unshot being frightened away. It should seem too that the fact of firing on these birds is more cruel than wise, just as the fact of firing upon birds sometimes is in this country. These parakeets may sometimes do a little mischief in the gardens, though the produce of the gardens is pretty nearly over by the time that they begin to flock. Their principal resort are the fields, and their favourite food is the seed of the cockle-burr (*Xanthium strumarium*), which is one of the greatest pests that annoy cultivators, in the great western valley of the United States. It is highly probable that the comparative rarity of this plant on the poorer soil toward the Atlantic may be one of the causes why the birds do not find their way so far to the northward on that side of Alleghany Mountains. On the Ohio side of the mountains the bottoms are richer. The burr alluded to is a composite plant producing, like the whole of that order, an immense number of seeds; and thus tending to spread its over every piece of ground which man has cleared timber or recovered from being a swamp. In a wi country like America, human labour can but ill co tend with the progress of a plant of this descriptio and the inhabitants of Canada, to the northward Lake Ontario, can tell how terrible the infliction where one of these composite plants comes in f force to take possession of a district. According Wilson's account, and he is still the best, though n the most recent authority, these parakeets appear have especial charge of the cockle-burr, and th visit the fields in tens of thousands, apparently the express purpose of destroying its seeds. T plant and the bird, taken in conjunction, appear ther fore to be worthy of a little more philosophical atte tion than they have hitherto met with. It is not little remarkable that in the temperate latitudes America the fields have a great tendency to be ov run by composite plants of some description or oth The rich parts of the Pampas, to the south-westwa of Buenos Ayres, are at some seasons of the ye completely overrun with thistles; and it is not a lit remarkable that the portion of North America whi has the greatest tendency to be overrun with the burrs is very nearly in the same latitude north as t Pampas is south. Nor is it less remarkable that t Patagonian parakeet ranges over the Pampas certain seasons of the year, much in the same manr as the Carolina parakeet ranges over the plains the banks of the Mississippi and its branches.

The circumstances which we have now stated w show that this parakeet is one of peculiar intere and therefore we shall venture to quote Wilso description of it, with one or two of his highly teresting anecdotes.—"The Carolina or Illin parrot (for it has been described under both the appellations)," says Wilson, "is thirteen inches lo and twenty-one in extent; forehead and chee orange-red; beyond this, for an inch and a h down and round the neck, a rich and pure yello shoulder and bend of the wing also edged with ri orange-red; the general colour of the rest of t plumage is bright yellowish silky green, with ligh blue reflections, lighted and most diluted with yell below; greater wing-coverts and roots of the prin ries deep dusky purple, almost black, exterior or bluish green; tail long, cuneiform, consisting of twel feathers, the exterior one only half the length, t others increasing to the middle ones, which a streaked along the middle with light blue; shafts all the feathers, and of most part of the gre plumage, black; knees and vent orange yellow; fe a pale whitish flesh-colour; claws black; bill whi or slightly tinged with pale cream; iris of the e hazel; round the eye is a small space without feathe covered with a whitish skin; nostrils placed in elevated membrane at the base of the bill, a covered with feathers; chin wholly bare of feathe but concealed by those descending on each sid from each side of the palate hangs a lobe or skin a blackish colour; tongue thick and fleshy; inside the upper mandible, near the point, grooved exact like a file, that it may hold with more security. Th female differs very little in her colours and markin

from the male. After examining numerous specimens, the following appear to be the principal differences:—The yellow on the neck of the female does not descend quite so far; the interior vanes of the primaries are brownish instead of black, and the orange-red on the bend and edges of the wing is considerably narrower; in other respects the colours and markings are nearly the same. The young birds of the preceding year, of both sexes, are generally destitute of the yellow on the head and neck until about the beginning or middle of March, having these parts wholly green, except the front and cheeks, which are orange-red in them as in the full-grown birds. Towards the middle of March the yellow begins to appear, in detached feathers, interspersed among the green, varying in different individuals. In some, which I have killed about the last of that month, only a few green feathers remained among the yellow, and these were fast assuming the yellow tint; for the colour changes without change of plumage."

Wilson was not able to ascertain, by personal inspection, the exact position of the nests of these birds, or the length of time which the female sits; but he made rather an interesting experiment on the education of one. The specimen which he used for this purpose was but slightly wounded in the wing, and readily ate the seeds of cockle-burrs almost as soon as it was taken. In travelling through the woods, he bound it up in a handkerchief, and carried it in his pocket, but loosed and fed it always when he rested. He must, however, be allowed to tell part of his own story:—"In recommitting it to 'durance vile' we generally had a quarrel, during which it frequently paid me in kind for the wound I had inflicted, and for depriving it of liberty, by cutting and almost disabling several of my fingers with its sharp and powerful bill. The path through the wilderness between Nashville and Natchez is often bad beyond description. There are dangerous creeks to swim, miles of morass to struggle through, rendered almost as gloomy as night by a prodigious growth of timber, and an underwood of canes and other evergreens, while the descent into these sluggish streams is often ten or fifteen feet perpendicular into a bed of clay. In some of the worst of these places, where I had, as it were, to fight my way through, the parakeet frequently escaped from my pocket, obliging me to dismount and pursue it through the worst of the morass before I could regain it. On these occasions I was several times tempted to abandon it, but I persisted in bringing it along. When at night I encamped in the woods, I placed it on the baggage beside me, where it usually sat, with great composure, dozing and gazing at the fire, till morning. In this manner I carried it upwards of a thousand miles in my pocket, where it was exposed all day to the jolting of the horse, but regularly liberated at meal-times and in the evening." On arriving at the house of a friend, Wilson placed it in a cage under the portico, and its call-note speedily attracted a number of its fellows. One of these was wounded, and placed beside the former, and the attachment which they showed to each other was truly wonderful in birds; and when the last-caught one died, the other appeared quite disconsolate for some days. We must again refer to Wilson for the catastrophe of this most interesting tale of animal history:—"On reaching New Orleans," says he, "I placed a looking-glass beside the place where she usually sat, and the instant she perceived her image all her former fondness seemed to return, so that she could scarcely absent herself from it a moment. It was evident that she was completely deceived. Always when evening drew on, and often during the day, she laid her head close to the image in the glass, and began to doze with great composure and satisfaction. In this short space she had learned to know her name—to answer and come when called on—to climb up my clothes—sit on my shoulders—and eat from my mouth. I took her with me to sea, determined to persevere in her education; but, destined to another fate, poor Poll, one morning, about daybreak, wrought her way through the cage while I was asleep, instantly flew overboard, and perished in the Gulf of Mexico."

There is still another species of parakeet, which is worthy of notice, as being the only one with a portion of the cheeks naked, which occurs in any part of the eastern continent or its islands. This is

The Solstitial Parakeet (*P. solstitialis*). It is a native of Africa, especially of those fertile regions which lie on the west coast between the equator and the fifteenth degree of south latitude, but it has been transported to Brazil, and is naturalised there in the wild state. It is not a large species, being only about eleven inches in length. The upper part is yellow, with reddish borders to the feathers; and the top of the head, the front, the cheeks, the fore neck, and the under parts of the body, are orange; the primary quills are margined with green, and have blue tips; the two middle feathers of the tail are green, with blue tips, and the lateral ones are blue, with grey borders; the bill and the feet are grey. The female has the plumage in great part yellow; but the forehead, the sides of the head, and a portion of the under part, are reddish orange; the rump, the upper tail-coverts, and the feathered part of the legs, are brown mottled with green and yellow; and the quills and tail-feathers are green, with blue borders. The young birds have the rump and the belly red; the head, the neck, and the breast, mottled with reddish; and the upper coverts of the tail green. It is necessary to attend to these distinctions of sex and age, because the three have sometimes been described as three distinct species.

We shall now proceed to the PARAKEETS properly so called, which have no naked skin round the eyes, and which, generally speaking, have the two middle feathers of the tail much longer than the others, on account of which latter circumstance they are sometimes called "arrow-tailed" birds. They are all natives of the eastern continent; their bodies, generally speaking, partake more of the parrot form than the American ones do. Some of them are exceedingly beautiful in their plumage; the greater part are gentle and docile in their manners; and some at least can be taught to articulate a considerable number of words. The species are exceedingly numerous; and, therefore, all that we can possibly do is to enumerate a few of them as specimens of the whole; and we may remark in passing, that, as they trench on the confines of some of the other sections of the family, it is extremely difficult to give anything like accuracy to a minute and circumstantial list of them.

If we are to consider them as a genus, the following may be said to be their leading characters: the bill thickish, but not so large in proportion as in the maccaws; the upper mandible widened at the base,

rounded in the culmen, and the lower one closing upon it in some of the species at more than a right angle; the cutting edges of both mandibles are strongly toothed or margined, so that the bill can retain a substance with great firmness; the tongue is thick and fleshy, smooth on the surface, and without any appendages; wings are of medium length, and the first, second, and third quills are nearly equal; the exterior webs of these are broad at the middle part; but they become very short toward the tip, thereby bringing the three shafts close to each other, and giving a pointed appearance and also great firmness to the wing; the tail is very wedge-shaped, the lateral feathers being short as compared with those nearer the middle, and the two middle ones very long and rounded at the tips. They are birds which have been admired from the remotest antiquity for the gracefulness of their forms, the beauty of their plumage, and, if the expression may be allowed, their faculty of speech, though like all the rest of articulating animals, they must stand acquitted of understanding a single word that they utter. No doubt they sometimes suit the word to the occasion, at least apparently, though it is purely accidental on their part. They distinguish places and persons, however, and discriminate between those who are kind to them and those who are not; but these are mere animal propensities, found in many animals, and probably existing in all if we could find them out; and therefore they have no more to do with anything like mental reasoning and judgment than is possessed by the mere fact of seeing with an eye, hearing with an ear, resorting to the proper kind of food, or keeping out of the way of danger.

Alexander's Ring-Parakeet (*P. Alexandri*). This is a very beautiful bird, and it bears a royal name, for it is called after no less a personage than the mighty Macedonian himself, who, though he conquered, always conquered with magnanimity, and showed a desire to promote the welfare of man and the kindly treatment of the lower animals: his positive injunctions to his army, that they should injure none of the peacocks or other beautiful birds of India, is a proof that the lessons of Aristotle were not thrown away upon him; and it deserves to be known more generally than it really is, that Alexander did not lose his life by the excess of a banquet at Babylon, as the vulgar story has it; but that he lost it in his zeal to obtain a proper drainage of the neighbouring marshes, in order to improve the salubrity of the city, and the navigation of the Euphrates.

This beautiful species is about twenty inches in length, but twelve or fourteen of that are occupied by the tail. The general colour of the upper parts is green, varying in different shades so as to show off the individual feathers; the turns of the wings are bright red, which extends as far as the bastard wing, forming a large and beautiful spot in the middle of the green; the throat in front has a deep black collar which narrows toward the nape, and under it there is a collar of brilliant red, advancing forward nearly to the throat on each side, but not meeting; the bill also is red; the under sides of the wing and tail-feathers, and the tips of the latter, are yellow, and the under part of the bird generally green, but of a much lighter tint than the upper parts. The shape and action of the bird are very graceful, its manners are gentle, it acquires great docility, and articulates well. It is therefore a favourite bird, and there is perhaps not one more so in the parrot family; because, though some of the short-tailed parrots perhaps spe better, none of them is nearly so handsome or gentle in disposition.

At this distance of time, it is not easy to say whi of the Indian parakeets was first introduced into t western world, or whether several species may n have been brought. It is well ascertained that, lo before Alexander's invasion, the Egyptians carri on a considerable commerce with India; and as t Indian birds and other animals appear to have alwa been great favourites in the western world, it is by means improbable that parrots were introduced the way of Egypt even before the invasion of Ind by Sesostris. Though much nearer in geographic situation, the parrots of Asia do not appear to ha been introduced into Europe till some time after t commencement of the Christian era; and we accor ingly do not find any allusions to them in the classic writers, though there are such allusions to the Indi ones. It is worthy of remark, that those handsome a splendid birds have preserved their interest for period of between two thousand and three thousa years, so that they continue to be sought after with much avidity as ever.

There are at least five other parakeets of con nental India, having the two middle feathers of t tail much longer than any of the lateral ones. Th manners, however, so far as they are known in state of nature, are nearly the same, and the ch differences between them are those of size and colou hence we must content ourselves with a mere list them.

Pondicherry Parakeet (*P. Pondicerianus*). As local name implies, this species is found on the Co mandel east of southern India. It is about fourte inches in length; the upper parts are deep gree the quills bordered with yellow on the outer we and with blue on the inner; the larger coverts the wings have blue tips, and the smaller ones y low; the top of the head and the cheeks are p violet or lilac; there are large black mustachies scending from the angles of the gape, and a band black over the eyes; the middle tail-feathers are bl and the lateral ones green with blue tips; the thro fore neck, and breast are bright rose-colour; t under parts are dull green; the bill red at the ba and ash-coloured at the tip, and the feet grey.

Bengal Parakeet (*P. Bengalensis*). This species rather smaller than the former, being about thirte inches in length; the upper parts are yellowish gre the forehead and upper part of the face red; t cheeks and hind head violet, the collar on the ne black, and the hind neck and scapulars bluish gree the bastard wing red, the middle tail-feathers viol blue with pale yellow tips, the lateral ones gre tipped with bright yellow, the under parts of the bo yellowish, the upper mandible whitish, the low brown, and the feet black.

Yellow-ringed Parakeet, (*P. annulatus*,) is rath larger than the former, being fifteen inches in leng It is brilliant green on the upper part, and yellowi green on the under. The head is blue; the forehe cheeks, and throat brownish, marked with a ve distinct yellow collar. The middle tail-feathers a blue, with yellow tips; the bill is yellow, and the fe grey. The female has the head grey mottled wi paler spots. These birds are found in various pa of India.

Yellow-shouldered Parakeet, (*P. xanthonosus*,)

green on the upper part, with the head, neck, and wing-coverts pale greenish blue. The primary quills have black tips. The under parts are of a very clear pale green. The smaller coverts of the wings are yellow; and there is a spot of the same colour on each shoulder. A circle round the eye is rose-colour, the bill red, and the feet black. It is very doubtful whether this species occurs on any part of continental Asia; for the specimens of it which have reached Europe have been brought from the oriental isles.

Double-collared Parakeet (*P. bitorquatus*). There is some doubt about this species also; and some of the authorities speak of it as a native of the Mauritius. But birds and other productions of India and the Indian islands have been so often brought from the isles on the east of Africa, or the Cape of Good Hope, as native productions of these places, that it is very difficult to discover the truth in the case of some of the rarer ones, of which only a specimen or two have been seen. All the upper plumage of this species is deep green; and the throat is black, surrounded by a double collar, the upper portion of which is bright blue, and the under one brilliant rose-colour. The under sides of the wings and tail are olive green, the belly olive brown, the bill red above and brown below, and the feet black. The length is about thirteen inches.

Ring Parakeet (*P. torquatus*). This is another species of which the geographical distribution is not completely decided. Some of the authorities say that it is found in western Africa, as well as in India; but, if it occurs in the former country, it is an anomaly, as all the others which have the middle feathers of the tail much produced belong to the south-east of Asia, or to the islands still to the south and east. The name, ringed, is also inapplicable; because all the parakeets, with long middle feathers in the tail, have more or less of a collar on the neck. The plumage of this one is pale green, with the throat and collar black, bordered with rose-colour on the hind neck; and there is a black streak from the gape to the eye. The quills are deep green on the upper sides, and greyish on the under. The middle tail-feathers are bluish green, and lateral ones yellowish green on the upper sides, but the whole are yellow on the under. The flanks are also yellow, and the bill is red, except the tip of the lower mandible, which is black. The length is about fifteen inches. The females and the young are entirely green, or green with a few partial mottlings of yellow.

Some of the parakeets of this form which occur in the eastern islands and in New Holland differ a little in their general appearance and expression from the Indian ones. Their bills are, generally speaking, more slender, and also their bodies; the middle tail-feathers more produced, and the whole expression softer. We can afford room for only a single species of each, as a specimen.

Molucco Parakeet (*P. Moluccensis*). This light and beautiful species, which is one of the most delicate in appearance of the whole race, is found in the Molucco or Spice Islands, and several adjoining parts of the Oriental Archipelago, though some recent copyists have described it as being a native of Malacca, and so being a town-bred bird, instead of a country one. This would be a curious new fact in natural history; for we are not aware of any one species of bird having its primary origin in a town; and there is very good reason why there should not, because birds were made before towns were built. A cap on the top of the head of this one is shining green. The hind head and neck are violet rose-colour, with a curve of black descending from the base of the lower mandible and turning backward; the back, throat, and breast bright green; the wing-coverts green, with yellowish margins to the feathers; the quills blue at their bases, and blackish toward their extremities; the long tail feathers bright violet blue, the lateral ones yellowish green; the flanks yellowish; the upper mandible red, and the under one of yellowish brown. The length of this species is about seventeen inches, of which the tail occupies considerably more than half. It is a light bird for its lateral dimensions; and its wings are long and powerful for its weight, so that it floats in the air like a meteor. A bird so capable of ranging about is not likely to be confined to any very narrow locality; but probably extends from Sumatra on the west to New Guinea on the east. This bird affords a striking instance of the mischief which is done to the geography of animals by the absurd custom of naming an animal after the particular locality from which the first specimen was obtained, while the animal itself has a much wider range. If we take the Indian Archipelago as extending from Sumatra to New Guinea, the Moluccos are only a few little specks in it; and, though the Dutch are said to have been very successful in extirpating each of the more valuable species from all the islands except one, the parakeets have too much power of themselves in the air for suffering even a "flying Dutchman" to extirpate them from any one island they choose to inhabit; and, therefore, it is highly probable that every species is distributed over a pretty wide extent; and not only so, but it is highly probable that these birds as well as the other forest birds of the same parts of the world, shift their localities with the monsoons.

Swainson's Parakeet (*P. Swainsonii*). This is a very handsome species, a native of New Holland; and it is somewhat different in character from the species of India and the Indian Islands. The most obvious difference is in the tail, of which the two middle feathers are not so much longer than the rest as in the others; while the lateral feathers of the tail have much more tendency to spread. From this structure of the tail, in which the bird makes a slight approach to the broad-tailed parrots of Australia, we would naturally conclude that it alights more frequently on the ground than those of India and the Isles. This is further confirmed by the character of the feet, which have the tarsi longer, and the articulations of the toes with less lateral motion, than those birds which are exclusively perchers and climbers. We are, however, in perfect ignorance as to the habits of the bird; nor do we know exactly to what particular parts of the East it extends. Australia is named as its residence; and certainly the expansile tail and the firm feet would suit it for subsisting in that country, where, at certain seasons of the year at least, even a parakeet must in part seek its food in those farinaceous roots, the tops of which are left leafless above the barren surface during the long and severe drought to which the country is subject. This species is about sixteen inches in length, of which the tail measures nine. The upper mandible is red on the sides, and yellowish in the culmen; and the lower

mandible is brownish. The front is golden yellow, extending upward to nearly the middle of the head. From the gape, over the eyes, and down to the nape, is bright green, which is also the general colour of the body, both on the upper part and the under. The chin, the lower parts of the cheeks, the throat, fore-neck, and sides of the neck, are rich yellow, passing gradually into a collar of dull red. A small portion of the hind head and the outer margins of the quills are blue. The tail differs from the tails of the others, in the form and colouring of the feathers, as well as in the general shape. The whole is green on the upper part; and the two middle feathers are very stout and broad, and only two inches longer than the rest; whereas the Indian ones have those feathers four inches longer, and the islander which we have noticed has them at least six. The tail is also more powerfully fortified by coverts, especially on the upper side, than in the Indian ones, and more especially than those of the isles, which have the base of the tail but little fortified.

There is no doubt that, if the manners of this parakeet could be ascertained by observation, it would be found that its structure agrees with the physical character of its native country. We have, indeed, remarkable instances of coincidences between country and inhabitant, in the parakeets of the three localities. The Oriental Archipelago is to a great extent a perennial garden; New Holland is for great part of the year parched with drought, and it is probable that very large tracts of it are alternately stagnant water and sun-baked mud, impregnated with salt, and incapable of producing any vegetable; and India, taking it in its general character, is intermediate between the two. Now, the parakeet of the isles is all for the wing, and the tail is so feeble that it can serve little purpose save that of a streamer; the Australian one has this organ vigorous, capable of spreading to a considerable extent in the air, and fortified for acting against the air with considerable effect; and the Indian one has an intermediate character. It is to be regretted that there are no data for working out in a satisfactory manner those relations between bird and country; because the birds, of tropical countries especially, are so numerous and beautiful, that if we could but apply them they would form a most delightful index to the general natural history of those countries.

There still remain to be noticed a vast number of parakeets, perhaps not fewer than sixty or seventy species, well made out; and this is a muster-roll which no ordinary reader could be expected to get through. These many writers characterise as the true parakeets. Like the last-mentioned ones, they have the cheeks completely feathered; but their tails are differently constructed. They are, generally speaking, long; but the two middle feathers are not greatly produced beyond the others, neither do they differ from the others in their general structure. The tails are, generally speaking, acutely wedge-shaped; but then, as we proceed from the lateral feathers toward the central ones, the excess in length of each feather beyond the one immediately external of it is almost the same throughout the whole.

There is one circumstance which has tended to render this sub-division of the parakeet so exceedingly confused, that one can with extreme difficulty grope one's way through it; and that is the fact of having placed every member of the parrot family, with a long wedge-shaped tail and feathers on the cheeks, and being rather diminutive in size, within this sub-division. Accordingly we have these parakeets in all parts of the world, though probably many of them ought to rank with some of the other sub-families, or at all events to be formed into distinct genera or sub-genera, in terms of their own specific organisation and habits, and without reference to any gratuitous hypotheses, whether *quinary*, or any other more aberrant from common sense as possible. The characters which we have mentioned, namely, the feathered cheeks, and the long tail greatly but uniformly wedge-shaped, are the only characters which apply to the whole of these, and distinguish them from the others; and they are but scanty foundations upon which to build anything like a natural history of birds so exceedingly numerous, and differing so much from each other in various parts of their individual characters. There is another disadvantage attending the matter, and that is, our comparative ignorance of the habits of these birds. From their structure we are led to conclude that they are, generally speaking, eaters of fruit; but in what they differ from the rest of the family in this respect, and in what particular part of the forest or of the field they have their natural labour assigned to them, we are perfectly ignorant. All that we can do under such circumstances, therefore, is to mention one or two of the species as specimens of the whole, and we shall take them from different countries, remarking, in passing, that by far the greater number of them appear to be natives of Australia, though they Africa are also found in India, in the Oriental Islands, in and its islands, in the tropical parts of the western continent and also in its inter-tropical appendages.

Bordered-wing Parakeet (*P. marginatus*), is a native of India. Its general plumage is green, with a blue band on the top of the head, and blue on the fore part of the body, the feathers externally bordered with yellow. The wing-coverts next the body are blue with yellow borders, the others are green marked with yellow. The quills are brown, marked out with borders of the same colour a good deal paler; and the tail-feathers are green above and yellow below. The bill is red and the feet black.

The species of those wedge-tailed parakeets occurring in the south-eastern parts of Continental Asia are few, compared with those which occur in the eastern Archipelago, and these latter again are few as compared with the Australian ones. Some of them in both countries are very handsome birds.

Flat-tailed Parakeet (*P. platurus*), is one of the species of the Oriental Islands. It is greenish ash-colour on the upper part, and brilliant green on the head and neck, surmounted by a coronet of bluish ash, with a large red spot in front of it, and it has a half collar of orange on the neck. The lesser coverts of the wings are grey, and quills green. The intermediate feathers of the tail are green, and have a portion of the shafts without barbs, and much longer than the other feathers. The under part is yellowish green, and the bill and feet brown. The length is about eleven inches.

Lichtenstein's Parakeet (*P. Lichtensteinii*), is an Indian species of rather portly dimensions, being seventeen inches in length. Its general plumage is green, with the top of the head blue, and the hind part of the neck and belly black. The flanks and tips of the quills are yellow, the bill red, and the feet black.

Latham's Parakeet (*P. Lathami*), is an Australian bird, only eight inches in length. The general plumage is shining green varied with bluish on the head. A small space round the eye, the bastard wing, and the upper coverts of the tail, are red, with bluish borders to the feathers, the under tail coverts are yellow. The greater wing coverts are blue, some of them bordered with white. The under coverts are yellow, the bill and feet are brown.

Many-coloured Parakeet (*P. multicolor*), is also an Australian species, about eleven inches in length. The upper parts are green, passing into olive on the back. The front is yellow, the middle of the cheeks red, the shoulders orange, and the bastard wing and under coverts of the wings blue. The quills are black, with blue at their outer margins. The tail feathers green, variegated with bright blue and black, the belly is reddish yellow, and the bill and feet ash-colour.

New Zealand Parakeet (*P. Novæ Zelandiæ*), is green on the upper part, and the same on the under, but a shade lighter. The crown of the head, the eye-spots and the sides of the rump are red. The quills are blue on their external edges. The length about nine or ten inches.

Such are a few of the wedge-tailed parakeets by way of specimens; and though we were to go through the whole of the long list, we should be able to give but little information further than an enumeration of mere varieties of colour. From the structure of their wings and tail, and the comparative lightness yet firmness of their bodies, we have every reason to believe that these are birds which act their part in nature with no inconsiderable energy. In point of disposition they appear to be intermediate between the macaw parakeets, and that subdivision of the eastern parakeets which have the produced feathers in the tail; being less wild and fierce than the former, and less gentle than the latter. They are not birds of much resource, neither are they capable of much education. We are but little acquainted with the use of them in wild nature, but from their numbers and their general distribution, we must presume that their use is considerable.

Parrots.—The parrots, properly so called, are in some respects the most interesting birds of the whole family. They are by no means the handsomest, either in their forms or in the colours of their plumage. They are, however, the most dexterous climbers, and some of them at least are the most susceptible of being taught to articulate words. The general characters which distinguish them from the rest of the family are but few in number, but they are well marked and easily observed. They have the tail short and squared over at the extremity; the bill very stout, and greatly hooked in the upper mandible; the face entirely covered with feathers, and the body thick and strong, and very muscular. Their tarsi are short but stout, and they have great action with the toes as well as with the bill. There is much oblique motion at the articulation of the toes, so that the foot can be turned almost directly outwards, and for this reason they are but ill adapted for walking on the ground, but their climbing is very dexterous and amusing. They are, properly speaking, tree birds, and use their wings much more in leaping from branch to branch, when the distance is too great for the stretch of their bill and feet, than they do in flying far distances; but they can fly when necessary, though not very rapidly, or very far upon a stretch. Among the branches of the trees their wings are very clever, and ready to act in a comparatively small space. Their plumage is of an exceedingly firm texture and difficult to be ruffled; and the feathers of the neck are also firm and closely individually rounded off at their extremities, and overlaying each other like distinct scales. This structure of plumage adapts them well for scrambling over among the leaves and twigs of trees, where they have their constant habitation, and find the greater part of their food. As is the case with the members of some others of the subdivisions, the parrots are but ill defined. The greater number of them are natives of tropical America, where the trees furnish them with an ample supply of food. There is one, however, which is a native of Africa, though there are some distinctions between it and the American ones, in the air of the body, the form of the bill and head, a certain portion of the face being naked, the general tint of the plumage, and several other characteristics. Of the species enumerated in many of the catalogues, some are doubtful, and others belong to different sections of the family. On this account and also in order to keep our notice within limits as moderate as possible, we shall advert only to two or three of the leading ones; and as most people are familiar with them, even they will not require much notice.

Common Grey Parrot (*P. erythacus*). This bird has but little to boast of the gaudiness of its plumage being clad in sober grey with the exception of the tail feathers which are red; but still it is the parrot *par excellence* with those who are fond of the loquacity of these birds after they have been taught to speak. The whole plumage is soft ashen-grey, approaching to smoke colour, with the exception of the tail which is red, and sometimes brownish, the belly which is whitish, and the tips of the quills which are blackish; the naked space around and in front of the eye is whitish, and appears to be covered with a scaly powder, which the bird is very fond of having disturbed by gentle scratching; the bill and feet are black or blackish, contrasting pretty strongly with the sober colour of the general plumage. This bird, however, differs from all the American ones, which ought perhaps to be considered as the typical parrots, and also from the greater number, if not the whole, of the short-tailed birds of the parrot family, which are found in the eastern countries, in not having the slightest trace of green, or indeed any tendency to green, in its plumage. Some specimens have part of the feathers brownish, and others have them inclining to red; but we believe that no instance has occurred in which any trace of green, of blue, or of yellow, has appeared upon them. If difference of appearance, difference of colour, difference in the shape of the body, and of the head and bill, are to be considered a sufficient ground of generic distinction; then it is clear that this bird ought not to be placed in the same genus with the green parrots of South America. It is a native of western Africa, where it inhabits the thick forests in the richer parts of the country, and is understood to subsist entirely on wild fruits. Its manners in a state of nature are but little known, as is the case with every bird of the tropical forests. It is understood, however, to nestle in the holes of decayed trees, and seek no materials for its nest except the powder into which the wood has been reduced by the progress of natural decay, or the ravages of the wood-devouring insects. We are not sure that this part of its economy has been much observed in the

wild state, even by the natives of those districts in which it abounds; but the nesting place, and materials which it has selected in confinement, afford a sort of proof that the dust of the decayed trees is the only substance on which the eggs are deposited. The bird is of very gentle disposition, easily tamed, and by no means impatient of captivity; and, like other birds which are not over excited in this state, it is sometimes bred. Buffon mentions a pair which for five years successively brought up their young in France; and preferred to every other place a cask partially filled with sawdust, which is as near an approximation to a tree which has been hollowed by the depredations of insects, and only a small portion of the exterior left sound, as can well be supposed. The eggs are described as being four in number, of a white colour, and about the size of those of a pigeon. One of the smallest-sized pigeons is indeed the European bird which is most nearly equal in bulk to the grey parrot.

The bill of this parrot, though differently formed from the bills of the American parrots, is an exceedingly powerful instrument. In the course of this work we have had occasion to remark again and again, that dark-coloured bills and claws are always the most firm and compact in their structure; and the strength of the grey parrot's bill is a practical proof of this. It is true that it is not quite so mischievous in the use of its bill as the green parrot; but the bill is a very efficient feeding instrument. The internal part of the hook of the upper mandible is very much roughened; and the ridges on the interior part of the palate, which occurs in all the nut-cracking parrots, are very firm, so that the bird can use the bill very readily in breaking the hardest shell of a fruit which the gape will admit within it. The foot, too, is capable of being used partially as a hand; and the bird can support itself upon one foot, while the bill and the other foot are jointly engaged in preparing the food. The bill indeed in this, and in several others of the species, partakes something of the nature of a pair of grinding jaws; for the food can be worked about in it, and held in its place by the tongue, until it is reduced to small portions. In doing this, however, there is a sort of deficiency in the absence of lips; so that when a parrot has to practise much of its peculiar kind of mastication, a considerable quantity of the food is lost, as the bird is quite incapable of picking up small fragments.

There are various accounts which appear to confirm the fact that this parrot is a very long-lived bird. Instances have been recorded of individuals which have lived in captivity to the age of fifty, of sixty, and even of a hundred years.

Le Vaillant gives an account of one which had lived thirty-two years with a gentleman, after having been previously forty-one years with his uncle, and it came into the possession of the latter as a full-grown bird, though of what age is not known. Altogether, however, it may be presumed that this specimen could not have been less than eighty years old at the time when it was seen by the naturalist. It had then lost its sight, and what may be called its memory; which latter, by the way, is a necessary result of the loss of sight. It was quite lethargic, speaking none and moving little; but it was respected on account of the length of its former services, and it was kept alive by biscuits soaked in Madeira wine. In the days of its prime it had been a prince of parrots, for it was capable of speaking many sentences, calling the servants, fetching a pair of slippers, and performing various other sayings and doings. In the sixtieth year of its confinement, its aptitude appeared to be in a great measure gone; for it not only never afterwards learned to articulate any new phrase, but very speedily forgot those of which it had previously learned the articulation, or jumbled them together in an incoherent manner, the same as is done by human beings when they have fallen into the dotage of old age. Till the sixty-fifth year it continued to moult regularly every year; but at that time the red feathers of the tail were shed, and replaced by yellowish-white feathers, after which the bird moulted no more, but continued in the same identical feathers to the end of its life.

It must not be supposed that this loss of capacity and memory on the part of this parrot was the slightest evidence of anything in the least resembling mind. On the contrary, they serve to reprove us for an inaccurate expression which we sometimes apply to human beings, when the display of the mind is rendered less conspicuous by the decay of the body. We are accustomed to say, in the case of such a person, "the mind is gone;" but nothing can be more erroneous. From its very nature the mind cannot undergo decay, and as the physical body is the instrument by means of which the mind takes cognisance of the physical world, it is quite evident that the mind must be controlled by its medium of perception; and that which we call a derangement of the mind, is, in reality, a derangement of the body, whether the derangemen tbelongs to the class of madness or of dotage.

The grey or ash-coloured parrot not only learns to articulate clearly, and to whistle tunes with great accuracy both of tone and of time, but it is capable of playing a number of tricks which show considerable skill, though by no means equal to those performed by a well-trained dog. We can only afford room for a sentence or two more on the manners of this highly-interesting bird; and we shall give these in a quotation from Buffon. A grey parrot "being instructed on its voyage by an old sailor, had acquired his harsh hoarse voice so perfectly, that it was often mistaken for him. Though it was afterwards given to a young person, and no longer heard the voice, it never forgot the lessons of its old master, and it was exceedingly amusing to hear it pass from a soft pleasing voice to its old hoarse sea tone. This bird has not only a great facility in imitating the voice of man, but it also seems to have a wish to do so; and this wish is shown in its great attention, the efforts which it makes to repeat the sounds it hears, and its constant repetition of them; for it incessantly repeats any words which it has just learned, and endeavours to make its voice heard above every other. One is often surprised to hear it say words and make sounds which no one had taught it, and to which it was not suspected to have listened. It seemed to practise its lesson every day till night, beginning again on the next morning. It is while young that it shows this great facility in learning; its memory is then better, and the bird is altogether more intelligent and docile. This memory is sometimes very astonishing, as in a parrot which, as Rodiginus tells, a cardinal bought for one hundred crowns of gold, because it could repeat correctly the Apostle's creed; and M. de la Borde tells us of another which served as chaplain to the vessel, reciting the prayer to the sailors, and afterwards repeating the rosary."

It is probable that there are many varieties of this species of parrot in size as well as in colour, and they appear to be very abundant in the forests of the richer parts of western Africa.

Common Green Parrot (*P. Amazonius*). This is the favourite thick-bodied and short-tailed parrot of South America: but it should seem that there are many more varieties of it than there even are of the grey parrot. The colours of the one in greatest request are as follow: the bill blackish, the irides yellow, the forehead bluish; the head and throat yellow, but with bluish margins to the feathers; the general plumage bright green, inclining to yellowish on the back and the middle of the belly; the bastard wing red, the quills more or less mottled with green, black, red, and yellow, and the tail of nearly the same colours. It is, however, subject to great varieties of colour, some being almost entirely yellow, some brownish, and some yellow with red margins to the feathers. It is not very well ascertained which of the varieties is most remarkable for its colloquial powers, but the green one is the one which is most frequently seen in Europe, and it is one of the most easily procured of all the parrots. It is rather docile, and not difficult to be taught to articulate; but it is rather mischievous in the use of its bill in pulling its cage to pieces, destroying furniture, and performing various other mischievous operations. The parrot which we mentioned in a former part of this article, as piping the boatswain's whistle, and giving the word of command, belonged to one of the varieties of this species.

Green parrots of this species, or of others nearly resembling it, are found in vast numbers in tropical America, and especially in the rich woods which fringe the valley of the Amazon. They generally congregate near the margin of the waters, and lodge in the mangroves and other aquatic trees, where food for them is to to be had at all seasons. They are much less frequently on the wing than the maccaws and other long-tailed races; but they sometimes make their appearance on plantations near the woods, where they commit very serious depredations by mangling and destroying ten times the quantity that they eat. In a state of nature they are strictly vegetable feeders; but when kept in confinement and treated artificially, they show a partiality for animal food. Such food, however, if taken in any quantity, does not agree with them, it stimulates their digestive organs too much, and thereby injures their health. This is the case with all animals which naturally feed upon vegetables; and we believe that the converse holds good, and that vegetable food injures an animal naturally carnivorous, by stimulating its digestive organs too little.

The chief disease, however, to which these and all the other habitually climbing parrots are most subject, when most closely confined in cages, is a sort of gouty affection of the feet, obviously arising from too little exercise being afforded for organs which nature formed for very constant and very laborious action. When one of those parrots is described, all may be said to be described, with the exception of mere size and colour; but still we shall give a very brief notice of another one.

Festive Parrot (*P. festivus*). This is an inhabitant of the same country with the common green parrot; but it differs so much, that it is well entitled to rank as a distinct species. It is larger than the other, measuring about fifteen inches. Like that, it is a green parrot, but the green is generally clouded with white, and there are other differences. The bill inclines more inwards at the tip of the lower mandible, and it is flesh-coloured; the nostrils are very conspicuous, placed in a cere at the base of the bill; a red streak extends from the nostril to the eye, and a very narrow one across the forehead, just above the cere; over and behind the eyes the feathers are glossed with bright azure; the external webs of the quills are deep blue, and the lower part of the back and rump are dark red; the tail is the same colour as the body, except the margins of the external feathers, which are blue, and a red spot near the base of each feather, except the two middle ones. When we speak of the tail of a parrot being squared over all that is meant is, that the feathers are of equal length, for each individual feather in the tail and the wings, and their coverts, has its tip rounded off, and a firm and well-defined outline; and the clothing-feathers generally have their terminations flat circles. It is this peculiar form of the feathers which prevents them from being ruffled while the birds scramble about among the branches in the performance of their natural avocations. All those South American parrots are understood to nestle in the holes of trees and to produce four white eggs in each hatch. The young, when they first break the shell, are white callow, and naked, and they are first covered with down before their plumage begins to appear. The parent birds, therefore, require to feed them for a considerable time, and they do this with great assiduity and attention. The pair have also a strong attachment for each other, independently of the mere fact of pairing; and, indeed, parrots of all kinds are remarkably attached to their own species. It is this attachment which is the foundation of such teaching as they admit of; because those who attempt to teach parrots to articulate words, or to do anything else, always begin by endeavouring to gain their favour.

The anecdotes which are told of these birds are very numerous, and some of them have the appearance of being rather wonderful, but they are all easily explainable on the principle of common animal conduct without the slightest reference to the possession of reason or intellect. We shall not repeat any of the anecdotes, but proceed to another section of the family; remarking, as we pass, that there are several genera of short-tailed birds, approaching the parrots in size and resembling them in manners, which authors have described as different genera, if not groups, though it is not easy to arrange them in a manner quite satisfactory. We shall just mention one or two, which are so differently named and classed by different authors.

Grand Lory of Latham (*P. grandis*, Kühl). This is a bird of the eastern islands, and though not perhaps entitled, in strict propriety, to hold a place in the same genus with the parrots of Africa or of America, it is still more of a parrot than a lory, having the powerful bill and the fruit-eating habit of the former. No doubt it is a red bird, and the lories are, generally speaking, red; but colour is only a trivial circumstance. The bill and feet are black, the upper mandible of the former arched and rounded in the culmen; the nostrils are hidden by the feathers at the base of the bill; the irides are yellow, and the cheeks completely feathered; the head and upper neck are rich crimson; the lower neck behind, the scapulars, the back, and the coverts of the wings and

tail, are scarlet, but with a dash of purple; the bastard wing and the primary quills are bright violet blue, the coverts of the latter being tipped with yellow, which is also the colour of the lower side and coverts of the tail; the fore neck, breast, and anterior part of the body, are clear lilac purple; the length of the bird, when full grown, is about fourteen inches, which makes it about the average size of the green parrots of South America, but it is a much more splendid bird in its colours. The young have the red parts mottled with green, which mottlings disappear as the birds approach to maturity.

Various other minor distinctions are made—such as the absence of the projecting angle or tooth on each side of the upper mandible, or the tail still shorter than it is in the typical parrots, and not reaching so far as the closed wings. The absence of the tooth denotes a bird living upon rather softer food, or, at all events, food in softer envelopes than that of the species which have the tooth; just as the carrion-feeding vultures have no tooth in their bills, while the falcons, which kill their prey, and eat it as soon as killed, always have the bill toothed. The short tail would seem to indicate a bird less disposed to ascending and descending than those which have the tail more produced; and the birds which have this structure are generally of powerful wing and lofty flight. We shall notice one as a specimen.

Robart Parrot—Latham (*P. Le Vaillantii*). This is an African species, and appears to be a migrant bird. It occurs on the eastern side of Africa nearly as high as the Cape, but we believe not in the vicinity of Cape Town. The ground upon which it is principally found is a wild country, subject to very heavy rains at one season of the year, and scorching drought at another. The naturalist after whom it has been named was its original discoverer, and he has given an account of its manners. It comes into those high latitudes of Southern Africa, during the warm and dry season, in large flocks; and appears to move northward, nearer to the equator, when the rains, and the evaporation thence arising, have reduced the temperature of the mountain forests. On their passages these birds fly at a great height, but are very clamorous withal in their flight, as is the case with all the discursive species of the parrot family. The screams which they then utter are their call-notes, and, like the rest, they appear to be social birds, and much attached to each other. They migrate southward for the purpose of rearing their broods; and, though each pair seek their own hollow tree for this purpose, a sort of intercourse is kept up among the whole. They are laborious birds, and regular withal in the distribution of their time. As soon as the sun rises they assemble on the tops of the trees, and spread themselves out to the morning sun for the purpose of evaporating the dews of night from their plumage. When this is done, they proceed in quest of their food, which is wild stone-fruit, of which they eat the kernel only. They continue at this feeding till about eleven o'clock, and then they resort to the waters, from which they are never very far distant, in order to enjoy the luxury of a bathe. This being done, they betake themselves to the close shade of the trees, in order to take their *seista*, during the heat of the day, which they enjoy with the utmost silence: but, though they are silent, they are watchful; for if the report of a musket, or any other loud and unusual sound, is heard, the whole are very speedily on the wing; and though, previous to the report, one would not suspect a single bird to be present in the trees, yet, the instant that it is heard, they rise in such numbers as to fill the air; screaming in loud and harsh tones, and flying with great rapidity. If undisturbed, they remain quiet during the mid-day, but come out again in the evening for the purpose of going in quest of their second meal, for they appear to take two regular meals in the course of the day. On their feeding excursions, and also at their morning bathe, they are usually in rather small parties; but, when supper is over, they assemble in much greater numbers, and proceed to bathe again. On their evening assemblings they appear all glee and hilarity, and literally exhaust the echoes with their screaming. Then, when they proceed to the pools and streams—to the pools especially, for few streams run in Southern Africa during the dry season—they tumble and sport about at the edge of the water, and splash and play in a very animated manner. When this assembly breaks up, the pairs proceed together, and every pair to their own hollow tree for the night; but they assemble again at sunrise, and the occupations of one day are simply a repetition of those of another. From this account which Le Vaillant gives of their daily occupations—and we should suppose that there is no reason to doubt his veracity—it is probable that those birds which breed during the dry season, in countries where the season is very dry, do not require to sit upon their eggs during the day, though they must do so during the night, in order to protect them from the dews, which form so heavily in those countries, and occasion such a reduction of temperature during the night. Upon turning to the article Ostrich, the reader will find some remarks on the incubation of those birds which deposit their eggs in the free air on the naked sand; and it is not a little satisfactory to learn, that birds which build in the holes of trees, in countries having the same character of seasons, follow a practice nearly similar. These birds agree with the typical parrots in laying four white eggs about the size of those of pigeons, and both the male and the female are equally attentive to the nest. The young, on their first appearance, are quite naked, but they speedily receive a covering of greyish-coloured down, though six weeks elapse before they are in plumage. During all this time the old birds feed them with great assiduity, and appear to have the greatest affection for them.

These are highly interesting birds, from the regularity of their manners; but the colours of their plumage are not very striking. The head, the neck, and the breast, are dull olive green, darker on the upper part of the head, and marked by a black streak from the gape to the eye; the lower neck, the scapulars, and the coverts of the wings, are brownish-black, with green borders to the feathers; the rump, the belly, and the tail-coverts, both upper and under, are bright green; the turns of the wings, and the feathers on the tibiæ, are bright reddish-orange; the quills and tail-feathers are brownish-black, glossed with green; and the naked parts of the feet and toes are grey. The active and regular habits of these birds give them a higher degree of interest than is possessed by those species which are habitually found in the same trees; and it would be very desirable to know to what regions they migrate when they quit Southern Africa during the rainy season. Unfortunately, however, we have no information upon

this point; neither are we well informed as to the conduct of the birds in a state of domestication.

The next subdivision of short-tailed parrots to which we have to advert, consists of birds of very small size, but of great beauty and elegance. Systematic writers have bestowed upon them the generic or subgeneric name of *Agapornis*, the literal translation of which, "love-birds," is their common English name. They are not numerous in species, at least as hitherto discovered; and, altogether, they are rather rare birds, though we believe some of them are, or at all events lately were, in the collection of the London Zoological Society at the Regent's Park. But it is to be regretted that, notwithstanding all their zeal and all their science, the managers of that society have placed their splendid collection of live animals in one of the very worst situations for natives of tropical countries, whether birds or beasts, that could possibly have been selected. Their gardens are on a most retentive part of the London clay; and hence the climate is more trying to the constitutions of animals of dry and warm countries than if the gardens had been situated in Orkney. The matter is now beyond cure, however, because the gardens are established, and yield a profit as a mercantile speculation, which the author of this article believes was the first object in their establishment, notwithstanding the pain, disease, and death, which the damp and chilling atmosphere over the clay inflicts upon the unfortunate captives. *En passant*, we may perhaps be allowed to remark, that here is a strong feeling of the merchant running through all those establishments in the British metropolis, which profess to have for their object the advancement of science, and which furnish specimens of nature, or gimcracks in art, to feast the eyes of the wondering multitude. The pretended science may be zoology, or anything else; but the real and substantial end is that of obtaining from the visiters as many shillings as possible. This is a disgrace to science and a shame to England; and every man who loves knowledge, and the honour of his country, should assist in setting the brand of infamy upon it, and putting it down. But we must leave this most unlovely subject, and advert for a little to the love-birds.

We shall only notice two species, and they are both about the same size, or at least not greatly different from each other; the one is a native of the eastern islands, and the other, we believe, of Africa, the African species being the smaller and handsomer of the two. The one of these is about six inches in length, and the other not more than five. Their forms and their bills are exactly those of the larger parrots; but there is a difference in the texture of the general or clothing plumage of their bodies. The feathers in it are not formed into distinct scales, as they are in the large parrots, but close and resembling smooth and flat fur, like the feathers of other small birds. Their wings are rather short, and not so pointed as the wings of parrots; their tails are also rather short, and round at their extremity, but they are proportionally broad. Little or nothing is known of their habits, though we can infer that they must be very short-flighted birds; while the breadth and power of the tail show that they must have great power of ascending and descending.

Molucca Love-bird (*P. Moluccensis*). Though named after the Molucca group, or indeed after Malacca, by authors, it is probable that this pretty little bird is pretty generally distributed over the Eastern Archipelago, though it is a bird which keeps close in the forests, and is in consequence very seldom seen. We must not wonder at those very small parrots keeping very constantly in the trees; for the very smallest birds of our own country, the *Reguli*, or crested wrens, have the same habit; and so close do they keep to the trees that one species, the red or fiery-crested, was never supposed to be a British bird, until a cat made the discovery some few years ago. The species of love bird in question has the head, rump, and upper tail-coverts blue, and the back blackish grey; the upper wing-coverts are bordered with yellow, and the under sides of the wings are red; the front part of the cheeks and the hind neck are whitish ash, and all the under parts yellowish; the bill is red, and the feet grey. The total length of the bird is six inches.

Van Swindern's Love-bird (*P. Van Swindernianus*). This is the species known by way of eminence as the love-bird. It is an exceedingly beautiful little creature, only about five inches in length, and understood to be a native of Africa; but it is a rare bird, probably from the difficulty of getting a sight of so small a creature in the close foliage of the trees, which foliage it very much resembles in colour. Its head is thick and strong for its size, indicating the presence of powerful muscles for working the bill. The bill is deep chestnut brown inclining to black, and formed for the most powerful action in proportion to its size; the upper mandible is very much arched, and the sharp tip projects far over the extremity of the under one; the upper mandible is strengthened with margins, and, though it is not decidedly toothed, it has a flexure in the outline which amounts nearly to the same thing; the top of the head, the cheeks, and the neck are beautiful green, terminating in a half collar of pure black on the back of the neck, which ends in a point on each side; beneath this there is a collar of greenish yellow, which barely meets behind, but forms a pretty large gorget on the throat and upper part of the breast; the back and wings, and also the under part, are of a pleasant green, though less brilliant than that on the head, and having a slight brownish or purplish tinge on the middle of the back; the quills are black in the middle, with broad green borders; the middle tail feathers are blue; the remaining ones are red at their bases, then crossed by a bar of black, and afterwards dull green at the tips; the rump and upper tail-coverts are bright blue, but when the wings are closed they are scarcely seen; the tarsi and toes are blackish grey, and they are strong for the size of the bird. Nothing has been hitherto observed of the nest of this beautiful little creature, or indeed of any of its domestic habits. From their conduct in a state of captivity, however, it is clearly ascertained, that their attachment to each other is extreme; and it is on this account that they have obtained the name of "love-birds." They are not the only members of the parrot family which evince a strong attachment for each other, for this is shown by many of the other species. But the love-birds are characterised, more strongly perhaps than any of the others, by appearing to live not so much for themselves as for their companions. If two are placed in the same cage, the one of them will not eat, or drink, or bathe, or rest on the perch, or do any one thing, unless the other does the same; and if a portion of even the most favourite food is given to

the one, and none given to the other, that one instantly divides it fairly with its companion. This is a beautiful instinct; and perhaps it is not so strong in any other department of nature, as among the smaller members of the parrot family. In many animals we find other instincts, the strength of which we cannot fail to admire; but this is one with which we are not only delighted, but from the example of which we may actually learn to "love one another."

In the southern islands of the Pacific there are some members of the parrot family which retain the general shape of the parrots properly so called, and have the tongue large and fleshy like them, though the bill is differently formed, and the muscles which work it are less powerful. We shall mention only one of these, because much is still wanting before we can correctly determine what difference of habit is associated with the different structure of their most important organ, the bill.

Nestor (*P. Nestor*). This bird is a native of New Zealand; and it is almost as anomalous in the parrot family as some others of the New Zealand birds are in the families to which they are most nearly allied. It may possibly exist in Australia, and in some of the adjoining islands, but in the meantime we must consider it as a museum bird. Its general plumage is sombre compared with that o the parrots. Its head is more slender, its bill more elongated, and the upper mandible straighter; but it is about the size of the larger parrots, and in the character of the feathers it is dressed in a parrot's plumage. It is about fifteen inches in length; and the general colour of the plumage is reddish, passing into bronze in some parts, and into yellow or orange in others. The bill is lengthened, the upper mandible compressed and hooked at the tip, furrowed on the under side to receive the lap of the under mandible, which is compressed and but slightly convex in its outline. The wings are both long and broad; and the tail is of mean length, strongly fortified by coverts, square at the end, and having the points of the shafts of the feathers extending a little beyond the webs. The bill is brownish grey, with the tip of the upper mandible dusky; the front and top of the head are mottled with greyish white in different shades, with a trace of green; the cheeks and upper sides of the neck are yellow and red, and the feathers small and loose; the remainder of the neck and the under parts are dull red, with brownish green margins to the feathers; the upper and under coverts of the tail are deep red, and the wings and tail feathers are brownish green. Inhabiting a colder latitude than the typical parrots, this bird is less brilliant and more mottled in its plumage; but little or nothing is known of its habits.

All the varieties hitherto enumerated have the bill and tongue so formed as that they can subsist chiefly upon fruits, though it is probable that the last-mentioned one lives in great part upon farinaceous roots. There still remain a sort of two sections of the family which have the bill constructed for this purpose, but which differ from all those already mentioned in other particulars. They are chiefly natives of Australia, though some have been observed in the islands farther to the north and east. The most strikingly beautiful and characteristic section are,

Cockatoos. These are very handsome birds, elegant in the form of their bodies, and with beautiful crests, which they can erect or depress at pleasure. They are also birds of very gentle disposition, easily tamed, very susceptible to kindness, capable of a good deal of obedience, and not so prone to gnaw and do mischief as the macaw and parrots. They are not, however, capable of learning to articulate words with any thing like perfection, or even at all in most of the species, though they enunciate very distinctly the word "cockatoo," which has been adopted as their general name. There are as many known species of them as eleven or twelve; but we must content ourselves with a mere notice of one or two.

Great White Cockatoo (*P. cristatus*). This is a large and handsome bird, seventeen inches in length, and nearly as heavy as a common fowl. Its general plumage is white, except the primary quills and the outer feathers of the tail, which are sulphur-yellow on the middle of their inner webs. The bill is blackish, and the cere at the base of it is quite black; the irides are dark brown; the crest is five inches in length. It is a native of the eastern islands, and is often exhibited in Europe, where its manners are amusing, though its articulation is confined to the word already mentioned.

Red-crested Cockatoo (*P. Moluccensis*). This species is the same length with the former, but rather stouter; and it is a particularly handsome bird, though more shy than its congener with the white crest. It can hardly be taught to articulate words, but it imitates very readily the voices of various other animals. Its bill is bluish black, with a black cere; the irides are deep red; and the feet are leaden-grey, with black claws. The general plumage is white, but glossed over with a general blush of rose colour. The tuft, which can be either depressed over the hind head or erected, is very large, the feathers being six inches in length. Some of the feathers are orange on the under sides, and the middle feathers are red. It is a native of the eastern isles as well as the former, but it is a hardy bird, and bears easily the climate of this country.

Banks's Cockatoo (*P. Banksii*). This is a large and very splendid bird, measuring seven and twenty inches in length, though a considerable portion of that is occupied by the tail, which is much longer than in most of the cockatoos. Some authors have made it the type of a separate genus; and it certainly has peculiar characters. The crest, when in a state of repose, lies flat and concealed; and the upper mandible is so much hooked that the tip of it approaches near to the throat, while it is so broad that it almost conceals the under one. The bill is yellowish blue, the feet black, and the irides red. The prevailing colour of the plumage is black; but the cheeks and a portion at the base of the crest are mottled with yellow, and there is a tinge of yellow spotted over the under part. The wings are of the same colour with the general plumage, and so are the two middle feathers of the tail; but the lateral feathers, though blackish at the base and the tips, have the middle crimson, crossed by five or six bars of black. This bird is, however, subject to considerable varieties. It is a native of Australia, where it appears to be rather a rare bird, as but few specimens of it are brought to Europe.

Three-colour-crested Cockatoo (*P.* ———). This is rather a rare bird, but it is one of singular beauty, especially in the crest, which consists of ten principal feathers, five on each side, pointed, and standing apart from each other when erected. It is about eleven or

twelve inches in length. The general colour of the plumage is white, variously shaded with reddish chestnut, which is very deep on the under sides of the wings. The bill and feet are pale grey, and the irides bright reddish brown, showing very conspicuously in the comparatively pale plumage with which the eyes are surrounded. A row of feathers over the base of the upper mandible are scarlet, but the remainder of the plumage on the forehead is of the general colour of the body, the feathers being elongated, and forming a species of coverts over the bases of the principal crest feathers. These crest feathers are first bright brick red, then yellow, then bright red again, and ultimately white for the last half of their length, where they are lancet-shaped. This is an exceedingly handsome species, but unfortunately scarcely any thing is known of its history.

It is generally understood, however, of this and of all the other cockatoos, that they nestle in holes of trees, and have only two eggs in a hatch, which are white without any markings. They are vegetable feeders, and flock together after the young are hatched, at which time they levy pretty severe contributions upon the crops of the colonists inland from Sydney. They are wary birds, and place sentinels, as appears to be the case with all the ranging members of the parrot family; but the colonists shoot the young of various species in great numbers, and hold them in considerable estimation as game. So few particulars are known, however, with regard to the general habits of this interesting division of the parrot family, that there are not materials sufficient for forming even a guess at their use in the economy of nature, or the kinds of localities for which they are peculiarly adapted.

Resembling the cockatoos, in so far as having a crest upon the head, and partially also in the shape of the body, there are one or two species which inhabit the oriental islands, more especially New Guinea. Their habits in a state of nature are little known; but the form of the tongue leads us to conclude that they must be different from those of all the decidedly *frugivorous* members of the parrot family; for all of these have the tongue thick, fleshy, long, and smooth or simple at the extremity. The species to which we now allude have the tongue small, in the form of a little horny gland, surrounded by a sort of capsule, and supported upon a cylindrical peduncle of some length. From this slenderness of the tongue, as compared with the typical parrots, these birds have got the name of *Microglossus*, or little tongue; though what particular purpose this singular form of tongue answers in their economy has not been ascertained. We shall notice only one of them.

Goliath Aratoo (*P. aterrimus*). This is a very large bird, one of the largest, if not the very largest, of all the parrot family; and its aspect is rather repulsive. The general colour is blackish, with a dash of purple toward the head, and of green on the wings. A large space around the eye is covered with a naked skin, wrinkled, and of a red colour; in the midst of which the brownish yellow iris glares out in rather a formidable manner. The head is furnished with a crest of feathers, of slender form, and nearly of the same colour as the body; and these feathers the bird can erect at pleasure, though, when not erected, they give the head a shaggy appearance. This bird has been known for more than a hundred years; but we are still in perfect ignorance as to its manners. We do not even know what it feeds upon; though the great strength of its bill, and the decidedly marked teeth in the upper mandible, lead naturally to the supposition that the work which it performs must be of no ordinary kind.

Though, in common with various others, we have applied the specific epithet, *aterrimus*, or the blackest, to this species, we believe it is not quite correct; for there is one still blacker as to external appearance; and *goliath*, the specific epithet adopted by Kühl, may be better descriptive of this one. The difference in blackness does not, however, arise so much from the tint of the feathers, as from a grey powder which comes out in considerable quantity between the feathers of this one, and gives them a tinge of its own colour. The other is a much smaller kind, not above fourteen inches in length; and the bill and feet are rather paler than in this one. Both appear to be natives of the same countries, and their manners are equally unknown. It is possible that they may be merely varieties, or even the same bird; for it is stated that the skins which are distributed through the different museums of Europe, differ greatly in size, and not a little in the tint of the plumage.

There is another bird, exceedingly little known, and rarely to be met with except in the most extensive collections, which has the general air of a parrot, and a formidable bill, fitted for hard labour; but in its bill and head it differs greatly from all the rest of the parrot family. Wagler has made it the type of a genus, under the name of *Dasyptilus*, in consequence of its head being covered with hairs, rather than with feathers. It is a bird of pretty large dimensions, measuring about twenty inches in length, and being stoutly made. With the exception of the upper part of the neck and the head, the feathers have the character of parrot's feathers; and the feet also are those of a parrot. The bill, however, when seen in profile, appears to be something intermediate between those of a parrot and the beak of a bird of prey. It is of moderate height at the base, and pretty long, the basal part of the upper mandible being straight, though the point curves strongly over the lower one, which is narrow at the tip, with strong margins, and fortified with a keel along the middle. This bill and the shape of the head, together with its being covered with hair, and not feathers, give this bird a more ferocious air than the generality of the parrots; though it is still probable that it is a vegetable feeder. The cheeks and a portion round the eye are brownish ash, and nearly naked, being covered with only a few hairs. Above the eye there is a crimson spot, which is covered by hair, like feathers. The remainder of the head and neck are black, and thinly covered with feathers of the same kind, which do not conceal the skin. The tarsi are strong, but very short; and the toes and claws powerful. The scales on the tarsi are not imbricated, as they are in the majority of birds which live in trees, or on the dry ground; but reticulated, or placed in a net-work of connecting membrane, as they are upon the tarsi of wading birds. This particular covering of the head and upper neck, and of the tarsi, certainly points to some peculiarity in the habits of this bird; but what this peculiarity is it is impossible to say in the present state of our knowledge. The form and shortnessof the tarsi, and the decidedly zygodactylic structure of the feet, are against the idea of the bird being in any respect a

wader. But farther observation must be made, before anything can be known respecting it. It clearly belongs, however, to the strong-billeddivision of the parrot family, and to those whose general habit is climbing. The breast, the upper parts, the wings, and the tail, with the exception of the coverts, are black; and the greater part of the wing coverts, the upper and under coverts of the tail, and the rest of the upper parts, are crimson. The bird is well furnished for flight both in the wings and the tail; and it differs so much from the mere typical parrots, that a knowledge of its habits would be very desirable.

There still remains a beautiful and highly interesting division of the parrot family, more delicate in structure, and also in feeding, than those which have been hitherto mentioned. This division comprises all those birds which are usually known by the name of

Lories. The birds of this division are all natives of the east; and many of them are birds of great beauty and highly interesting manners. They are, however, more delicate in their nature than the maccaws, parakeets, and parrots; and, therefore, though they are abundant in their native countries, there is some difficulty in bringing them alive to Europe; and a good deal of care is necessary in order to keep them alive after they are brought. The name "lory," by which the whole are popularly designated, is, like the word "cockatoo," the call-note of some of the species; though neither the one nor the other is the call-note of all the birds of which it has become the name.

The members of this division are inhabitants of the south-east of Asia, the Oriental Isles, and New Holland; and it has sometimes been proposed to subdivide them into *Lories* and *Lorikeets*—applying the former name to those in which the prevailing colour is red, and the latter to those in which it is green. It does not appear that much distinction of character would follow this distinction of colour; and, therefore, it is of little practical use, though there is a sort of geographical distinction between them; the red ones inhabiting nearer India, and the green and variegated ones more toward Australia, and the remote islands of the Pacific, some of them being found as far to the eastward as the Sandwich Islands.

They are all climbing birds, and have the feet as well adapted for that purpose as any of the parrot family. They differ considerably in their bill, however; and they all, in a great measure, agree with each other in those particulars in which they so differ from the rest. The bill is still much hooked in the upper mandible, and arched in the ridge of the lower one; so that any one who sees it, in any one of the species, would at once pronounce it to be a parrot's bill. It is, however, much smaller and feebler in proportion than the bill of a parrot; and the form of its acting surfaces points it out as adapted for a less severe kind of work. It is never toothed, scarcely ever margined, and the inside of the hook on the upper mandible has not the rough and file-like character of that of the nut-cracking parrots. The strong palatal ridges, which serve as a base of resistance, against which the lower mandible acts when compressing a large nut, are also wanting; and the whole structure of the organ points out that the lories could not by possibility subsist in the same manner as what one may with propriety call the "hard-mouthed parrots." There is a difference also in the tongue. With the exception of the *microglossi*, the precise use of whose very peculiar tongue is, as we have said, not known, the whole of the hard-mouthed parrots, by what name soever they may be called, have the tongue full and smooth at the point, and they use it with great dexterity in keeping the food against those parts of the bill which can divest it of its hard covering. The tongue of the lories, on the other hand, is slender, soft in its consistency, more or less covered with projecting papillæ, and sometimes those papillæ form an absolute brush at its extremity. We find the tongue similar to this in those birds of a different order, which sip or suck the nectar or honey of flowers; and we naturally conclude that such, in part, is the use of this structure of tongues in the lories. The honey of flowers, and the sweet juices of pulpy fruits are the substances upon which the lories feed; and the countries which they inhabit abound greatly in such substances. The mango, the mangosteen, the banana, and a countless number of others, grow in great profusion in forests of the Oriental Isles, and furnish the beautiful birds of this section with an ample supply of food, so that they leave the kernels of fruits to the hard-mouthed tribes, and very rarely, if ever, attempt breaking the shell of a nut. The Australian ones fare somewhat differently for Australia naturally furnishes scarcely one pulpy fruit; and, therefore, the birds of this division, which inhabit there, subsist chiefly upon the nectar of flowers, and have the extremities of their tongues fringed with longer papillæ than the birds of the eastern isles.

The beauty and elegance of this section of the parrot family, their geographical distribution, and the peculiar office which they perform in nature, all tend to give them a high degree of interest; and we regret that the space to which we are restricted will not allow us to enter into the details of their characters, either general or particular. We may hint however, that, in the tails and general forms of the lories, there are resemblances to several of the divisions of those parrots which eat hard fruits. Some of those which have been denominated lorikeets bear a slight resemblance to the maccaw family; others have the tail short and the body thick, more resembling the common parrots; and there are also some which have the body slender, and the two middle feathers of the tail much longer than the others, in the same manner as the arrow-tailed parakeets; nor are there wanting some, which, in size and in the general form of the body, and even in the colours, have no inconsiderable similarity to the "love-birds." Under all those shades of difference among themselves and of agreement with different sections of the nut-breaking and kernel-eating divisions, they are still, however, constant to their essential character, namely, that which determines the nature of their food; and we should, perhaps, make as rational a popular distinction as any, if we considered the birds already described as strong-billed parrots, and the lories and their allied races as weak-billed ones. We must, however, close our general remarks, and proceed to mention a few of the species.

Purple-caped Lory (*P. domicella*). This is a very beautiful bird, one of the most typical of the true lories, or those which have a general resemblance in form to the characteristic short-tailed parrots. There is a wide distinction in the body plumage, however, to which it is desirable, and even necessary, to attend. The plumage of the parrots is all over firm and scaly,

whereas that of the lories is soft and downy, excepting on the wings and their coverts. The clothing plumage of birds is far from the worst index to their general habit. A bird of gentle labour always has the plumage of the soft and downy character, whereas one which has to rough it, whether in field or forest, or in the sky, invariably has the individual feathers firmly set. This bird is a native of the eastern islands, of which it is one of the principal winged ornaments. Its size is about the same as that of the grey parrot, namely, between ten and eleven inches in length. The bill, which is not very large, and has no notch in the upper mandible, is yellowish orange, with a blackish cere at the base, in which the nostrils are pierced; the feet are dark grey, and the claws black. The head is flat on the crown, and occupied as far as the eyes, but not over them, by the cap. This cap is very dark purple at the base of the bill; but passes gradually into very delicate violet, as it approaches the back of the head. The general plumage of the body is a very fine red, intermediate between scarlet and crimson, with the exception of a gorget of pale reddish yellow, in the form of a crescent, between the throat and breast; but this gorget is very obscure in some of the specimens. The external margins of the quills and the lesser coverts of the wings are deep blue, passing into sky-blue. The others are yellowish green relieved with lighter. The primary quills are beautiful blue, and the secondaries yellowish green; but, when seen at a little distance, the whole wing has a green appearance, which, being the complemental colour of the red on the body, makes both show off to the greatest possible advantage. The feathers on the tibiæ are sage-green. The tail, which is rather large and firm, has its extremity formed into a very perfect half-oval. The tips of the feathers are reddish orange; within that there is a crescent of deep brown, almost black, and the remaining part of the feathers is nearly the same red as the body, only a little more inclining to purplish brown. The female bird is less in size than the male; the gorget is obscure or wanting; and there is no blue in the wings, except a slight mottling along with green on the margins. Sometimes, however, this species breaks into coloured varieties.

It is one of the best-tempered and most desirable of all the parrot tribe; but it is very delicate, difficult to be brought alive to Europe, and, therefore, scarce as a living bird. It never uses its bill in any work of destruction; and it is remarkably docile, and highly susceptible of every species of kindly attention. "Lory" is its habitual cry, in the use of which it is by no means sparing; and it also articulates tolerably well, though in a hollow voice; but it whistles with great clearness, and very readily acquires a knowledge of any tune. As its voice, though very incessant, is not so loud as that of the parrot, it is a very desirable bird for those who are fond of amusing themselves with such creatures; but, in consequence of its delicacy, it is high priced, and a good deal of care is necessary in order to keep it alive in European climates.

Ceram Lory (*P. garrulus*). It is probable that this species obtains its trivial name from having been first brought from the island of Ceram. It is not, however, confined to that island; for it is found in others of the Molucco group, and probably through the Oriental Islands. In size it very much resembles the species last mentioned, namely, that of a common pigeon; and its manners and delicacy of constitution are nearly the same. It is, however, subject to very considerable varieties of colour, on which account it is in danger of being described as several species. The following are the colours which most frequently occur: the bill orange, the cere and naked circle round the eyes grey, the irides deep yellow, and the feet brown. The clothing plumage is bright red; but the lesser coverts of the wings are mottled with green and yellow. The primary quills are deep green on the outer webs, red on the inner webs, and grey at the tips. The two centre feathers of the tail have three colours: brown at the base, red in the middle, and green at the tips. The next pair have more than half the length from the base red, and the remainder green; and the four external ones, on each side, are red at their bases, violet in the middle, and green at the tips. Except in colour, this bird resembles the former species very nearly; and its disposition is also very much the same.

Black-caped Lory (*P. Lory*). This species has usually been brought from a more northerly latitude than either of the two preceding ones, namely, from the Philippine Islands; but whether it is merely a climatal variety of the purple-cap, or a distinct species, has not been very clearly ascertained. In Europe it is a very rare bird, and is on that account highly prized; but its disposition and manners do not appear to be either better or worse than those which we have already mentioned. Its colours are, however, different from either of these; and, though they are subject to some variety in different species, the following may be taken as the most common: the bill and irides orange, and the cere and circle round the eyes dark flesh colour; the feet black, and the cap on the head bluish black; the general plumage of the body scarlet, but with a blue spot at the setting on of the neck, and another at the lower part of the breast. The general colour of the upper surface of the wings is green; but the inner webs of the quills are yellow, passing into dark brown toward the tips; and some of the secondary quills have yellow margins to both webs. The under coverts of the wings are red. The tail is blue on the upper side, with the exception of the two middle feathers, which are dark green; and the under side of the tail is yellowish. The feathers on the tibiæ and those on the under parts, backwards, are bright blue. The colours of this bird are remarkably beautiful; but we know nothing of its manners farther than we do of those of the section generally.

Papuan Lory (*P. Papuensis*). This is one of the most elegant birds of the whole parrot tribe, both in the form and in the colours of its plumage. In the structure of the bill and tongue, and also in the general red colour of the clothing plumage of its body, it resembles the lories to which we have already alluded; but the form of the body is much more elegant, and the tail is particularly handsome. The whole length is nearly eighteen inches, of which the two middle feathers of the tail measure about twelve, leaving not more than six for the length of the body. Those long feathers are narrow, and rounded at their tips; and the remaining feathers of the tail, five on each side, are so graduated, as, with the exception of the two long ones, to make the outline of the extremity of the tail but very elongated half-oval. The longest of these feathers are not above one-third the length of the two middle ones; and the lateral ones

are about two-thirds the length of those nearest the middle ones. They are all rather broad, very firm in their texture, and very firm at their terminations. The two middle ones are delicate grass green for nearly two-thirds of their length from the base, and delicate yellow for the remaining part. The lateral feathers are darker green, for about the half of their length, and deep saffron yellow for the other half. Taken altogether, the tail is one of the most beautiful appendages to be met with in the whole of the feathered race. The general plumage of the body is a very brilliant, though rather deep, red; but it is variegated by markings of brilliant azure. Of this colour there is one well-marked spot upon the hind part of the head, reaching nearly from eye to eye; and another on the nape. These two spots are rendered still more brilliant by each of them having a margin of deep purple, inclining to black. The lower part of the back, the rump, and also the feathers upon the tibiæ, are also azure; and in some species there is a little white or yellow below the turn of the wing. The wings are green, passing into darker on the inner webs of the primary quills, which are almost black. The bill is reddish orange, with the tip of the upper mandible extending far over that of the under one; but it is a light and delicate bill, and the projecting tip is not nearly so much hooked as in the parrots. This is indeed one of the most beautiful of birds, in every point of view in which it can be taken. It is a native of that country which is the grand head-quarters of the birds of paradise, and which is perhaps richer in its ornithology, and also in its vegetable productions, than almost any other country on the face of the earth. It is, therefore, seriously to be regretted that the character of its inhabitants is such, that no naturalist can explore it, or even venture to land upon it, without almost the certainty of being murdered. This is the more to be regretted, because it occupies a very peculiar situation on the globe. Its coasts are not yet wholly discovered: but enough has been observed to show that it is an island, or islands (for the fact of its being or not being intersected by the sea has not been ascertained), of large dimensions. It meets the regular wind and current of the Pacific from the east, and also the current which is turned north-eastward by the great coral reefs which stretch away to the south. The means of fertility are thus concentrated upon it; and there is no question, that, were there any means whereby it could be opened to scientific investigation, New Guinea would more richly repay the labour than any other spot on the face of the earth. It is especially remarkable as a station in the annual movements of a vast number of exceedingly splendid birds, which move in countless multitudes between it and the lands to the north and west, at one season of the year; and between it and the fertile spots on the east coast of New Holland, in another. It is highly probable, that, besides the species which we have just mentioned, this island may contain various other species of lories equally splendid; and until favourable circumstances arise, under which its natural history can be explored, the eyes of naturalists, and especially of ornithologists, will be directed towards it in the most anxious manner.

We must now direct our attention farther to the south and to the east—to New Holland, and to the remoter isles of the Pacific, where succulent fruits are not so abundant as they are in the native localities of the red lories, a few of which we have enumerat and where, in consequence, birds of this section m be adapted for finding a different sort of food.

It is here that we meet with those beautiful bi of very varied plumage, still resembling the lori properly so called, in the general form of the bill, having the tongue differently constructed. In lories the papillæ on that organ are short and so but in the birds now to be considered they are considerable length, drawn out like firm and elas ends of thread, and sometimes forming a tuft rou the extremity of the tongue like a little cylindri brush. On this account some have regarded th birds as a distinct genus from the lories, and appl to them the generic name of *Trichoglossi*, or "fibr tongues;" but this is perhaps a refinement in s tematic arrangement which is of small value in popular point of view.

If these birds are to be taken as a genus, they m be characterised as follows:—The bill smaller proportion than in any others of the parrot fam compressed laterally, weak in its structure, and w but a slight convexity in the lower mandible, thou in some species the tip of the upper one extend considerable way over it; the margins of both m dibles are in every instance thin and smooth, with any tooth, or other armature, by means of which birds could break a hard or a tough substance; wings are of moderate length, narrow and very mu pointed, the first quill in each being the longest; the webs of all the quills are very firm and entire, that the wings are powerful ones, and far more rea than if they were of larger dimensions; the tarsi short and stout, and feathered a little beyond th articulation with the tibiæ, affording protection to muscles and their tendons; the toes are also lar offering a broad base for rest; and the claws sharp, strong, and crooked; the tail, in most of species at least, is long, very strong at its inserti and generally tapering nearly to a point. Altogeth the birds are remarkable for the compactness of th forms, and they are by no means inferior in beauty of their plumage. Their food, in great pa consists of the honey which they extract from nectaries of flowers by means of the fringed app dages to their tongues; and their subsisting upo food so light, and obtained in such small quant from any individual flower, requires the laborious of their very neat and clever organs of flight. If are to compare the tender-billed members of parrot family with those which have the bills rob and fitted for severe labour, we should be inclined say that there is the same resemblance between th birds and the parakeets, which have not the mid feathers of the tail produced, as there is between short-tailed lories and the parrots properly so call Some have gone a great deal farther than this, a in the visions of the night of their own nonsense, ha seen representations of all the birds under the canc of heaven in the different varieties of the par families; but the gentlest appellations which can applied to such pretended discoveries is, that th are gratuitous nonsense. We shall now advert one or two of the species, and we shall use the wo lorikeet as the general English name.

Blue-bellied Lorikeet (*J. hæmatodus*). This is Australian species, and an exceedingly beautiful a characteristic one. It is not a very large bird, be only thirteen inches in length, of which the

occupies only a half; but the head, body, tail, and wings, are well proportioned; and it is a remarkably pleasing bird to look at. In the living bird, the bill, which is rather small and handsome, is of a rich golden yellow, but, as is very apt to be the case with bills, it fades to a much duller colour after the bird is dead; the feathers on the head and throat are stiff and awl-shaped, and of a fine purplish blue, which changes its colours as the light falls differently upon it; on the throat the feathers lose their pointed character, and on the breast their terminations are flat curves; the lower part of the neck and the breast are deep red, passing into rich yellow toward the shoulders; the middle of the belly is rich purple, and the feathers toward the sides deep red, bordered with bright green; the feathers on the legs are bright red, and the under tail-coverts are red at the base, yellow at the middle, and green at the tips; the under sides of the wings are also red; the upper plumage is bright green in its general tint, but the feathers on the lower neck are red at the bases and yellow at the tips; above these there is a demi-collar, more or less distinct, sometimes pure yellow and sometimes inclining to green; four feathers in the middle of the tail are entirely green, and the remaining ones have their inner webs yellow, the portion of yellow increasing as the sides are approached; the quills are dusky green on their inner webs, and each is marked by a yellow spot. These very beautiful birds are natives of Australia, where they sip the honey from the flowers of various species of eucalyptous trees, which are very common in the forests there. It does not appear that they eat kernels of any kind, or do the smallest harm to the plantations of the colonists; and as they are quite harmless in wild nature, so they will not live for any length of time in a state of confinement. The colonists about Sydney have been remarkably successful in cutting down the forests of eucalyptus, and, by necessary consequence, they have equally thinned the numbers of these beautiful birds.

Parti-coloured Lorikeet (*T. versicolor*). This is another handsome Australian species, but it would seem that the vocabulary was exhausted before it got its name, as its plumage is much less diversified than that of the preceding one. The bill and top of the head in this one are red; the throat, and a brush of pointed feathers behind the eye, yellow; a brush of the same kind of feathers, beginning from the bill to the eye, and extending to the lower neck, are blue; the lower neck and breast are deep but dull red; and all the rest of the plumage is dark green. As is the case with many others of the family, the caterers for museums have got the skin of this bird, and, in their own appropriate language, they have "set it up;" but of its manners nothing is known. The probability, however, is, that, from the similarity of structure between its bill and tongue and those of the last species, it also lives principally upon the honey which it extracts from flowers.

Orange-winged Lorikeet (*T. pyrrhopterus*). This is a small species, not exceeding seven inches and a half in total length, of which between two and three are occupied by the tail; but it is a pretty little bird. The bill is whitish, with a slight tinge of pink, and the upper mandible projects far over the under one, and is very sharp at the tip; and the edges of the bill are more margined than in some of the larger species; there is a white space round the eye, the iris of which is brown; the head is greenish blue, fading into whitish on the upper neck, and again into green, which is the general colour of the body, but the whitish colour makes a sort of holly collar on the neck; the wings are greenish-blue on the under sides, with the exception of the smaller coverts there, which are very bright orange, or fire colour; the upper sides of the wings and the tail are green and yellow, and the feet are dull reddish.

This is a very seaward bird, being most plentiful in the Sandwich Islands; and when the late king and queen of those islands came to England, where they unfortunately lost their lives, they brought some of these birds along with them. This gave the zoologists of the day an opportunity of examining the birds, and also of settling their locality, which had at first been erroneously supposed to be South America. "In their manner," says Mr. Vigors, "they are peculiarly interesting. Strongly attached to each other, like the individuals of the small species so well known in our collections, and which we familiarly style *love-birds*, they assert an equal claim to that title, if it is to be considered the reward or the distinctive sign of affection. They will not admit of being separated even for a moment; and, whether in their cage or at liberty, every act and movement of the one has a reference to the acts and movements of the other. They are lively, active, and familiar, distinguishing and following those who attend to them with perfect confidence, but *always in concert*. Their movements are less constrained than those of parrots in general, approaching, both on the ground and on the wing, to the quick pace and short and rapid flight of the more typical perchers. They have apparently less power of voice than the greater part of the family, uttering only a sort of chirrup like that of the sparrow. This is shrill, it must be confessed, at times when rivalship, or any particular incitement, induces them to exert it to the utmost; but at other times it is far from unpleasing, more especially when they employ it, as is their custom, either in welcoming the approach of the morning or acknowledging the attentions of favourites.

Somewhat allied to these last-mentioned species in appearance and structure, are several little parrots scattered over the groups of islands in the Pacific. They are, generally speaking, characterised by the small size of the bill, which, however, still retains the parrot form; and by the appendages to the tongue, which are long and surround the apex of that organ much in the same manner as the petals of a flower. Generally speaking, they are birds of powerful wing for their size, and their tails are very stout, rounded in the general outline of the extremity, and also in the tips of the individual feathers, and strongly supported by coverts. The coverts of the wings have the scaly character of parrot's feathers; but the clothing of the body is loose and silky. Though decidedly of the parrot family, from the form of the bill, every species of these appears to require a distinct generic situation. We might perhaps be prepared to expect this, inasmuch as the birds live far apart from each other, and as the islands of the Pacific differ greatly in their characters; but the data are still too scanty for enabling us to form any thing like a correct natural history of those singular parts of the world. Authors have called one of the forms *Coriphilus*, and another *Psittaculus*, and we shall neither dispute the names nor question the propriety of their application.

Kühl's Coriphilus (*C. Kühlii*). This is a native of

Otaheite, and it is a very handsome little bird. Its bill is slender, and rose-coloured. The top of the head is yellowish-green, behind which there is a crest of bright purple feathers, which the bird can erect when it is excited. The remainder of the upper part is green, passing gradually on the rump and upper coverts of the tail; the tail feathers are deep green with a purplish tinge, and slightly margined with pale yellowish green; the cheeks, fore neck, breast, and under parts, as far as the feathering of the tarsi, are deep red, the feathers being loose and flocculent, and the under coverts of the tail are yellow.

In the same group of islands there are some other birds, apparently of the same genus, but differing from this one in their colours. Some of these have blue where this one has green and yellow, and white where it has red; and others are variously coloured. Their habits appear, however, to be exactly the same, and they subsist entirely or chiefly upon the honey of flowers, of which there is a constant supply in those islands of perpetual summer. They are clever on the wing, and altogether very delightful little birds. Their voices are also soft and murmuring, and without any of the harshness which characterises the sounds emitted by the hard-billed parrots. Some specimens of them have been brought alive to Europe, but we are not aware that any attempt has been made to teach them to articulate.

Blue-crowned Little Parrot (*P. vernalis*). This bird is a native of the Philippine Islands, and it is a very pretty little creature. Its length does not exceed four inches and a half, but it is a perfect miniature of a parrot. In the young birds the greater part of the plumage is green, but in the full-grown male the top of the head and the under sides of the quills and tail feathers are blue. The lower part of the back, the rump, and the upper tail coverts, are deep red; and the feet and toes are black. In the full-grown male also the throat is red, and there is a demicollar of yellow on the hind neck. In many of the islands of the Pacific there are various species of these *psittaculi*, or little parrots, not exceeding in size the common little birds which we meet with in our own country; but their history and manners are very little known. It should seem, however, that the whole of them subsist chiefly on the sweet juices which they collect from the nectaries of flowers; and as they float about over the cocoa-nut trees, and other evergreens of the countries which they inhabit, they are very amusing little creatures.

There still remain some very peculiar species of the parrot family which inhabit the south, especially New Holland and Madagascar. Their place in the system has not been very clearly ascertained; but one portion of them have got the name of *Platycercus*, from the breadth and extensibility of the tails; another has been called *Nanodes*; and a third, *Peroporus*, from being found chiefly upon the surface of the earth, and not perching upon trees. Little or nothing is known of the rest of them, and this article has already extended to such a length that we shall content ourselves with merely noticing a single species of each of the subdivisions to which we have alluded.

The Platicurii, or broad tails, are inhabitants of New Holland; and, though their bills are small, they belong to the hard-billed parrots, rather than to those which follow in the train of the lories. They are chiefly found in New Holland, where they attack the plantations in great flocks, and do considera damage; but some of them are highly relished game.

One species, which has been denominated Penna broad tail, is called a lory by the settlers of Austra because its general plumage is red. The tail is b however, and so are the coverts and turns of wings, and a peculiarly formed whisker descend from the gape. The total length is about sixt inches, but half of that length is occupied by the t It is a very pretty bird, and sometimes kept in ca for show, but it does not appear to be capable much education.

Another species, which is much more beaut in its plumage than the former, has been denomina *Pale-headed*. It is found in some parts of New H land, but much more abundantly in New Gui The tail is very long and broad, the two middle thers green, and the rest violet, almost white at margins. The tibiæ and under part backwards h their feathers deep red. The rest of the lower p as far as the neck, is violet; the wings are blue, upper part yellow, with the centres of the feath dusky; and the head and neck dull white, more less relieved by yellow.

The species to which the name of *Nanodes* been given are very pretty little birds. They perch; but they are also clever walkers, and in at least, the parrot form, with the exception of bill, is entirely departed from. The species to wh we allude is the waved or undulated one (*N. und tus*). It is a pretty little bird, about seven inche length, of which the tail occupies half. The gen colours are greenish, yellow, and brown, with blue the middle feathers of the tail, which are very m produced; and there is a small patch of blue on e check. This handsome little bird is very commo New Holland and Van Diemen's Land, and app as often upon the ground as on trees. There several other species, some of them approaching m more to the form of parrots, or rather perhap maccaws; but they are much more ground birds t any of these, though they eat seeds rather than and pulpy substances. We have space left only one other species,

The Grand Parrot (*Peropterus formosus*). Th a remarkable instance of a zygodactylic bird adap for walking on the ground. The tarsi and toes very long; and the claws upon the latter, instea being hooked, as they are in the tree parrots, comparatively straight. The bill is small and sh but decidedly that of a parrot, with the upper m dible much hooked, and the lower one much arch The general tint of the plumage is green, but m barred and mottled with black and yellow. wings are of moderate length, but the tail is v long and pointed. This bird is found in New H land, and more especially in Van Diemen's L where it generally inhabits what is called the "ba that is, the places which are covered with low shr It does not perch upon trees, but runs upon ground among them; and, when it is raised, it h leaping flight, and very speedily alights in ano part of the bush. Its manners are, however, very perfectly known.

Such is a slight outline of the parrot family, questionably the most peculiar and most interes of the feathered race, and also one of the best defi In the course of our few and slight remarks, we h

seen that these birds admit of a natural division into two great sections, the one of which feeds entirely upon the kernels of fruits, and the other upon sweet juices. We are disposed to consider the maccaws as taking the lead in the first of these divisions, and the red-coloured lories as taking the lead in the second. There are, however, many difficulties in the way of any thing like a natural arrangement of the parrot family; and to attempt following the systematists through their artificial fancies would be worse than useless. We have endeavoured to embody the principal points, and to notice the most characteristic species, and having done so we shall close this article.

PARSNEP is the *Pastinaca sativa* of Linnæus, a well known culinary plant long in cultivation. It is a nutritious vegetable, and contains so much sugar, that a very palatable and useful wine is made of its fermented juice. Its culture is extremely easy. The seed is sowed on deeply digged or trenched rich soil in March, either in drills fourteen inches apart, or broad cast. At the end of April, or during the month of May, the plants are thinned out to nine-inch distances apart, and being kept free from weeds during summer by repeated hoeing, are fit to be taken up and stored for winter use in October.

PARSONIA (Dr. Brown). A genus of tropical climbing plants, bearing pentandrous flowers, and belonging to *Apocyneæ*. This genus was called *Echites* by Jacquin and Swartz.

PARTRIDGE. See Gallindiæ.

PASQUE FLOWER, is the trivial name of the *Anemone pulsatilla* of Linnæus. It belongs to *Ranunculaceæ*, and is a native of Britain, found on chalky pastures.

PASSALUS (Fabricius). A genus of coleopterous insects, belonging to the section *Pentamera*, and family *Lucanidæ*, and forming a distinct subfamily *Passalides*, having the antennæ slightly elbowed at the extremity of the basal joint, the body long and depressed; the upper lip distinct, the lower jaws corneous, and with many teeth, and the abdomen, as it were, pedunculated, as in the *Scaritidæ*, which this family appear to represent. This genus is confined to America, Asia, and New Holland, none of the species having been discovered in Europe or Africa. They are of considerable size, and black colour, the specific differences being very difficult of investigation. Madame Merian informs us, that the larva of a species which she has figured, feeds upon the roots of the batatas. The perfect insect is not rare in the sugar plantations. About fifty species are described by M. Percheron, in his Monograph upon the family just published.

PASSERINA (Linnæus). A genus of plants so called from their seeds having beaks like those of sparrows. They are shrubs and undershrubs found at the Cape of Good Hope, and belong to the eighth class of Linnæan botany, and to the natural order *Thymeææ*. They succeed well in our greenhouse collections, and under the ordinary management.

PASSIFLORACEÆ. A conspicuous natural order containing six genera and above eighty species. The genera are arranged in two tribes, the first *Paropsieæ*, containing *Smeathmannia*; and the second *Passifloræ veræ*, comprising the other five genera, viz. *Passiflora*, *Murucuia*, *Tacsonia*, *Disemma*, and *Modecca*.

The passion flowers and their immediate allies are herbaceous or shrubby plants, rarely trees, with often twining scandent stems, and alternate simple, petiolate leaves, either entire or lobed, and usually furnished with glands and stipules.

The enflorescence is axillary, and the peduncles in the non-climbing species are all floriferous, but become in the climbing ones converted into tendrils. The flowers are showy, regular, and united, rarely separated by abortion, usually solitary, seldom aggregate, and for the most part invested with a triphyllous involucrum. The calyx is free, with from five to ten sepals, the external ones herbaceous, the inner petaloid, and constitute a tube of various degrees of length, which is lined by filamentous or annular processes forming a nectary; the petals when present are five in number, and exserted from the throat of the calyx; the stamens are five, surrounded by numerous barren filaments, forming a radiant circle, arranged in one or two series; the filaments are shortly monadelphous, and opposite the external lobes of the calyx; the anthers versatile or peltate, two-celled, and opening lengthwise; the germen is free, borne on a stalk, one-celled, and many ovules; the styles are short or none, and the stigmata are thick, or lobed, or dilated. The fruit is a berry or capsule, either naked or invested by the calyx; when capsular it opens by valves; when a berry it is indehiscent.

The *Passifloraceæ*, although in general innoxious, are suspicious plants; for one species, the *Passiflora quadrangularis*, is known to be deleterious, and the others have not been sufficiently examined to allow their innocence to be affirmed, notwithstanding the fruit of most of them, even of the noxious one, is eatable. *P. malaformis* is the sweet calabash of the West Indies, where it is much esteemed as a dessert; and the fruit of *P. alata*, *coccinea*, *edulis*, *laurifolia*, *ligularis*, *ornata*, *tinifolia*, and *cærulea*, are all likewise esculent. The part which is eaten is either the fleshy arillus or the juicy pulp which surrounds the seeds. This succulent matter is fragrant and cooling, and has a pleasant flavour. It is mostly sucked through a hole made in the rind.

The name, passion-flower, owes its origin to some imaginative Jesuit, who fancied he had found an allegorical representation of our Saviour's passion, or, at least, of the instruments of torture, as well as other attendant circumstances in the structure of the blossoms, leaves, and tendrils of these curious and beautiful plants. There are a great number of species, and also many varieties, in our collections, the latter being hardier, and bloom more freely than the species; all requiring a good deal of room, as they soon cover any trellis or column against which they may be planted. They grow best in a mixture of loam and heath-mould, and are readily propagated by cuttings.

PASTINACA (Linnæus). A genus of herbaceous plants, mostly biennials, and natives of Europe. The flowers are pentandrous, and are ranged from their mode of inflorescence among the *Umbelliferæ*. A large species, called the cocquaine, is cultivated in Guernsey and Jersey for feeding cows, and hence it is supposed is derived the richness of their milk. *P. opopanax* is a medicinal species, as well as several others. See Parsnep.

PATERSONIA (Dr. Brown). A genus of Australian herbs, belonging to *Irideæ*. The flowers are pretty, and are commonly cultivated like Cape bulbs, that is, potted in sand and moor-earth, and kept in a cold frame; or, if planted in the open

border, they must be well guarded from frost in winter.

PAULLINIA (Schumacher). A genus of tropical American evergreen climbers, bearing octandrous flowers, and belonging to the natural order *Sapindaceæ*. Generic character: calyx of five sepals, imbricated, and persisting; petals four clawed, with scales at the base; two or four glands between the petals and stamens; stamens unequal; anthers oblong, fixed by the back, and two-celled; style thickish, short, and connivent; capsule pear-shaped, three-sided, and three-celled. The species thrive in our stoves in light soil, and are propagated without difficulty.

PAUSSIDÆ. A very extraordinary family of coleopterous insects, placed by Latreille amongst the *Xylophagous Tetramera*, but having a nearer relation to some of the aberrant *Necrophaga*. In this family the antennæ are of a very large size and singular form. In some of the genera they are composed of only two or three joints, the last being nearly as large as the rest of the body, and very irregularly constructed. The body is of small size, and depressed; the palpi are large, the maxillary having the second joint greatly dilated; the maxillary and labial are of unequal size; the elytra are square at the tips; and the tarsi short, and not bilobed. These insects are exceedingly rare in collections, and highly prized on account of the singularity of their form. They are exclusively confined to the old world, and are found in tropical Africa, at the Cape of Good Hope, in the East Indies; and more recently a species has been discovered on the Balcan mountains, which is described in the last part of the Transactions of the Academy of Hungary. Nearly thirty species (being about twice the number previously known) are described in a memoir published in the sixteenth volume of the Linnæan Transactions, and about a dozen additional species are intended for publication in the forthcoming number of the Entomological Transactions. They constitute several very well-marked genera, varying either in the structure of the mouth or the number of joints in the antennæ. The type of the family is the *Paussus microcephalus* of Linnæus, about one-third of an inch long, and an inhabitant of Guinea.

PEA is the *Pisum sativum* of Linnæus. A well-known leguminous plant, extensively cultivated both in the garden and field. The garden varieties are very numerous, and the earliest crops, appearing at table about the beginning of May, are highly valued. Peas are sown once or twice in every month, from October to the beginning of July, yielding pods from the first of May till the middle of November. The latest crops are, however, precarious, and only valued in high cookery.

PEACH is the *Persica vulgaris* of Miller, a well-known wall-fruit, and one of the most esteemed in our desserts. It is difficult to state, with certainty, whether the peach, with its variety, the nectarine, are natural, or only accidental creations. They cannot be reproduced from seed with certainty; for, although all our best varieties have been obtained from seed at different times, and in different countries, yet no dependence can be placed on raising good peaches from their kernels. In this respect they are like our orchard fruits, and require to be budded on plum-stocks to perpetuate the best varieties.

In raising peach trees for bearing, very much depends on a proper choice of stocks. This is particularly the nurseryman's business, who, for his own credit, will take care to place the different sorts upon the most congenial stocks.

Next to the necessity of choosing proper stocks is the preparation of the border to receive the young trees, either in the first, second, or third year after they have been budded. A fresh mellow loam, on a perfectly dry subsoil, is most suitable for the peach and nectarine; and, when planted, the next step of importance is the manner of pruning and training the trees in order to render them healthy and constantly fruitful. In this the utmost skill of the gardener is required; because, as they are to be trained to a wall or trellis, the natural form of the head cannot be allowed; and therefore the natural vigour of a young healthy tree must be so far subdued, that a moderate habit of growth be induced, in order that it may be *compelled to be content* with a limited space of wall, unnatural form of head, and yet, at the same time, be prolific.

This subduction of the natural vigour can only be accomplished by the manner of training. If all the branches were trained perpendicularly, the growth would be extraordinarily luxuriant, and, if luxuriant, they would be certainly unfruitful; because the growing principle neutralises the productive one—strong shoots, numerous laterals, and large leaves, are produced instead of those of moderate growth, plentifully furnished with flowers. To prevent this unfruitful waste of vegetable strength, the branches must be trained out of their natural position: a part of them must be laid horizontally, or even descending, rather than upright, in a sinuous direction rather than directly straight. By these means a moderate motion of the sap is induced, a partial stagnation promoted, and a fruitful rather than a barren habit acquired.

Practitioners have had recourse to different methods of training to accomplish this moderate habit of growth. One is to train the stem quite naked to a considerable height (six or eight feet), and then allowing branches to diverge in all directions over the face of the wall. The distance between the root and the branches being a lengthened course for the sap to be invited or propelled upwards, moderates, and, as some imagine, elaborates it in quality, and therefore fits it to flow into the branches for the purpose of fruitfulness. Others think that a single stem concentrates the current of the sap too much, and therefore advise the stem to be divided into principal arms near the ground, and these trained, first horizontally, and afterwards zig-zagly upwards, allowing lateral secondary branches to be produced and trained right and left from the principals, and whence the bearing shoots of every year are ejected. Another method is to train, radiating upwards, a dozen or more principal branches, and extended as far as there is room or convenient, they should grow in right line. These are called *mother-branches;* because a regulated birth of young shoots are annually produced from them, which, being laid in the intervals, yield the flowers and fruit of the next year. This system of training and pruning the peach is much practised in France, and by a few English gardeners, and is highly commended.

The methods generally practised, however, in British gardens, is that called *fan-training*, that is training a principal part of the leading shoots in a directions from the crown of the root. Young bearing

wood is carefully preserved over every part of the tree, and young branches are ever rising from the lower parts of the tree, to succeed those which have become worn out above.

These trees bear their fruit only on the moderate-sized shoots of the former year; and this is one reason why so much skill is required in their management. Standards in the open ground need no pruning, because the head takes its natural rotund form, and the vigour being distributed into so many channels, it is never redundant in any one place. Standard peach trees are, however, but seldom seen in our gardens, being seldom fruitful unless they stand in very sheltered situations.

PEAR—is the *Pyrus sativa* of De Candolle. A hightly-improved garden and orchard fruit-tree. The pear is found wild in England, and probably over all the continent of Europe. In its wild state the fruit is small, hard, and austere; but, since its domestication, new varieties of the greatest excellence have been obtained, vying in flavour even with some of our best peaches, and, in one respect, superior to them, in keeping good for several months after being taken from the tree.

The different varieties are propagated by grafting on stocks raised from the seeds of any of the common sorts, more especially those of vigorous and upright growth. Sometimes quince-stocks are used for particular sorts, especially if the trees are required to be dwarfs.

In gardens the pear is trained on walls, or as espaliers, or trained in the low bush-form on the borders of compartments. Such as are planted as riders on walls, or high standards in orchards, always come into bearing sooner than dwarfs planted in the same places, because the former grow with less vigour.

Crops of pears are frequently lost by reason of their early flowering. Night frosts often occur when the trees are in blossom, and the protruding style of the flower, being remarkably tender, is sure to suffer; and, notwithstanding the hardy character of the tree, the flowers are as easily killed as those of the peach, and require covering quite as much.

The old sorts of the French pears, such as the colmar, cressanne, St. Germain, &c., do best on east or west walls; but the new sorts lately introduced from France and Belgium are found to do well as standards.

Young trees require a longer period of time to come into bearing than most other sorts of fruit-trees. This is discreditable to the gardening world, as assuredly there are practical means by which this defect of the pear-tree might be easily remedied.

PEDALINEÆ. A natural order, containing only one genus, of which there is only a solitary species yet discovered. The plant is a herbaceous annual, found in India; its leaves, when steeped in water, render it viscid, in which state it is recommended to be drunk by patients suffering under dysuria. The *Pedalium murex* was formerly placed among the *Bignoniaceæ*, but separated on account of the small number of seeds in each cell of the fruit.

PEDICULARIS (Linnæus). A numerous genus of herbaceous perennials, chiefly European. They are placed by Linnæus in his fourteenth class, and in the natural system among the *Scrophularinæ*. In our hardy collections they thrive best in sandy heath-mould, and the choicer sorts should be potted and kept in frames during winter. They are propagated by seeds.

PEDICULUS (Linnæus). A genus (or more strictly, *Pediculidea*, Leach, a sub-order) of apterous insects, belonging to the order *Anoplura*, Leach, of minute size and parasitic habits, having only six legs, and the abdomen destitute of articulate movable appendages. The mouth is minute, tubular, and placed at the anterior extremity of the head on the under side, in form of a small rostrum, and enclosing an instrument for suction; the tarsi are composed of a single joint nearly as long as the tibia, and terminated by a single claw of considerable size, folding back upon the inside of the tibia, performing the office of a hook. In several of these particulars we find a difference of character between the suctorial *Pediculi* and those species of *Anoplurous* insects which are attached to birds composing the sub-order *Nirmidea* (*Ricinus*, De Geer), and which have the mouth mandibulated, the tarsi articulated, and terminated by two claws of equal size. All these insects were, however, united by Linnæus in the genus *Pediculus*, and by Leach and Latreille in an order which the former named *Anoplura*, and the latter *Parasita*. Some recent German authors have, however, considered these two groups as belonging to different orders, placing the *Pediculidea* amongst the haustellated insects (*Hemiptera epizoica*, Nitzch), and the *Nirmidea* amongst the mandibulata (*Orthoptera epizoica*, &c.). We prefer, however, retaining these insects in a single order (*Anoplura*), on account of their general similarity in structure, as well as in their parasitic habits; and, therefore, having already noticed the mandibulated species in the article Nirmus, and detailed in the article Louse the natural history of the haustellated species, we shall here confine ourselves to a notice of the genera of which the family is composed.

a, the common louse; *b*, magnified; *c*, one of the legs magnified; *d*, eggs; *e*, ditto magnified.

Genus 1. *Pediculus*, Linnæus. Thorax composed of three distinct segments as broad as the abdomen, the legs terminated by a finger and thumb. The common louse (*Pediculus humanus*), and head-louse (*P. cervicalis*), belong to this genus. The former is comparatively rare. The eggs of these insects are called nits, and are attached to the hairs of the body or head. They are provided at one end with a cap which slips off with ease when the young first bursts forth. The males of these two species have the abdomen terminated by a small conical scaly organ.

Genus 2. *Phthirus*, Leach. Body short, rounded, thorax very short and indistinct, the four hind legs very thick, *Pediculus pubis*.

Genus 3. *Hæmatopinus*, Leach. Thorax narrow, distinct; abdomen very broad. The type is the

as a New Holland species, about the same size as the common one, and, like that, white in the general plumage, but with additional black markings; these are placed on the scapulars, the middle coverts of the wings, and the quills and tail feathers. The lesser coverts of the wings are white, the feathers being long, narrow, and pendent over the wing. A small space round the eye, and also the bill and the pouch, are reddish, and the feet are brown.

A pelican beating on the waters is really a fine sight. At one time it flies close to the surface, and actually strikes the water with its wings, making a splash and causing the body to bound upward every time that it does so. Again, it soars aloft until it perceives a fish, and then it pounces upon that fish, not perhaps with exactly the same splendour as the gannet, but still in a very splendid style.

PELIDNA (so called from the prevailing tawny brown colour of the upper part). A genus of birds belonging to the order *Echassiers*, and comprising the smaller species of birds, allied to the sanderlings, which for the greater part of the year run screaming about those shelving portions of the coast from which the sea retires to some distance at low water. The whole of those birds which are not in the water as waders, or upon it as swimmers, are birds of great interest, and many of them are highly prized as food. But they are very numerous, and we shall be better able to give a short explanation of their coincidences and their differences, by bringing the whole into one article, which we purpose to do in the article SNIPE, or snipe family.

PELOPÆUS (Latreille). An interesting genus of aculeate hymenopterous insects, belonging to the tribe *Fossores* and family *Sphegidæ*, having the mandibles unprovided internally with teeth, with the second submarginal cells of the anterior wings receiving two recurrent nerves; the clypeus is also dentate, and the maxillary longer than the labial palpi; the abdomen is attached to the thorax by means of a very long and slender footstalk. These insects (none of which are inhabitants of this country, although *P. spirifex*, Linnæus, is a reputed British species) construct their nests, according to Reaumur, in the interior of houses and outhouses. Their nests are composed of kneaded earth, &c., which they fix in the corners of rooms, &c. They are of a rounded form, and consist of a spirally-twisted thread of mould, exhibiting also on the underside two or three rows of holes. The nest is afterwards provisioned with living insects for the supply of the future young, when hatched from the eggs, also deposited at the same time in the nest. M. Palisot de Beauvois, in his splendid work upon the insects of Africa and America, says, that the store of food of *P. spirifex* consists of spiders. The same author adds decidedly, that this species closes the aperture of the cells after the deposition of the eggs. In the first part of the Transactions of the Entomological Society, Mr. Saunders has published an interesting account of the habits of an Indian species of this genus, which are quite at variance with the statements of the French authors quoted above. These insects are exceedingly active; they are generally somewhat more than an inch in length, and of a black colour, varied with yellow. The species are somewhat numerous, and found in all the warm climates of the globe. The best known species is the *Sphex spirifex* of Linnæus, which is black, with the abdominal peduncle and legs yellow. It is found in the southern districts of France, &c.

PENEACEÆ. A natural order, containing only one genus, of which there are eight or nine species, all very beautiful greenhouse plants. They have the habit of *Pimelea*, and are nearly allied to *Epacrideæ*. The species grow well on sandy loam and heath-mould, and are propagated by cuttings.

The *Peneaceæ* are evergreen shrubs, natives of southern Africa, with opposite or imbricate, exstipulate leaves, inflorescence terminal, or axillary, the perianth usually of a red hue and inferior. The stamens are definite, either four or eight, exserted from the lower part of the tube of the calyx; the anthers two-celled; the germen is superior, four-celled; style simple; stigmata four. The fruit is capsular and four-celled.

The gum-resin, called *sarcocol*, is the produce of the *Penæa sarcocolla* and other species, natives of Ethiopia. It is an exudation found chiefly on the perianths of the flowers, and, as collected for importation, it is in small grains like sand, of a yellow or reddish colour, and very fragile. Though long known among medical men, and occasionally used as a cathartic, it is now almost forgotten.

PENNISETUM (Richard). A genus of tropical annuals, belonging to the natural order *Gramineæ*, not in cultivation.

PENNYROYAL is the *Mentha pulegium* of Linnæus, an aromatic-scented herb found wild in Britain, but sometimes cultivated as a pot or medicinal herb.

PENTADESMA (Dr. Brown). An African fruit tree, bearing polyadelphous flowers, and belonging to *Guttiferæ*. *P. butyracea* is the butter or tallow tree of Sierra Leone. The fruit is large, nearly as big as a child's head, and gives out, when cut, an abundance of yellow grease or semi-concrete oil, which the natives mix with their food, but it is not used by the settlers on account of its strong turpentine flavour.

PENTAMERA (Latreille). One of the primary sections into which this author divided the coleopterous order of insects, in consequence of the species of which it is composed possessing five joints in all the tarsi (see COLEOPTERA). The families of which this section consists are, according to the system of Latreille, as follows:—

Subsec. 1. *Carnassiers.*
Families, *Cicindelidæ*, *Carabidæ*, with its subfamilies, *Dyticidæ*, and *Gyrinidæ*.
Subsec. 2. *Brachelytra* or *Staphylinidæ*, with its subfamilies.
Subsec. 3. *Serricornes.*
Families, *Buprestidæ*, *Elateridæ*, *Cebrionidæ*, *Lampyridæ*, *Melyridæ*, *Cleridæ*, *Ptinidæ*, and *Lymexylonidæ*.
Subsec. 4. *Clavicornes.*
Families, *Scydmænidæ*, *Histeridæ*, *Silphidæ*, *Scaphididæ*, *Nitidulidæ*, *Engidæ*, *Dermestidæ*, *Byrrhidæ*, *Heteroceridæ*, and *Elmidæ*.
Subsec. 5. *Palpicornes.*
Families, *Hydrophilidæ*, *Sphæridæ*.
Subsec. 6. *Lamellicornes*, which see for its families.

The majority of these families have already been treated upon in their alphabetical situation in this work.

PENTATOMIDÆ (Leach). An extensive family of hemipterous insects, belonging to the suborder

Heteroptera and section *Geocorisa*, or land bugs, and at once distinguished by the length of the upper lip, and the five-jointed antennæ. The details of the mouth of one of these insects having been already figured in the article INSECT (vol. ii. p. 851, fig. 89), we need only refer the reader thereto for a complete illustration of the trophi of this family. The body is generally short, oval, or rounded, or more or less depressed; the tarsi are three-jointed, and the antennæ are filiform. The family is of very considerable extent, and comprises some of the largest and handsomest species of field bugs, as the majority of the Linnæan *Cimices* are called.

The family comprises several principal genera, namely, *Scutellera* (of Lamarck, type of the family *Scutellerites*, Laporte), having the scutellum very large and covering the body; *Pentatoma*, Fabricius (type of the *Pentatomides*, Laporte), having the scutellum of moderate size; *Tesseratoma*, Saint-Fargeau, having the antennæ four-jointed; and *Edessa*, Fabricius, having the metasternum porrected. These genera have been greatly cut up by Laporte, Curtis, and Burmeister, into minor groups, which it will be unnecessary here to detail, as they rest chiefly upon minute structural distinctions. Amongst the genera separated from *Pentatoma*, the following, as consisting of British species, ought not to be omitted, namely, *Ælia*, having the head considerably elongated, and the antennæ covered at the base; *Cydnus*, with the head large, semicircular, the thorax transverse, almost as broad in front as behind, and the legs very spinose. They are chiefly found upon low herbage, *Cimex bicolor* being the type; *Acanthosoma*, Curtis, having the prosternum porrected, type *Cimex hæmorrhoidalis*; and *Pentatoma*, in which the thorax is much narrowed in front, the sternum not porrected, and the antennæ five-jointed; the joints, however, vary considerably in their relative proportions, and the divisions raised thereupon are considered by Hahn, in his "Wanzenartigen Insekten," as so many genera. In the genus *Pentatoma* there are about twenty British species, amongst which the following, described by Linnæus, are especially noticeable: *Cimex rufipes*, *baccarum*, *juniperinus*, *cæruleus*, *oleraceus*, *prasinus*, *&c.*

In the larva state they resemble the imago, except in wanting the organs of flight, whilst in the pupa these organs are seen in the shape of rudimental cases lying upon the base of the abdomen, those enclosing the wings being smaller, and lying beneath those which contain the wing covers. These changes are accompanied by a total moulting. In all these states their habits are similar, and they possess the same faculties, except those of flight and reproduction. They feed by suction upon the sap of various plants, or the juices of fruits, whilst some attack other insects, even including weaker individuals of their own species. The greater part emit a most disagreeable odour, which they communicate to whatever they feed upon. The eggs are deposited together upon the leaves or stems of vegetables, being fastened by means of a viscid fluid. They are disposed in regular layers, and we learn from Kirby and Spence that the female sits upon these eggs like a hen brooding over her nest, a peculiarity in insect life which is of exceedingly rare occurrence.

PEPEROMIA (Ruiz and Pavon). A genus of American herbaceous perennials, belonging to *Piperaceæ*. The species are the herbaceous tribe of pepper-bearing plants, the true peppers (*Piper nigra*, &c.) being climbing shrubs. They are all tropical plants, abounding in the hottest regions, and exclusively found in the equinoctial zone. They grow very well in our stoves.

PEPPERMINT is the *Mentha piperata* of Linnæus, a British herbaceous plant, belonging to *Labiatæ*, and cultivated in gardens for the druggist and distiller.

PEPSIS (Fabricius). A genus of hymenopterous insects belonging to the fossorial aculeata, and family *Pompilidæ*, having four submarginal cells, the four palpi of nearly equal length, the two terminal joints of the maxillary and the last joint of the labial palpi being shorter than the preceding joint. The abdominal peduncle is short. These gigantic sand wasps appear to be confined to South America, and far exceed in size any other species of the order to which they belong. They are remarkable for the brilliant velvety colours of the body, which change when held in different positions. Their wings are generally either of a shining blue-black or fiery red. From their great size and energetic activity of motion, it may be easily supposed that the effect produced by their stings is no trifling matter. In their economy it is most probable that they resemble the *Pompilidæ* of our own country.

PERAMELES (literally, "pouched badger"). A genus of marsupial animals peculiar to New Holland. They are animals of slow motion, but they have no resemblance whatever in their structure to those badgers which belong to the common placental mammalia.

The generic characters are chiefly founded upon the teeth, which are the great means of distinguishing the pouched animals from each other; as none of those animals have horns, great differences in the coverings of the body or very great in the structure of the feet, by means of which we could divide them into orders in the same manner as we divide the other mammalia. This genus have forty-eight teeth in all; in the upper jaw there are ten incisors, two canines, six false grinders, and eight true ones; in the lower jaw the number of canines and grinders is the same, but there are only six incisors; the upper incisors are peculiarly formed at the ends, their extremities being bevelled off to a lengthened oval, with the convex or trenchant end outwards; the first one is very small, and inclines inwards, the three following are larger; these, to the number of four on each side, are close together; but there follows an open space between them and the fifth one, which is small; there is also an empty space behind the canine, which tooth is sharp and crooked, compressed laterally; the other teeth are also peculiar in their structure, but the details are tedious, and the more so, that the use of the peculiarities which they present is not known; the head of the animals is long, and the muzzle pointed; the ears are of mean length; the feet have five toes furnished with large and nearly straight claws; the thumb and little toe on the fore feet are sometimes little else than rudimental; the hind feet are considerably longer than the fore ones, and have only four toes upon each; the inner ones are very small, and the first and second are enveloped in the skin as far as the claws; the third one is very stout, and the fourth small; the tail is not prehensile, but soft and velvety, of mean length, pointed, and with some fur on the under side; the covering is of two kinds, a close fur immediately on the skin, and

longer hair projected through it. The females are furnished with the marsupium. This genus are, in a great measure, earth animals, digging passages under the ground, something after the manner of moles, and living upon dead animals, small reptiles, and insects. They are pretty numerous in various parts of New South Wales, where they make their burrows in the dry and sandy ground.

Long-nosed pouched Badger (*P. nasuta*). This species has the head very long, and the muzzle drawn out and flexible, and the nose or point of the muzzle extending a good way beyond the mouth; the body is about sixteen inches long, and the tail about six inches more; the ears are short and oblong, and the eyes very small; the fur is pretty thick all over the body, but most abundant on the shoulders and ridge of the back, where the long hairs are also the most plentiful; they are ash-coloured at their origin, and black or fawn-coloured at the points; the mixture of colours makes the whole of the upper part appear, as it were, of a uniform brown; and the under part is white, and the claws are yellowish; the tail is dark brown on the upper side, with a streak of maroon down the middle, and chestnut on the under side.

Bougainville's pouched Badger (*P. Bougainvilleii*). Though this has been described as a separate species, and differing in some of its characters from the former, it is highly probable that it is nothing else but the young of the others; but these are obscure creatures in their habitations, and their history is not much known.

Fat-pouched Badger (*P. obesula*). This differs a good deal in form from the other, has the nose short, and the outline of the forehead arched. It is also a much smaller animal, being only about the size of the brown rat; the form of its body is very thick and short; its ears are rather large and rounded, the general colour of the fur is reddish-yellow on the upper part, with black points to the silky feathers, and it is white on the under part; the manners of this one are just as little known as those of the others, because the creatures live lonely, and seldom appear.

PERCH (*Perca*, or rather, perhaps, *Percidæ*, the perch family). A genus, and also a family of spinous-finned fishes, and remarkably characteristic of that order of the finny tribes. So characteristic are they indeed, that Cuvier has given them the foremost place in his arrangement, and placed the common perch at the head of the family, as a most typical fish. The family contains a vast number, not of genera merely, but of sub-families or groups. There is a sort of general likeness running through all these groups; and yet, in the details of their characters, in their haunts, and in their habits, they differ greatly from each other. Some are of considerable size, others are small; some are armed with spines capable of inflicting very serious wounds, and others have none of the spines capable of inflicting an injury. Some swim in the free waters, others lurk in the mud at the bottom; and there are even some which are capable of journeys, though very short ones, upon land. Some notice will be found of the place of the family in the article Fish; and some of the more singular species are described under their proper names in the order of the alphabet.

The leading divisions of the family are, first, the true perches, *Perca*, which have the ventral fins placed exactly under the pectorals, the gill-lids armed with spines, and the gill-flaps toothed; second, *Centropomus*, which have the flaps toothed, but the gill-lids without spines; they have often, however, a spine near the orbit of the eye; third, *Enoplosus*, which differ from the second division in the height of the body, and also in the greater production of the dorsal fins; their gill-lids have spines on them, and the flaps are toothed, and also have a few spines; fourth, *Prochilus*, which have only one tooth in the gill-flap; fifth, *Sandat*, which have the flap toothed, but no spines on the lid; their heads are without scales, and their jaws are armed with pointed teeth; sixth, *Terapon*, having the body and head oblong, the muzzle blunt, the scales minute, and the body small, and with even rows of teeth. Fishes of this sixth division are very abundant in many latitudes, and very easily caught. The master fishers of those latitudes feed their slaves with the flesh of these fishes, which, though not very palatable, yet can be eaten; and this is the reason of the name *Terapon* being given to them, which, we believe, is the Japanese for slave's meat; seventh, *Apogon*, the fishes of this division make a very close approach to the mullets, but they can hardly be considered as true perches in any but the first of these divisions; to it, therefore, we shall restrict the remainder of our observations.

The common Perch (*P. fluviatilis*), is the typical species of the genus; and it is a fish with which every one who knows anything about the fishes of the still fresh waters of Britain must be well acquainted.

The characters of the genus are: two dorsal fins, separated from each other by a smooth space, the first having spinous rays, and the second flexible ones; both jaws, the front of the vomer and the palatal bones are armed with teeth; the tongue is smooth; the gill-lid is bony, and terminates in a flattened point; the under gill-flap is toothed behind, and has a notch below; there are seven rays in the gills, and the scales are rough and hard, and not easily detached from the skin. The common perch is found in the lakes, large ponds, and other currentless waters of all Europe, and the corresponding latitudes of Asia. There is some reason to believe that it agrees better with cold latitudes than with those which are warmer; for perches, three or four feet long, are mentioned as being taken in Sweden and Lapland; whereas in Britain or in France, they rarely exceed a foot and a half. Specimens larger still are mentioned as occurring in some parts of Siberia; but they leave some room for doubt. The perch has been known in all ages, as well as in all countries whose story in the history of civilised man is of any considerable length. The Greeks and Romans were well acquainted with it, and described it accurately; and it is not a little remarkable, that in most countries in Europe, its name differs very little from the specific one given to it by Aristotle. Few lakes or large ponds in Britain are without perch, and as they are exceedingly bold and voracious, they are very easily captured. We shall quote Mr. Yarnell's accurate description of its appearance. "The perch," says Mr. Y., "though very common, is one of the most beautiful of our fresh-water fishes, and when in good condition, its colours are brilliant and striking. The upper part of the body is a rich greenish-brown, passing into golden yellowish-white below; the sides ornamented with from five to seven dark transverse bands; the irides golden yellow; the first dorsal fin brown, the membrane connecting two or three of the

first and last rays spotted with black; the second dorsal and pectoral fins pale brown; ventral, anal, and caudal fins bright vermilion. A deformed variety of perch, with the back greatly elevated and the tail distorted, has been noticed by Linnæus as occurring at Fahlun in Sweden, and in other lakes in the north of Europe. Similar perch are also found in Llyn Raithlyn in Merionethshire. A fish of this description is figured in the volume of Daniel's Rural Sports, devoted to Fishing and Shooting, page 247. Specimens of the perch, almost entirely white, have also been found in the waters of particular soils."

Perches can swim with great rapidity, and they often associate together in considerable troops. In fine tranquil weather these troops may be observed in a lake, a river, or even a large ditch, drawn up in lines with all the regularity of an army near the surface of the water, and perfectly motionless. But their perceptions are very keen; for the least disturbance of the state of things around, sets the whole instantly off with wonderful celerity; and even when one who is observing them is aware of nothing calculated to give alarm, they will dart off as if an electric shock were discharged into the whole.

Perches are exceedingly voracious. Their common food consists of tadpoles, water-newts, frogs, and other reptiles, and also of worms, molluscous animals, and small fishes. It is alleged that they sometimes pay rather dearly for their fish dinners, for they sometimes swallow the stickleback, the strongest spines of which fasten in the gullet, so that the perch can neither get it up or down, and consequently it is starved to death. The strong spines in the dorsal fin of the perch sometimes make it a very unpleasant mouthful for its still more ravenous neighbour the pike; and sometimes when the perch has been actually seized, the pike may be seen to shake it out again, apparently in great pain. There is one enemy, however, against which the perch has no defence. This is a little feeble crustaceous animal of the genus *Cymothoe*, which enters the mouth of the fish along with the water, and preys upon the substance of the gills. The gills of every fish are the most susceptible parts of it; and we need not wonder that a perch, which has perhaps hundreds of these little creatures eating away at its gills at the same time, must suffer the greatest agony that can be inflicted on a fish.

It is generally understood that perch are not fertile till the third year. They spawn in April or May, according to the season and climate, and they are very prolific. The eggs are usually deposited among aquatic plants, such as the stems of reeds and rushes. They are not buried in beds like the eggs of the salmon, but united to each other in a species of little strings. Bloch mentions three hundred thousand eggs being found in a perch only half a pound weight, and more than three times the number in one of a pound weight. The perch is tenacious of life, and may be carried in wet grass for a pretty long distance, so that nothing is easier than to stock any suitable water with perches.

PERESKIA (Haworth). A genus of West Indian fruit-bearing shrubs, commonly called the Barbadoes gooseberry. This genus was named *Cactus* by Linnæus, and it is still kept in the order *Opuntiaceæ* or *Cacteæ*. It differs from the other *Cacti* in having more of a ramified and shrubby appearance, as well as a hostile character, being profusely armed with spines. The fruit is about the size of a small plum, and very pleasant to eat. They are perfectly easy of increase by cuttings; and they make an excellent stock on which to work the other *Cacti*, particularly the *Cereus truncatus*, which, growing from an elevated stem of a pereskia, is a beautiful ornament.

PERGULARIA (Linnæus). A genus of tropical climbing shrubs, bearing curious pentandrous flowers, and belonging to *Asclepiadeæ*. It is easily cultivated, and the flowers are highly valued for their fragrance.

PERIPLOCA (Linnæus). A genus of deciduous and evergreen climbing shrubs, belonging to the natural order *Asclepiadeæ*. Three of the species are from the south of Europe, and one is found in India. The *P. græca* is a common bower plant in our gardens, and, like the others, is propagated by layers.

PERIPTERA (De Candolle). A curious flowering evergreen shrub from New Spain, belonging to *Malvaceæ*. From the remarkable shape of the flowers it is called the crimson shuttlecock. It succeeds in our stoves, and is increased by cuttings rooted in the usual way.

PERIWINKLE is the *Vinca minor* of Linnæus, which, with several other species, are frequent in our flower borders; and an Indian sort, *V. rosea*, is common in our hothouses. They belong to *Apocyneæ*.

PERLIDÆ (Leach). A family of neuropterous insects, belonging to the tribe *Filicornes*, and distinguished by having three joints in the tarsi; the mandibles small and membranous; the posterior wings larger than the superior, and folded on the abdominal margin when at rest; the body is long, narrow, and flattened, and the wings, when the insects are not in the act of flying, are carried flatly upon the back; the abdomen is generally terminated by two filiform threads. These insects frequent the neighbourhood of water, and are very inactive; they are especial favourites with the trout, and imitations of some of them are amongst the most "killing flies" in the fly-fisher's entomology. The larva, as we have long been aware, is an active insect which resides in the water without any cases, although the contrary is expressly stated by Latreille. A figure of one of these larvæ has been published in the German periodical, Der Naturforscher, full half a century ago; and yet, from ignorance of this fact, and the assertion that the larvæ reside in cases like the caddice worms, the greatest confusion has been made by those authors who have attempted to arrange the *Neuroptera* in a natural system. The type of the family is the *Perla bicaudata*, the specific name of which, however (two-tailed), indicates a generic character. It is not very common. There are other species of the genus, the males of which have very short wings; others, which differ only in having wings of equal size in both sexes, form the genus *Isogenus* of Newman. *Nemoura* of Latreille is generically distinguished by having no filiform appendages at the extremity of the abdomen. There are many species of this genus which depart from the habit of the family by being generally found in damp woods. Some other genera have been described by Mr. Stephens in his Illustrations of British Entomology, together with descriptions of all the species.

PERSEA (Gærtner). A fruit tree called, in the West Indies, the alligator-pear. It belongs to *Laurineæ*, and was formerly called *Laurus persea*. It is propagated by layers.

PERSICA (Tournefort). A genus of fruit trees

said to be natives of Persia, containing only two species, or in fact only one; for making the nectarine a species is a piece of ridiculous discrimination. See PEACH.

PETAURUS. A genus of marsupial mammalia, natives of New Holland, and called, by the English settlers there, flying cats, flying foxes, flying squirrels, or any thing else in the mammalia of Europe to which they were fancied to have the greatest resemblance. By many naturalists, or at all events many authors, they were at first confounded with the opossums, to which, however, they have little or no resemblance. They are wholly confined to New Holland and the adjacent isles; and they are invariably tree animals. None of them can exercise any function entitled in the slightest degree to the name of flying; but they have some cross motion of the legs, and the power of extending between them a loose fold of the skin of the sides, which forms a very efficient parachute. The most remarkable characters of the genus are the following: in the upper jaw there are six incisors, and, generally speaking, no canines, though the presence or the absence of these is not a constant matter; the cheek teeth in this jaw are sometimes six, and sometimes seven; in the under jaw there are two incisors, the canines are generally wanting, and the number of cheek teeth is not determined; the intermaxillary bones of the upper jaw form an angle with each other; the incisors are large in the front, and have powerful cutting edges, but get gradually smaller as they proceed backwards; there is a blank space between the incisors and the false grinders; the first false grinder is very small, the second a little larger, and the third larger still, and having its crown formed something like that of a true grinder. This structure of mouth is rather an anomaly, when we come to compare it with the mouths of the ordinary mammalia in which each is tolerably constant to the general type belonging to its order. It is not a decidedly carnivorous mouth certainly, and perhaps the nearest approach to it is found in the mouths of the rodentia; but still it cannot be considered as identical with these. They live, as we have said, in trees, and repose chiefly during the day, so that if not absolutely nocturnal, the morning and evening appear to be the chief times at which they are active. They leap from branch to branch with great adroitness, and are among the most numerous mammalia to be met with as natives of Australia. The aboriginal inhabitants of that island seek after them with great assiduity, and smoke them out of the hollow trees by fire. The head is long, the ears large, the eyes also are large, and the nose pointed, and the naked part of it covered with that peculiar but almost indescribable sort of skin which never fails to point out that any animal upon which it is seen is marsupial. The legs are short but stout, and all the feet have five toes; the inner toes upon the hind feet are placed considerably farther back than the others, and without any nail; it is probable that they act as points of support in grasping; the first and second toes upon the same feet are rather shorter than the others, and partially united by membrane; all the toes on the fore feet are free, but the inner ones, or those answering to the thumbs of hands, are much shorter than the others. The claws are crooked, compressed laterally, sharp pointed, and very strong; and there is no doubt that these animals can seize and retain their hold on a tree in a very perfect manner. The parachute, which is a sort of mantle, folds into plaits when the fore and hind feet are brought near to each other; but when these are advanced in front and projected to the rear, a large volume of membrane is spread out to break the fall of the animal. The tail is, generally speaking, very long, covered with shaggy hair, and capable of a good deal of motion, but not prehensile. Sometimes it is round in the section, and sometimes flat. They do not appear to be absolutely confined to New Holland; for some are understood to be met with on Norfolk Island, though there is no mention of them in any place more remote from the Australian coasts.

We shall not make use of any general English name for the different species of these animals, but shall speak of them by the epithet only.

The Dwarf (*P. pygmæus*). This is a very pretty little creature, about the size of a mouse, but stoutly made; the upper parts are of a delicate mouse-coloured grey, with a reddish tinge, and some clear brown round the eyes; the upper lip and the under part of the body, and also of the expansile membranes, is pure white; the tail, which is long, is a very beautiful organ. It consists of a central articulated part, and an exceedingly regular appendage of reddish grey hairs on each side ranged with the most perfect symmetry, and the whole bearing some resemblance to a handsome little feather; the loose membrane is not attached to the fore feet any further than the elbow joints. Its manners are very little known; and, indeed, it is so little a creature, and so clever among the twigs and leaves of the trees, that it cannot be observed without the utmost difficulty.

The Great (*P. maximus*). Even this species would not be very great in most groups of mammalia, but still it is entitled to the epithet as compared with the one last mentioned. The body measures altogether about twenty inches in length, and the tail about eighteen; the head is small and the mouth very small, the muzzle being pointed; the eyes are rather large, and, as is the case with the greater number of marsupial animals, they have no appearance of eyebrows or any enfoncement in the head; the lines on which they close are very much inclined downwards at their extremities next the nose, and this of itself gives a sinister look to the animals; the ears are large, partially rounded off at their extremities, and they stand nearly at right angles to the mesial line; the tail is very thick of fur, which lies in all directions, cannot easily be ruffled, and thus has a fine appearance; the upper part is, generally speaking, greyish-brown of nearly uniform tint; but it is subject to varieties of colour, and some are met with almost white; the head is rather deeper greyish-brown, with a trace of yellowish-fawn colour down the middle; the throat, the under part generally, and a line on the inner surface of each of the fore legs, are white; the feet are blackish-brown; the tail is fawn colour at the base, increasing gradually to very dark blackish-brown towards the extremity.

Black Petaurus (*P. Taguanoides*). Though the preceding species is called the great, yet the present is still greater, and this is an instance of the absurdity of giving superlative names to species when little is known of the genus. From this foolish custom, we have some species of plants standing in the list as grandiflora, though the flowers are not half the size

of some others of the genus; and in other genera we have *gloriosa* and *superba*, applied to the very plainest species of the whole. Though the present species is styled black, it is subject to great varieties of colour, consisting chiefly of various shades of brown and fawn colour, or a clouded mixture of the two; and some specimens are entirely white. The length of the body is about eighteen inches, and the tail about twenty; the muzzle is triangular and very pointed; the ears are large and erected; the tail is round and very thickly covered with fur; the fur on the body of the animal is long and close, and remarkably soft, so that it is held in considerable estimation by the furriers; and we belive that in Sydney it is used in the manufacture of hats. Like the others, it is found in the forests of eucalyptus, in the hollows of which it takes up its abode.

Large-tailed Petaurus (*P. macrourus*). This species is about the size of a brown rat. The fur on the upper part is brownish-grey, with a dark brown band down the middle of the forehead; the ears are large, rounded, and of a whitish colour. Like the other, it is subject to very considerable varieties of colour.

Several more species of these animals have been mentioned; but as this has often been done by rival naturalists, each of whom was more anxious to discover and name a species, than to find out the habits of the species already known, those specific distinctions are really of very little value. In the case of this, and indeed of all the native mammalia of New Holland, the lovers of nature have much to regret. Of all animals they are the most singular; but the greater part of them are the most obscure in their habits, and, therefore, the most difficult to study. The description of characters that have been sent from Britain to New Holland, to labour in the forests as a sort of penalty for crimes committed in the mother country, are exactly such as we might expect to destroy every living creature that comes in their way, without paying the least attention to its manners. In consequence of this, the native mammalia have been exterminated from all the cleared lands of the colonies, and as it does not appear that any of them, with the exception perhaps of the great kanguroo, have the slightest tendency to be social, there is little chance of their again returning, even when ornamental plantings shall have in part covered and sheltered those grounds which have been so indiscriminately denuded by the desolating zeal of the axe.

This is the master vice or folly of British colonists in every wooded country of which they take possession, and they thereby spoil both the natural history and the land. It will readily be understood, that if a country is thickly covered with a primeval forest, every native creature that lives in it must be adapted to that forest, and form part of the system alone. Consequently, if the forest is suddenly cut down, there is no resting-place or shelter left for the tenants of the forest, and they must either flit before the axe, be killed by the woodsmen, or perish on the clear grounds. This is true, not only of the irrational animals, but of the human natives. Let any one consider how many nations of American Indians have even now their memorial in an historic name, and how speedily the remainder is wasting away before the progress of colonisation by Europeans and their descendants, and he will once admit that, in as far as the system of nature is concerned, this plan of colonisation is not altogether an unmixed good. It so happens too, that the lands, tender from being so long shaded by the forest, are over-worked in a few years, and thus cultivation cuts down stately trees in order that their place may be occupied by weeds.

PETREL. A family of long-winged web-footed birds, the characteristic family of those which are habitually on the wing on the waters, and may be said to inhabit the wide oceans in the full extent of their breadth. The name petrel has been given to them rather superstitiously. It is a corruption of *Petrellus*, or little Peter, and was given to them because they appear to walk naturally upon the waters, as the Apostle Peter tried to do without very notable success. There are other superstitions connected with them, or at least with some of their species, to which we shall afterwards have occasion to allude, and altogether they are among the most singular and the most interesting productions of nature, not for their commercial value certainly, for that is but small, though there are some of the northern countries in which they are used both as fuel and as candles; but to one who wishes to understand the system of nature, and see how all parts work together, they have an interest far higher than any mere commercial one. Nor must it be supposed that those enlarged views of Nature's operations on the great scale are contrary to the genuine spirit of commerce, industry, and the multiplication of the comforts of life; for not only are they the very reverse of this, but they are the very subjects in which commerce originates, and to which all its improvements are owing. Look at the productions of America, North and South, and think what Europe, and Britain especially, would be without them, and then turn round and think by yourself how we came by the original knowledge of these things? The answer to the inquiry is down upon the record, and never can be obliterated. Columbus crossed the Atlantic. Another might have done this it will be said, to which the answer is, another did not do it. We all know the story of Columbus breaking the egg, when he himself was told that others might have done the same as he did. "Any one can do what I have done, after I have shown them the way," was the implied declaration of the philosophic and enterprising navigator. What led Columbus to propose this enterprise—and he proposed it to several countries, and to England among the rest, before any one would enter into his views to the extent of that humble equipment which he required? Columbus had studied with the utmost attention the descriptive and the physical geography of the globe as far as it was then known, and he reasoned that if India and China, which were then the most desirable spots, could not be reached by a western voyage, more direct than the eastern one, and having the advantage of the trade wind in its favour, the obstacle must be land, and that land an addition to the then known world. This was the general view; and when the opportunity came, the execution was shaped accordingly, But even Columbus was under no small obligations to the petrels. When hope had gone down to all his crew, who were not supported by the same general views as himself, when they were in a state of mutiny, and Columbus himself would have despaired, if despair had formed any part of his nature, petrels from the gulf weed alighted on the rigging, and produced a similar effect on the crew of the vessel, to that which the dove with the olive-branch is said to have produced

upon Noah and his family. Had it not been for the timely visit of those birds, Columbus might have been flung in the sea, and the vessel might have returned or have been wrecked. America might have remained undiscovered, and the darkness of the middle ages might have been brooding over Europe up to the present hour.

If there were nothing in the history of the petrels but this part which they had in the discovery of America, they would have been entitled to rank high among the feathered race. But their own history is a highly important one. They are perhaps the most numerous of the feathered tribes in individuals, though not in species; and they are dispersed over every known sea, being, in fact, the grand scavengers of the surface of that mighty element. The other long-winged and web-footed birds, no doubt, also ply the same trade; but they are comparatively local in their vocation. The greater number of them are on or near the shores; and though there are some, and those very large and splendid ones, which are discursive over the broad waters, yet they are confined to particular latitudes, and none of them are so seaward as some of the petrels. Petrels are of various sizes and of different habits, and as such they are adapted to different situations upon the waters—the north and south.

The larger ones are accumulated in greatest numbers in the cold latitudes both of the northern hemisphere and the southern. In summer they extend to the very highest latitudes which man has been able to reach on the sea, and should there be clear water at either of the poles, which is not unlikely, as the poles do not appear to be the points of greatest cold, it is probable that numbers may seasonally visit the poles themselves. They are much more abundant in the southern hemisphere than in the northern; and we might expect this, because there is a greater extent of sea in the south, and it is on the sea chiefly that they depend. Some of the southern ones are much larger than the northern; but we are not very well acquainted with the birds frequenting the borders of the southern ice, for those borders are so extensive that it is scarcely possible to explore them. We do not even know what land there may be within those regions to furnish nesting places for those birds which consume the surface refuse of the sea there.

We say consume the surface refuse, because this appears to be the special office of the petrels; and we find their numbers are always great in proportion to the work which they have to do, and their boldness and voracity are in proportion. Taking the whole family, they may be said to be among the most omnivorous birds, eating indiscriminately dead carcasses that happen to be floating, fishes when they can catch them, molluscous animals, and, in short, every animal product of the sea, whether living or dead, so that they can master it.

In the middle latitudes, that is from the centre of the one temperate zone to the centre of the other, their appearance and also their habits are a little different. This does not arise from the sea being less productive in those regions than in the regions of the poles; but the polar oceans are the great eddies of the grand ocean currents, to which no small quantity of the lighter products of the intermediate oceans are carried. Thus, for instance, a great deal of the produce of the American seas, from Davis' Strait south to the extremity of the West Indian seas, is carried along the margin of the polar ice by the current of the Atlantic, which is indicated by the gulf stream on the American shores. There is even a great deal of the waste of the northern lands carried annually down into those northern seas. The storms of winter destroy many birds and small mammalia, which are carried down to the sea during the thaws and freshes in the spring. These of course go to feed the scavenger-birds of the sea, though, as the gulls are somewhat less seaward than the petrels, the greater share of this refuse of the land falls to them. Dead seals form a considerable portion of the food of the larger petrels. Those seals congregate in immense numbers at their favourite stations, which are generally those where a current along a coast, through a strait or round an island, brings plenty of food for fishes, and consequently plenty of fishes to feed the seals. These seals, when their numbers are not kept down by incessant fishing, are subject to periodical maladies which carry off great numbers of them—numbers so great indeed that, if a long and severe storm ensues, their dead bodies cover the beaches of coasts at a considerable distance from their natural habitations when alive. This mortality among the seals is of course a feasting time with the petrels, the points of whose bills are so formed that they cut like pincers, and very speedily tear the toughest carcass to pieces. The whale and seal fishings are also times of plenty to the petrels of the neighbourhood; and, though the refuse which is left upon these occasions attracts several others of the sea scavengers, the petrels are by far the most numerous, and the most daring in attempting indiscriminately to seize every eatable substance. In consequence of this, the cutting up of a whale is a scene of great bustle and activity; as it is rather unpleasant work though profitable, the sailors flense off the blubber as speedily as they can, and as that is the time of the profit of the voyage, in which they all partake more or less, they are in high glee. The birds too sometimes almost darken the air, keep up an incessant coil of squeaking and screaming, and ever and anon commit petty larceny upon pieces of the blubber. If one gets a piece, others are sure to attack him, and others these again, upon which occasions they battle with great and very often with fatal desperation. When they are killed, however, the dead bodies of their fellows is just as welcome food for the survivors as any other animal matter. When, owing to any of these causes, the petrels get an extraordinary share of oily food, whether of the whale or seal families, or of any others, they get exceedingly fat; but the fat of them is then offensively rancid, and even the flesh is not eatable by any one who can procure other food. We believe that the same process which the northern islanders resort to for purifying the flesh of many sea birds would succeed with the petrels even at this season; and, if it could be carried into execution, these birds might furnish an abundant supply of fresh provisions. The plan is to clean and skin the birds, carefully remove all the fat, both external and internal, and then bury the flesh in fresh sweet vegetable mould for a day and night or more.

When the petrels are left to the ordinary produce of the sea, their flesh is not so rancid, and the sailors often boil them down into a kind of soup. They are best on the currents, where their food may be supposed to be more miscellaneous than when numbers are attracted to a particular spot, by what may be

considered as an unnatural accumulation of garbage. It is astonishing how soon and with what certainty garbage attracts all the scavenger-birds of the sea. Thus, for instance, if there is a cleanly town upon the shore and a fishing village at a little distance from it, which is in general not remarkable for the cleanness of the beach, gulls are almost constantly to be seen parading about the village as if they formed part of the establishment, while not a single gull visits the town.

The sea and those birds which are specially charged with the office of keeping the surface of the sea clean are very extensive subjects, however, and we can afford room for no more general remarks, though the subject is worthy, and well calculated to repay, the closest attention that can be bestowed upon it.

Petrels admit of subdivision into at least two genera—*Procellaria*, or the larger petrels, which, as we have said, congregate most plentifully in the Polar Seas; and *Thalassidromi*, or those birds of smaller size, and something of a swallow-like aspect, which career more at large over the broad waters in warm latitudes. In common English, the first are called "Petrels," and the second "Storm Petrels;" but the generic names which have been given to them, have almost the reverse meanings. *Procellaria* is formed from the Latin word *procella*, which means a storm, or a bustle and disturbance of almost any sort; and certainly, when the petrels are contending for the krang of a whale, or any other great prize, they make no small *procella* among themselves. The other generic name is more happy, because it is more descriptive of the general habits of the birds. *Thalassidroma* literally means that which courses, drives, or careers over the surface of the sea; and this is the general habit of the storm petrels, though they frequently do alight upon ships, and surround them with plaintive cries, especially on dark nights during storms, when the little creatures have been fatigued by the fury of the wind, and can find no rest upon the tumbling surface of the angry sea.

The genus *Procellaria* perhaps admits with propriety of a farther division; for though the birds inhabit the same seas, and carry on the same kind of trade, they do not do it exactly in the same manner. This subdivision consists in separating, from the petrels properly so called, those which are termed puffing petrels; and there is sufficient difference in the structure of the bill, and the habit of the birds upon the waters, to warrant this. The *puffins*, or members of the genus *puffinus*, resemble the true petrels much more than they do the storm petrels, but still they are intermediate between, and may be considered as more seaward birds than the petrels, and less so than the storm petrels. We shall briefly advert to those three genera as making up the family, and mention one or two of the species in each. To enumerate them all would far exceed our limits—their manners are so much the same that it would involve much repetition, and very little is known respecting many of them, especially those of the Antarctic Ocean.

Procellaria, or petrels properly so called. The characters of these are—the bill about the same length as the head, and very strongly formed; depressed at the base, but having that part fortified by a horny tube, which contains the nostrils. The fact of the opening of this tube being single, is one of the characteristic distinctions between a petrel and a puffin; but it does not appear to be a very important one, though the two tubes of the puffins may enable them better to resist the entrance of the water, to which they are more exposed than the others, in consequence of their flying lower. A considerable portion of the bill toward the base is straight, but the tip is arched, forming a long, strong, and most efficient nail or claw, with very short trenchant edges, between which the tip of the under mandible is received. This mandible is not bent downwards, but it is so formed as that it slides against the nail of the upper one with a very powerful cutting motion. Both mandibles have also strong cutting edges, so that any ordinary substance can be divided by their entire length. The wings are long and pointed, the first quill being the longest, though they are perhaps not quite so long in proportion as those of the other genera. We shall, however, notice the remaining characters in describing the only species which frequents the British seas, because as the others appear to differ from it in little else than size and colour, this will save repetition.

The *Fulmar Petrel* (*P. glacialis*). This is the petrel, *par excellence*, of the Northern Ocean, and the one which attends so closely upon the northern whale ships. It also appears in great numbers on those parts of the coast which are favourable for its nesting in such numbers, and it drives about so much wherever it is seen, that it has got a vast number of names, such as "Mollmock," "Mollduck," "John Down," and a number of others. The general colour is whitish, and inclining to hoary on the back. The wings have a dusky shade, and the head and under part of the body are nearly white. The straight part of the bill, and also the nasal tube, which, though it has but one opening at the extremity, contains two distinct nostrils, are brown, and the nail on the tip of the instrument is yellowish. The inner side of this nail is toothed as well as grooved, so that it can take a firmer hold than probably can be taken by the bill of any other bird whatever. The legs are dusky, and the irides of the eyes are yellow. Thus this powerful scavenger of the sea is clad in but homely attire. The colour is, however, subject to considerable variation, which renders it by no means unlikely that those darker specimens which have been brought from the same seas, and have had names given to them as species, were nothing more than coloured varieties of the fulmar.

In the present state of our knowledge, therefore, we are to consider the fulmar petrel as the only true petrel of the north; and its distinguishing characters are, that it remains more within its locality, builds higher, flies higher, and is perhaps a more daring bird than any of the puffins of the same sea. In the Southern Ocean there is a bird very like this, but whether exactly the same or not it is impossible to say, for the species of petrels are so numerous there, that one out of the number is little or nothing.

The flights of fulmars, which are sometimes seen in very high latitudes, are exceedingly great. When Captain Ross made his first voyage to that part of the world, he was detained by the ice for about ten days, in about 71° north latitude. During those days a stream of fulmars continued setting northward over the vessel, unequalled by any known flight, except that of the ash-coloured puffins in Bass's Strait, between New Holland and Van Diemen's Island, or that of the passenger pigeons in the great valley of

America. There is little doubt that this movement north was toward the nesting place of the birds; though whether they nestle there in rocks or on the ice it is not easy to say. The direction which the birds took, and the numbers of them when taken together, afford, however, a pretty strong collateral proof of the fact of there being open water near the pole, and beyond the extreme cold experienced by the navigators, which does not appear to be in a much higher latitude than that in which Captain Ross saw the fulmar, if indeed it is as high.

The fulmar builds in all the northern countries which have been visited—in Spitzbergen, in Greenland, in Iceland, and a few, it is said, in St. Kilda, though the petrel which is so plentiful there, is probably one of the puffins. The fulmars never appear on the southerly coasts of the British Islands, and but rarely on the northerly, for it is only in very severe winters that anything more than a mere sprinkling of them reaches Orkney and Shetland. The nest contains only one egg, as is the case with many sea birds; and it is curious that those birds which have such small broods are yet far more numerous than birds that have larger ones. Besides being eaten by the sailors occasionally, or under particular circumstances, these birds are eaten by the inhabitants of the remote and cold islands; and it is said that in St. Kilda they are salted for winter provision, indiscriminately with other birds. The oil is understood to be previously extracted, and this oil is much prized by the simple inhabitants of that lonely isle. They have not the benefit, such as it is, of reading the marvellous lists of infallible quack medicines which pollute the columns of the newspapers, and tend to set the cupidity of their proprietors over their boasted zeal for the interests and morals of the people. But still fulmar's oil is in St. Kilda what Morison's pills, or anything more famous and filthy, can be in England; and it has the advantage that nobody can be poisoned by it, by what bungler soever it may be administered. A young bird will yield nearly an English pint of this oil, which is beautifully clear if kept above the temperature of fifty-two degrees of the common thermometer, but if it be allowed to get cooler than this it becomes turbid, and when once it does so it is not easily cleared again.

We may add, that the great fishing on the bank of Newfoundland affords a rich time for the fulmar, which greedily devours the offal of the cod as it is thrown from the fishing-boats. In these places, or, indeed, in any place where it hovers in expectancy of food, the bird is easily caught with a baited hook cast on the water, or swung in the air, for it is sufficiently bold to approach within the length of a very short line. When we consider its numbers, its activity, and the fact of its being the only far sea scavenger of the Arctic Ocean, this is one of the most interesting birds of the north.

When we turn our attention to the south, we find the importance of any one species of petrel lost in the numbers of the species; and we find them approaching gradually in size and in some other respects to the large long-winged sea birds which are met with there. Generally speaking, those birds of the south have more colour in their plumage than the fulmars; and perhaps we might expect this, as they occur in a lower latitude, and we find the fulmar paler in the extreme north and sometimes white. It is not easy to determine in every case, without a new examination, whether these birds are petrels or puffins; because the difference is more in the manners of the birds than even in their structure.

Gigantic Petrel (*P. gigantea*). This is the largest species which is known, specimens being met measuring forty inches in length, and about twice as much in the spread of the wings. The upper parts are whitish mottled with brown. The scapulars, the coverts of the wings, the quills and the tail feathers are brown, with paler margins. The sides and front of the neck, and all the under parts are white; the top of the head is blackish brown; the feet are yellowish grey with black webs; and the bill is brownish yellow, with a very large and strong yellow nail. This species is found only in the Antarctic Ocean, and may, perhaps, be considered as one of the most typical species there.

Most of the other petrels of the Antarctic Sea are much smaller birds, generally about eight or ten inches in length; and they appear to differ from each other in little else than size and colour. One might be prepared to expect that they should be more discursive birds than the petrel of the north, because there is an uninterrupted sea in their latitudes all the year round; and thus the same bird can freely circumnavigate all the globe. Where many of them nestle is quite unknown, and indeed we are nearly in the same state with the northern ones, for we do not know where those immense flocks which proceed northward in the summer find their nesting places. A good many nestle in Terra del Fuego, the Falkland Islands, Georgia Island, to the south-east of these, and South Shetland, to the south-west of Cape Horn. But as they come seasonably into temperate latitudes, in every longitude of the South Sea, we may naturally suppose that there are nesting places for them all round. The ice, however, will do for this purpose; because a hole in the ice, while it remains without melting, may make a very warm nest, and there is no want of feathers wherewith to line the bottom. In the north we know that there are some birds which do place their nest on the ice; and this may be more general in the south. It is highly probable that, if attention were paid to the motions of these and other birds of the Antarctic regions, with due care, and in the proper spirit of philosophy without any preconceived theory to trammel the mind, we might be put in possession of some means of at least guessing rationally at what may lie within those icy barriers of the southern sea, which exclude us from actual observation.

The flight of birds, when they are numerous from any particular direction, or to any particular direction, is always a matter worth attending to. The ancients saw this; but the low state of their knowledge unfitted them from making the proper use of it; and as people always do in such cases they perverted it for superstitious purposes, and sought for a foreknowledge of the fate of human beings, from that which was simply an indication of what had previously happened in some country or another. Whence they come, and why, are the only two questions to which the flight of birds can give any answer; but the rapidity of their motions, and the length of distance for which they can come, render them both early and valuable messengers, if we would but take the trouble of making ourselves understood.

Several species of petrels are mentioned as occurring habitually at intermediate latitudes, such as about New Holland, and some of the groups of

islands in the Pacific; but it is probable that these are puffins rather than petrels, or, at all events, that they have the habits of puffins.

Puffinus. The puffins have the bill rather longer in proportion than the petrels, but not so stout, and slightly curved from the base, with both mandibles of an equal length, and both curved at the extremity. The upper mandible is still furnished with a strong nail, and the bill is rather a powerful one, but it is not fitted for such hard work as that of the petrels. The nostrils are in a double tube on the upper mandible, or, perhaps, rather the external tube which surrounds the two tuberal nostrils in the petrels, is wanting. The birds also build their nests much lower down, many of them in holes in the sandy islands; and some have the tarsi longer and more slender than the petrels, and can walk better. At sea their flight is more on a level, and nearer the surface than that of the others. They appear to follow the shoals of fishes, especially the young of migrant fishes, and live less on the carrion of the sea. Still they are more seaward than the birds of higher flight. A bird which fishes over the wide seas almost invariably skims the surface, whereas one which looks out for offal, or fishes at particular places only, takes a higher station in order to look out. Their other structural characters are:—The plumage very close and firm, wings long and pointed, tails short and wedge-shaped, tarsi slender and compressed, front toes long and elastic, and the hind toe a mere claw. Their motion along the surface of the water is exceedingly graceful, especially when there is a heavy swell and they rise and fall to the waves; they manage their wings with so little play upwards and downwards, that they tip the water with the webs of their feet, and thus use the wings for little other purpose than that of buoying them up. From this beautiful gliding over the surface, the people on the British coast call them shearwaters; and where they are numerous they are among the most ornamental birds that appear above the surface of the sea.

They are found ranging through every latitude, except, perhaps, the very coldest ones; and from the odd situations in which stray individuals are often found, it appears that they are not very particular in dashing over a good many degrees of latitude. They have an interest in British ornithology, from the circumstance of one species at least being very common on the north-western coasts, though it rarely makes its appearance on the east. In winter the greater number appear to move considerably to the southward, though a few stragglers still remain on the coasts of the channel, and the South of Ireland. This species is,

The Shearwater (*P. Anglorum*). *Scolorum* would be a more appropriate name for it, because there are actually more of the birds which breed on a single small island in the Hebrides than there are in the whole of England. This bird is also often called the "Manks petrel," or "Manks shearwater," because it occurs on the shores of the Isle of Man; but that is not one of the localities in which it is most plentiful. They are not resident during the whole year upon any part of the British coast. They arrive on their breeding-grounds about March, and remain till August, during which time they rear a single young one out of a white egg of considerable size. Whilst this operation is going on, one or other of the birds is always very busy in skimming over the surface of the waters, though what their principal food is has not been very clearly ascertained. It is probable that they fish a good deal, but that the fish which they capture are small. It is also probable that they collect vast numbers of those small animals of various classes which are constantly floating in the sea, and which form the principal food of several of the small-mouthed fishes. Whatever they gather from the waters must, generally speaking, be in small portions, for they merely give a twitch to the surface, and pass on; whereas birds which catch fishes of any considerable size always enter the water in whole or in part, or make some sort of splash. The shearwater, on the other hand, glides along with wonderful rapidity, often combining the three operations of flying, walking, and swimming; and it not only makes forward motion, but wheels and turns and moves laterally with very little apparent effort of wings. Whatever they may feed upon, they must get abundance of it, for, notwithstanding their laborious lives, they are always fat. The young birds are relished by the islesmen, who salt them in large numbers as part of their winter provisions. The length of this species is about fifteen inches, and the stretch of the wings about thirty-three; but, as the tail is very short, it is rather a stout bird for its length, though neat and compact in the body. Its colours are plain, but strongly contrasted, being black on the upper part and white on the under; but these are broken into each other where they meet, especially on the sides of the neck. Some of the upper feathers are greyish in their margins, and this is the case during the winter months rather than the summer. The bill is rather longer than the head, and of a dark-brown colour, and the nasal tubes extend to three quarters of an inch in length. As these birds do not collect in large numbers upon any part of the coasts, during the winter, it is probable that they disperse very widely over the ocean, and that they take the advantage of that upturning of the waters during the gales at the autumnal equinox which brings such a supply of food to the surface. We believe that this is the only puffin which comes to any part of Britain to breed; but there are some others which occasionally make their appearance. One of these is

The Ash-coloured Puffin (*P. cinereus*), which is a native of much warmer climates. It occurs on all the western coasts of Africa, from the Cape to the Straits of Gibraltar, and also in the Mediterranean itself, most numerously, as is said, in the middle latitudes. It differs from the others in being without any distinct nasal tube, or, at all events, in having it very rudimental as compared with the others. It is considerably larger than the former, and it is probable that it is the same bird, or, at most, only a climatal variety of it which occurs in such multitudes in the Australian seas, where the birds nestle in holes of the dry and barren islands and beaches, and, at some seasons at least, appear to return every night to their subterranean dwellings in those places.

There are many other species or varieties of puffin, some of them larger and some smaller. Thus, the blue-billed petrel of the Pacific Ocean is twenty-one inches in length; and the whitish-billed one, found on the shores of Brazil, is as much as twenty-seven. Some of them are, however, much smaller; but, whatever may be their size, or the markings of their colours, their manners are so much alike, and so rarely does even one of them, besides those mentioned, make its appearance on the British shores, that the details of their distinctions have no general

interest. One other species, and only one, has been seen in this country—

The Sooty Puffin (*P. fuliginosus*). It is understood to have its proper home at the very antipodes; and, therefore, the one which appeared at the mouth of the Tees in 1828 was a stranger indeed.

THALASSIDROMA. Clever as the puffins are in their action upon the waters, they are nothing compared to the storm petrels, or members of the present subgenus. These are small birds, of dark colours, though sometimes there is a little white upon them, and they resemble the swallow tribe, both in colour and in the style and rapidity of their flight. Their dwelling is more exclusively upon the water than that of even the most seaward of the former sub-genus; and they drive about so much, and so incessantly, that it is not easy to say in what particular parts of the ocean they have what may be called their resting-places.

There are several species of the genus, but they all resemble each other very much in appearance, and still more in habits. In calm weather they remain comparatively quiet, each seeking its own food; but in severe storms they endeavour to find shelter, and it is on these occasions that they crowd so much about ships. As they accompany the storm, and sometimes outstrip it in their flight from it, so as to arrive at the ships before it, the sailors look upon it with no small degree of apprehension. They are known at sea as Mother Carey's chickens, among many other names not of the most flattering cast; and this Mother Carey is understood to have been a hag who caused an immense number of shipwrecks in the days of the belief in witchcraft, not only by her supposed influence with the "Prince of the Power of the Air," but by lighting false watchfires on the heights, as used often to be done upon those coasts where the infamous system existed.

The common Storm Petrel (*T. pelagica*) is the one most frequently met with. It is about five inches and a half in length, but rather more than fifteen in the stretch of the wings; the bill is about half an inch long, and rather slender; the nail on the upper mandible is nearly straight, and the nasal tube is very short: the upper plumage is smooth glossy black, with bluish reflections, and the under plumage is very deep blackish-brown; there are, however, some white feathers on the rump, the tips of the greater wing-coverts, and some of the primary wings. The nests are understood to be made in holes of tall cliffs, but, as the birds fly in and out with great rapidity, the nests are not often discovered. The eggs are two in number, which is double that of the petrels and puffins. Notwithstanding this double produce, as compared with the others, it does not appear that the storm petrels are nearly so numerous; and there is no doubt that it is their exposure to the severity of the weather which thins their numbers. The violent storms not only blow them about like chaff on the surface of the ocean, but they are often driven from inland, where they are left in a state of the greatest exhaustion.

Wilson has given by far the best description of the very characteristic manners of these birds, and as he has given it from his personal observation, to alter it would be any thing but to improve it. When sailing from New Orleans to New York, "on entering," says Wilson, "the gulf stream, and passing along the coasts of Florida and the Carolinas, these birds made their appearance in great numbers, and in all weathers, contributing much, by their sprightly evolutions of wing, to enliven the scene, and affording me every day several hours of amusement. It is indeed an interesting sight to observe these little birds in a gale, coursing over the waves, down the declivities up the ascents of the foaming surf that threatens to burst over their heads, sweeping along the hollow troughs of the sea, as in a sheltered valley, and again mounting with the rising billow, and just above its surface, occasionally dropping its feet, which striking the water, throws it up again with additional force, sometimes leaping with both legs parallel on the surface of the roughest waves for several yards at a time. Meanwhile it continues coursing from side to side of the ship's wake, making excursions far and wide, to the right and to the left, now a great way ahead, and now shooting astern for several hundred yards, returning again to the ship as if she were all the while stationary, though perhaps running at the rate of ten knots an hour. But the most singular peculiarity of this bird is its faculty of standing and even running on the surface of the water, which it performs with apparent facility. When any greasy matter is thrown overboard, these birds instantly collect around it, and, facing to windward, with their long wings expanded, and their webbed feet patting the water, the lightness of their bodies and the action of the wind on their wings enable them to do this with ease. In calm weather, they perform the same manœuvre, by keeping their wings just so much in action as to prevent their feet from sinking below the surface." "As these birds," he continues, "often come up immediately under the stern, one can examine their form and plumage with nearly as much accuracy as if they were in the hand. They fly with the wings forming an almost straight horizontal line with the body, the legs extended behind, and the feet partly seen stretching beyond the tail. Their common note of *weet, weet*, is scarcely louder than that of a young chick of a week old, and much resembling it. During the whole of a dark, wet, and boisterous night, which I spent on deck, they flew about the after-rigging, making a singular hoarse chattering which, in sound, resembled the syllables *protret-tu-cuk-cuk-tu-tu*, laying the accent strongly on the second syllable *tret*. Now and then I conjectured that they alighted on the rigging, making then a lower curring noise."

We regret that we have no more room for quotation, and we do this the more that the hints contained in Wilson's observations tend to throw more light upon the real characters and economy of these birds than all else that has been written on the subject. He found them in the gulf stream, which shows that they seek the water where it is moving along, and bearing with it those substances upon which they feed. He found the remains of a large fish in the stomach of one, and another filled with tallow which he himself had thrown overboard; in the gizzards of some he found fragments of barnacle shells, and in all he found little globular substances, about the size of mustard-seed, which he conjectured to be the *sporæ*, or germs of the gulf weed, of which such a mass remains floating in the great central eddy of the Atlantic, and continues sending fragments northward down the stream. He conjectures also that the partiality of these birds for the wakes of ships arises in great part from the turning up of those substances by the motion of the water, and also from the detaching of barnacles from the ships' bottoms by the same

operation, though the refuse which is cast overboard forms also a part of their attraction. These birds display none of that pugnacity of disposition which is so conspicuous among the fulmars of the north, but appear to live in the greatest harmony with each other.

The species which Wilson describes upon this occasion were a little larger in size, and browner in the colour, than those which are met nearer the shores of the eastern continent. Their general structure and also the forms of the tails are the same, however; and therefore, though they have been considered by some as a different species, the grounds of distinction are but slight.

There is, however, another species found in the Atlantic, and also occasionally on the British shores, though but rarely. They are rather larger than the even-tailed ones seen in the east parts of the Atlantic, and they have the tail very spreading and forked, but not very deeply. They are also different in their colours, the upper plumage being brownish; some of the scapular feathers and more of the wing coverts being whiter than in the species which have not the tail forked. Except in the termination of the tail, and that was slightly forked in some which Wilson examined, this bird agrees very exactly with Wilson's birds in size and in shape; and, as he observed some of them with much more white upon the body than others, it is very possible that they are identically the same; that the larger species or variety is chiefly found on the richer pasture of the gulf stream; and that the few stragglers which have appeared on the west coast of Britain may have followed in the wakes of ships from near the American shores. There is another circumstance which increases the probability of this: the greater number of those stragglers have been seen in the winter, and therefore they may be presumed to have followed the ships late in the season, when their breeding operations were over, and they were more dispersed upon the waters.

Of the species or the conduct of those birds upon the Pacific, we have but little information; and that ocean is so much wider than the Atlantic, and so rarely crossed in comparison, that information respecting its birds, and its natural history generally, is not so easily obtained.

PHACOCHÆRUS—Warty Hog. A genus of the hog family, which has been separated from the others in consequence of certain peculiarities of its structure; but we shall notice those differences, and also the other distinctions of genus or sub-genus which are to be met with in the family under Sus, the name of the typical genus.

PHALACRUS (Paykull). A genus of minute beetles. See ANISOTOMIDÆ.

PHALÆNA. Linnæus divided the lepidopterous insects into three genera only, *Papilio*, *Sphinx*, and *Phalæna*, or butterflies, hawk-moths, and moths properly so called, the last named genus being characterised merely as follows: "Antennæ setaceous, gradually attenuated from the base to the tips, wings at rest generally deflexed, flight nocturnal." These characters, it is true, have the merit of uniting together a great mass of species, although it is very difficult to draw the line between some of the less typical sphinges and some of the moths. Still, however, the step was so evidently natural, that it has been retained by most subsequent authors. It was however necessary even for Linnæus himself, from the number of species belonging to the genus, to establish sections as follows:

I. *Attacus*, with the wings horizontally extended.
II. 1. *Bombyx*, tongueless, with the wings reversed.
2. *Bombyx*, tongueless, wings depressed, back not crested.
3. *Bombyx*, tongueless, wings depressed, back crested.
4. *Bombyx*, with a spiral tongue, back not crested, wings deflexed.
5. *Bombyx spirilingues*, back crested, wings deflexed.
III. 1. *Noctuæ*, tongueless.
2. *Noctua*, spiral-tongued, back not crested.
IV. 1. *Geometra*, antennæ pectinated, posterior wings rather angulose.
2. *Geometra*, antennæ pectinated, wings rounded.
3. *Geometra*, thread-horned, wings angulose.
4. *Geometra*, thread-horned, wings rounded.
V. *Tortrix*.
VI. *Pyralis*.
VII. *Tinea*.
VIII. *Alucita*.

These eight primary divisions have constituted, in the works of most modern authors, the chief primary divisions of the nocturnal lepidoptera. By some authors, however, the name *Phalæna* has been employed in a manner which must surely be contrary to every true principle of scientific nomenclature, namely, as a family name, *Phalænidæ*, for the thread-horned *Geometræ* of Linnæus. We have, however, already in the article *Geometridæ* noticed the additional incorrectness of this step, and shall therefore terminate this article by regarding the term *Phalæna* as synonymous with that of *Nocturna* or *moth*, and referring the reader to the articles under these two heads, as well as to that upon the *Geometridæ*.

PHALANGIIDÆ. A family of arachnidous insects, belonging to the division *Trachearia*, and order *Adelarthrosomata* (see vol. i. p. 186), and distinguished by having the antennal claws very distinct and terminated by a didactyle claw. They have two filiform palpi of five joints, the last of which is terminated by a small hook, two maxillæ formed by the elongation of the basal joint of the palpi, two eyes, and occasionally four other maxillæ composed of the dilated basal joint of the fore legs. The body is short and of an oval or rounded form, the abdominal portion exhibiting the appearance of segments. The legs, eight in number, are always very long and divided as in insects.

These curious creatures are known under the common name of harvest-men or harvest-spiders. They live on the ground amongst grass, under stones, &c., and are exceedingly active, the great length and slenderness of their legs enabling them to proceed with very great rapidity. These insects are evidently rapacious, and feed upon other insects. Their relations are very interesting, appearing to be intermediate between the spiders and mites. Some of the exotic insects belonging to this family are amongst the most extraordinary of annulose beings; the species of *Gonyleptes*, in their threatening form and the singular spines with which the legs, &c., are armed, well merit the specific names, *horridus*, &c., which have been given to them, whilst others, figured by Dr. Pertz in the "Delectus Animalium Articulatorum Brasiliæ,"

(wherein a complete specific synopsis of the family is published), are even still more extraordinary. The *Dolichoscelis Haworthii* of Hope, described and figured in the last part of the Linnæan Transactions, covers an area of at least six inches in diameter, whilst its body is scarcely a fiftieth part of this extent. The other principal genera are, *Siro*, *Macrocheles*, *Trogulus*, *Phalangium*, and *Obisium*. There are numerous British species belonging to the two last named genera. The *P. cornutum*, Linnæus, being the male, and the *P. opilio* the female of the typical species of *Phalangium*.

PHALAROPE (*Phalaropus*). A genus of aquatic birds, having, as the name implies, the toes furnished with lobes. They are placed by Cuvier in the longirostral family of *Echassiers;* but it is not very easy to assign them a place in the system which will exactly suit all their habits, because, though their feet are only lobed and not entirely webbed, they are very expert swimmers, at the same time that they are discursive birds, and range to great distances. They are not birds of large size, but they are expert walkers, as well as good swimmers and fliers. Their generic characters are: the bill long, slender, weak, straight, and depressed at the base; the mandibles furrowed for the whole length, and the tip of the upper mandible blunt and curling over the under, which is pointed; this structure of bill is not adapted for very severe labour, and therefore we must suppose that that the birds live upon small substances, though they obtain them sometimes from the land and sometimes from the water; the nostrils are in the sides of the bill near its base, they stand out, and are surrounded by a membrane; the feet are of moderate length, with the tarsi rather slender and compressed laterally; there are three toes to the front, all webbed as far as the first joint, and then furnished with lobes for the remaining length, which are capable of striking the water with very considerable force, and yet of being much more easily recovered than feet entirely webbed. The hind toe is short, turned inwards, and without any membrane; the wings are of moderate length, but rather pointed, and they are clever birds and handsomely formed, but wild, and devoted to free nature. Though there are two of them that visit Britain in the winter, the one not unfrequently, and the other very rarely, yet in summer they seek the extreme north; and if we except the fulmars, there are perhaps no birds which approach nearer to the poles. These species are the red-necked phalarope and the grey phalarope.

The Red-necked Phalarope (*P. hyperboreus*). This is a very handsome and clever bird, almost equally expert at each of the three motions of running, swimming, and flying. It is a discursive bird, migrating northward in the summer, and southward in the winter, in doing which it takes a very considerable range. If we were to judge from the feet only, we should be disposed to say that the coot is the bird which it most nearly resembles; though the toes are much shorter than those of the coot, and the lobes upon them are smaller, and not so much divided. When, however, we examine the bills, and the general structure, we find a remarkable difference. The bill of the coot is decidedly an aquatic bill; and the form of the body, and the articulation of the legs, are so decidedly of a swimming character, that the bird is a bad walker. True to its structure, the coot is found only upon the waters, generally the fresh waters, and it does not range much. This phalarope, on the other hand, though its form is that of a shore bird, and its march is swift and graceful, while its habit corresponds, as it finds its food, at least in the winter, more upon land than in the water. Notwithstanding of this, the phalarope is by far the better swimmer of the two, and, as we have said, the places of its swimming and wintering are generally widely apart from each other. It is true that the legs are not articulated to the body, or the joints of the tarsi formed in that manner which is the best adapted for a running bird, because such a structure would be incompatible with expertness as a swimmer. The phalarope has, however, less of the awkwardness of the swimmer in its walk than any bird which can be named. Its body, though light, is firm, well shouldered, and exactly of that shape which indicates a good flier.

The following are the colours of the summer or breeding plumage, in which, however, the bird very rarely appears in this country:—The back is black, with reddish brown margins to the feathers; the top of the head, the hind-head, cheeks, and sides of the breast, are ash; there is a white bar across the wing, and the upper tail-coverts are mottled with the same colour; the front and sides of the neck are reddish brown; and all the rest of the under part, and also the skin, white, but with dusky brown spots on the flanks. The female has the general plumage less clear in the tints, and the brown on the neck much paler, and spotted with ash-colour. In the winter the time when the birds are seen in this country, the black parts have become brown, the brown part pale buff, and the brown spots on the flanks are nearly obliterated. The young birds have the upper part mottled with white and reddish, and the under parts with pale ashen grey. When birds in their summer plumage, and also young birds, first began to be obtained from the northern countries where they breed, there was a good deal of confusion about the species; but the facts are now well ascertained, and the changes of plumage tend greatly to show that the place which Cuvier has assigned to the phalaropes, in his arrangement of birds, is the right one.

The Grey Phalarope (*P. lobatus*). There is a double blunder in the naming of this bird and the last one for this is the more northerly bird, and ought, on that account, to be called *hyperboreus*, if any of them is to get that name; and the English epithet grey, applied to this one, is the name of its winter colour; whereas if it is to be named from the colour at all, it ought to be named from the summer, or breeding plumage because that is the livery of a bird when in its highest perfection.

This phalarope is very rare in England, even in the winter; and it is scarcely more common on the shores of the northern and western isles of Scotland. Indeed, any specimen which does find its way here must be looked upon as a stray bird, which has been beaten from the line of its regular migrations by the violence of the winds. Birds which come in this way do not come at a regular season, like the habitual migrants, but are more likely to arrive in the autumn than in the depth of winter; because, when winter fairly sets in, their migration in their own locality is over—they are comparatively at rest in their winter quarters, and not exposed to the winds. Such birds are also much more likely to come to the southerly parts of the country than to the northern. Accordingly, specimens have occurred in the southern

counties of England; and one mature male, which was found in Wiltshire as early as the month of August, retained so much of the summer plumage, as to show that the rich-coloured birds found far to the north in summer are identically the same as the grey ones which straggle southward in the winter.

At all times of the year this phalarope is a handsome bird, and in summer its plumage is very beautiful; but the colours are so mottled and broken, that it is scarcely possible to give a detailed account of them. The whole of the under part is then rich reddish brown, passing into a mixture of black, brown, and several other tints, which it is not easy to name, on the back, the wings, and their coverts. There is, however, a white bar across the greater coverts, the same as in the other phalarope, which undergoes no annual change. In winter the colour changes greatly, and in all probability the change is greater in proportion as the place in which the bird winters is colder. As it occasionally appears with us, the brown on the under part has faded to white, marked with some greyish ash on the sides of the lower neck. The colours on the back and wings fade almost to one entire tint of grey, notwithstanding their variety in summer. The most singular change in the plumage, however, takes place in the head. In summer the chin, the cheeks near to the eye, the top of the head, and the hindhead, are deep black; and a small space round the eye, on the cheek below the eye, and backwards to the nape, is white, mottled with a few feathers of brownish-grey, and passing gradually into the dark colour of the neck. In winter, again, those colours of the head exactly change places, by all that is black in summer turning white, and all that is white turning black. There is a seasonal change even in the bill and feet. In summer the bill is yellow, and the feet are blackish brown; but in winter the bill becomes dusky almost to blackness, and the feet lead-colour. In consequence of these changes, both of the feathers and of the naked parts, it would not be easy for any one to believe that the bird, in its two plumages, was still the same species, were it not that it has been seen in all its changes.

The young birds, in their first plumage, have the back and scapulars grey; the greater coverts dusky, margined with buff; the white bar on the wing more conspicuous, and a slight tinge of brown on the throat. Their bills and feet are also much paler in the tint than those of the mature birds in summer. The young might thus readily pass for a third species by those who attend only to colours; and, as they generally move southward earlier than the old birds, they are not only first seen, but most plentiful in the southern parts of the range. It should seem that this bird is chiefly an American, though it does not appear to come abundantly into the south, or even the central parts, of the United States. Wilson saw it, and left a few notes respecting it, but no finished description; and the American ornithologists who have followed him have not exactly come up to his standard in their attempts to furnish one. Indeed, it is only in the extreme north, among that dismal melange of rocks, ice, and water, with which the explorers of those dreary regions had to contend, that this phalarope seems quite at home in the summer. The situation of its nest, and its economy and food in the breeding season, are quite unknown.

PHALARIS (Linnæus). This genus is the canary-grass of authors, and is one of the cultivated *Gramineæ*. The grain is chiefly used for feeding poultry and singing-birds.

PHARNACEUM (Willdenow). A genus of annuals and undershrubs, having pentandrous flowers, and belonging to *Caryophylleæ*. They are all easily cultivated.

PHASCOLOMYS—wombat. A genus of marsupial mammalia, of which there is only one known species, and this species is so different from all the other mammalia, whether marsupial or placental, that it may almost be considered as forming a distinct order. It is one of the most quiet and peaceable of animals, as perfectly passive as a living creature can be, and it lives upon vegetables, and does injury to no living thing; but at the same time it does not, in the structure of its teeth, fall into any of the order into which the vegetable-feeding mammalia are divided, nor, in fact, resemble them. Almost the only character too in which it strictly agrees with the other marsupial animals, is simply being marsupial. If we were to liken it to any of the placental animals, the rodentiæ are the ones which it resembles the most in the teeth, and it is very unlike them in form and in habits. It seems that the teeth are not constant in number, but, generally speaking, there are two incisors in each jaw, placed very remote from the grinders, and sometimes with a tooth in the interval, somewhat resembling a canine tooth, but as often without this. Even the incisive teeth do not appear to be constant in their number, but to vary from two to six, to be thick and strong when few in number, and small and weak when many. The small ones are most frequently accompanied by canines, two in each jaw. These canines are crooked, but have flat oval crowns, and nothing of a carnivorous character about them.

The full-grown wombat is nearly the size of a badger. Its body is thick and heavy; its head large and flat; its eyes and ears small, the former moderately opened, so as to indicate an animal that lives partly above ground and partly below; the legs are short, and the fore legs are supported by clavicles, so that they have a cross motion, by means of which the animal can burrow readily in the ground; there are five toes upon each of the feet; but the inner toes on the hind feet are very small and without claws; the claws on the fore feet are very stout, and fitted for digging; and the three middle toes are supported for some length by a connecting membrane; the feet are plantigrade, or have the entire sole applied to the ground in walking; the covering of the body is rough and thick, and of a greyish-brown colour, paler about the ears and neck than on the rest of the body; the tail is reddish-brown, but it is so exceedingly short, as to be almost entirely hidden by the fur of the surrounding parts, and the ears are nearly concealed in the same manner.

The whole of the senses appear to be duller in this animal than in almost any other. It is perfectly passive even to danger; for any one who meets with a wombat may lift it and carry it off, not only without its offering any resistance, but absolutely without its making any complaint. In consequence of the extreme mildness of its disposition, it can readily be made to reside in houses, though it appears to be susceptible of hardly any education. It spends the greater part of the day in sleeping, during which it rolls itself up in the form of a ball. In the wild state it lives entirely upon vegetables; but when kept in

confinement it eats a greater variety of food, and it has no objection to milk. It readily eats all sorts of fruits, roots, and culinary vegetables, and also bread; so that it is just as passive in the taste of its food as in any thing else. It is understood that the seal-fishers about Bass's Straits keep it in their huts, where it is not only as tame as a dog, but a great deal tamer, inasmuch as it is perfectly indifferent to the appearance of strangers. It is not of course to answer any of the purposes of a dog that so dull and passive an animal is kept, but rather to answer those of a pig. The flesh of the wombat is considerable in quantity, and said to be more juicy, more tender, and every way better in quality than that of any other marsupial animal, and the animal itself is certainly more easily taken than any known species of game. For these reasons it has sometimes been proposed that Australia should send the wombat to Europe to become a domestic animal, as some slight return for the European animals which constitute a very important portion of the wealth of the colonists. Two live ones were once in the French museum, but they did not live long, and it is exceedingly doubtful whether so very simple an animal could be kept in a European farm-yard, as the poultry would be very apt to peck at it, and the pigs to trample it to death.

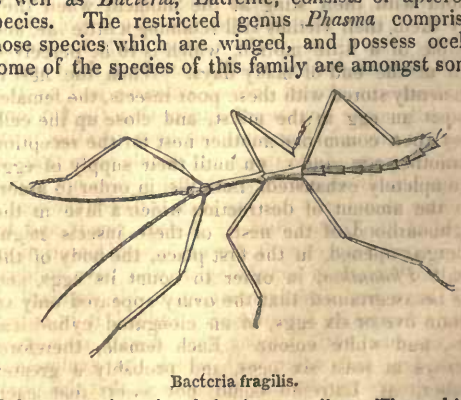
The geographical range of this animal appears to be very limited, being confined to some part of the shores of Bass's Straits, and to the islands situated there. It appears, also, that it is now very rare compared with what it was when those Straits were first discovered; and it seems to be in rapid progress towards extinction, so that, as we have said, an entire genus, and indeed an order, will be blotted out from the living inhabitants of the world.

PHASEOLUS (Linnæus). A large and useful genus of climbing herbs, natives of many different parts of the warmer parts of the world. The flowers are diadelphous, and many of them very beautiful, the genus belonging to *Leguminosæ*.

The kidney-beans are in every garden, and so well known, that they need no description. There are many species, and of both dwarfs and runners many varieties. The young pods of the dwarfs are one of our most delicate table vegetables; and the scarlet or rough runner, *P. multiflorus*, is one of the most useful cottage garden products.

PHASMIDÆ. An extraordinary family of orthopterous insects, belonging to the section *Cursoria*, and distinguished by the more or less elongated form of the body, exposed head, tarsi five-jointed, posterior wings longitudinally folded, and fore legs simply formed for walking, and not raptorial as in the *Mantidæ*, with which family they were long united. We have taken occasion in various instances of calling attention to some of those curious resemblances which exist between animals or tribes of animals of very different structure; but the creatures now under consideration exhibit perhaps the most striking similarity which could be desired between animals and vegetables. The author of this article has repeatedly been asked, when showing his collections of these insects to persons not versed in such matters, how he could wish so far to deceive them by fastening together bits of stick and old withered leaves, and patching them into something of the shape of insects! for the fact is, that so completely do some of these creatures resemble pieces of vegetables, that their ordinary names are walking-stick insects, leaf insects, an mated leaves, &c.; and surely to see some of the arranged upon a twig as Donovan has arranged the in one of his plates of "Indian Entomology," the de ception is complete. But it is not alone in form tha this similarity exists, but also in their colours, so tha to adopt an interesting theory propounded by th authors of the "Introduction to Entomology," would seem as though the Creator had impressed thes forms and colours upon these creatures, in order t guard them from the attacks of their enemies, wh are thus deceived, mistaking them for portions of th plants upon which they subsist. We are aware tha objections may be urged against this theory, and tha these kinds of resemblances may be termed merel freaks of nature; but as we know that instances ma be produced in which the precisely opposite effect produced, namely, where predaceous creatures lyin in wait for their prey are also hidden as it were fro the sight of their victims by the like similarities appearance, we cannot but think that concealment as much the object in one case as in the other.

These insects are inhabitants of tropical climate a very few species of comparatively small size bein found in the south of Europe. They delight in re maining stationary upon the branches or twigs of plant The females are provided with a strong apparatu enabling them to bury their eggs under the bark trees. According to the Rev. Lansdown Guilding who has published an interesting Memoir upo *Phasma cornutum* in the Linnæan Transactions, th insect remains tranquil all day, but at night it devou a great quantity of leaves; its motion in walking unsteady; and when it loses one of its legs in th larva state, the organ is reproduced, of a smaller siz at the following moulting. The student must consu the Synopsis of *Phasmidæ*, of Mr. G. R. Gray, fo fuller details and a notice of the various species, di tributed into many sub-genera. The family is div sible, as the names noticed above imply, into tw groups or sub-families, *Phasmides*, with the bod slender and stick-like, and the legs long; and *Phy lides*, with the body broad, very thin, and more less leaf-like, and the legs short and dilated. Thes two sub-families are divided into various generic an sub-generic groups. In the *Phasmides*, some hav the antennæ very short (*Bacillus*, Latreille), whic as well as *Bacteria*, Latreille, consists of apterou species. The restricted genus *Phasma* compris those species which are winged, and possess ocell Some of the species of this family are amongst som



Bacteria fragilis.

of the most gigantic of the insect tribes. That whic we have above selected for our illustration of th sub-family *Phasmides* is the *Bacteria fragilis* from Ne Holland, described and figured in Mr. Gray's Synops

of the Australian species of this family, from the collection of the Rev. F. W. Hope. The figure is about half the natural length.

PHEBALIUM (Ventenat). A genus of evergreen shrubs from New Holland, belonging to the natural order *Rutaceæ*. In greenhouse collections they thrive well with the ordinary management.

PHILADELPHEÆ. A small natural order containing only two genera, viz. *Philadelphus*, and *Decumaria*. Of the former there are fifteen, and of the latter three species, already described. The *Philadelphi* are very ornamental plants, possessed of neither deleterious nor useful properties; but some are so strongly scented as to cause headache when introduced into nosegays. The calyx is turbinate, with the limb in four divisions. Petals four or five, inserted into the calyx. Stamens attached to the throat of the calyx, and shorter than the petals. Style four or five parts, stigma oblong, capsule four or five-celled and many-seeded.

The *Decumarias* are climbing shrubs from North America, with icosandrous flowers, having a many-toothed bell-shaped calyx. Petals from seven to ten, stamens numerous, anthers double, style cylindrical, stigma peltate, with many rays, capsule valveless, and many-celled. They are hardy plants, and increased by layers or suckers.

PHILANTHUS (Fabricius). A genus of hymenopterous insects belonging to the fossorial *Aculeata*, and family *Crabronidæ*, but confounded by that author with the genus *Cerceris*, Latreille, from which it differs in having the abdominal segments not narrowed at the base, without any peduncle, and with the second submarginal cell not petiolated as in *Cerceris*; with this genus, however, it agrees in the predatory nature of its habits, and which render the *Philanthi* some of the most obnoxious of insects in places where they abound. Fortunately only one of the species has been found in this country, *P. androgeneus*, Rossi, and that occurs but very rarely. The typical species, *P. apivorus*, has formed the subject of a very interesting memoir by Latreille, of which the following is a concise abstract. The females of this insect make their nests in sandy places, where they form deep and cylindrical burrows, in which they deposit a considerable number of honey bees, (*Apis mellifica*), which they slightly wound with their sting at the moment when they bury them, their victims still retaining a little life, and capable of a little motion, which is to be perceived even at the end of many days. When the nest is sufficiently stored with these poor insects, the females deposit an egg in the midst, and close up the cell. They then commence another nest for the reception of another egg, and so on until their supply of eggs is completely exhausted. Latreille, in order to ascertain the amount of destruction which a hive in the neighbourhood of the nests of these insects might undergo, opened, in the first place, the body of the female *Philanthus*, in order to count its eggs, and thus he ascertained that the ovary appeared only to contain five or six eggs, of an elongated cylindrical form, and white colour. Each female, therefore, destroys at least six bees, and probably a greater number, as Latreille could not assert that each larva consumed only one bee, many of which were rejected and others abandoned. Latreille moreover counted on a space of ground, 120 feet long, about fifty or sixty female *Philanthi* occupied in the construction of their nests. This space of ground, therefore, at the lowest calculation, must be the tomb of between three and four hundred bees.

The larva is produced from the egg in a very short time, and in a few days consumes the food laid up for it in store. It then forms a cocoon, which appears rather to be a viscid secretion, than to be spun with silk, and which when dry becomes a flexible membrane. Within this cocoon the larva remains unchanged for many months, and does not become a pupa until the end of the winter, and hence there is only a single generation in the course of the year. The food of the different species varies in its nature, some preferring *Andrenæ*. In the perfect state, they very much resemble wasps, and feed upon honey, and the nectar of flowers; whence evidently is derived the generic name, which signifies lovers of flowers. This genus is not numerous in species; and the colour of the insects is generally black, varied with yellow.

PHILEDON—Nectar-sucker (*Meliphaga*). A genus of anizodactylic birds, which, as their name imports, subsist, in great part, upon the sweet juices which they gather from the nectaries of flowers. This is a peculiar mode of feeding for birds, and these birds are peculiarly organised, so as to adapt them to it. They also inhabit peculiar localities, where the productions of the vegetable kingdom are of a different character from what is met with any where else. The species of this genus are numerous; but notwithstanding their numbers, they are not generally distributed even in corresponding latitudes. There are none in America, in Europe, in Africa, or in continental Asia; and we believe there are few in those Oriental Isles which may be considered as partaking of the Asiatic character, or intermediate between it and the islands which spot the wide Pacific. New Holland, and especially the scattered isles which geographers include under the general name of Oceanica, are the only countries where birds of this genus are found; and though there are many of them in European museums, and some of them are very numerous in their native countries, their manners are very little known.

In the isles and regions of perpetual verdure, where some plants are always in flower, and many trees are rarely found without both flowers and fruit, these birds keep constantly flitting about from spray to spray, collecting the means of their subsistence.

They have frequently been confounded with other tribes of birds, such as the bee-eaters, the creepers, and even the thrushes, from all of which they are separated by distinct characters and habits, so far as the latter are known or can be guessed at. It is highly probable that the mistakes of the more early describers, respecting their proper place in the system, have been among the causes why so little attention has been paid to the ascertaining of their proper function in nature. This is indeed greatly the case with all the birds of Oceanica; and yet in their numbers, the beauty of their plumage, and the singularity of some of their forms, they are among the most interesting of all birds. It should seem, however, that those who visit these islands are far more anxious to bring home the mere skins of the birds, often mutilated or in bad condition, than to bring any portion of their history, or of the relations which subsist between them and the other productions of nature in the countries which they inhabit. The absence of

this information is a sad breach in the continuity of our knowledge of the growing and living world; but it is a breach which cannot in the mean time be made up, and therefore we must content ourselves with a statement of the generic character, and of the sizes and colours of some of the species.

The generic characters are as follow: the bill not longer than the head, of moderate thickness, a little convex, sharp, and curved a little toward the point, which is furnished with a notch in many of the species. The bill is depressed at the base, where the culmen advances a little on the forehead, and the cutting edges are margined. The nostrils are in the sides of the bill, at variable distances from the base, and covered in part by an arched membrane, which is naked of feathers. The nasal grooves in the bill are large, and produced toward the point. The variations in the positions of the nostrils, and especially the presence or the absence of a notch in the bill, would lead us to conclude that there are sufficient differences of habit among these birds, for warranting the separating of them into several genera; because the notched bill is decidedly insectivorous in its character. The tongue is peculiar; it is lengthened, a little extensible, and furnished with a bunch of cartilaginous fibres at the tip, by means of which the bird is understood to collect the sweet juices; the feet are of mean length, containing four toes, there are three in the front and one in the rear, the hind one is furnished with a very powerful claw; the wings are of moderate length, and rounded, the fifth quill being the longest. This form of the wings is against the birds' taking long flight; though it is the best form for enabling them to beat easily at short distances over plants and trees in search of food. The species as enumerated in the books amount to about sixty, varying from five inches in length to about ten or eleven; and not so remarkable for the brightness of their colours as many other races of birds of the same country.

Spotted Philedon (*M. maculata*). This species belongs to the remote isles of the Pacific, and is about five inches and a half in length; the upper parts yellowish green; the chin and space round the eyes deep grey, marked on the top by a white band passing from the gape over the eyes; the ear coverts golden yellow; and the under parts greenish yellow spotted with brownish ash; the bill is red at the base and black at the point, and the feet an ash colour. The female is brown above, with the top of the head ash; and nearly white on the under part, but mottled with little blue spots on the breast.

Black and white Philedon (*M. melanoleucos*), is a New Holland species, about six inches in length. It is grey on the upper part, brown on the forehead, with a white spot over each eye; the quills and tail feathers are black, with some of their webs yellow and others grey, and the tips of the outer tail feathers white; the middle of the breast and the belly are black; the flanks grey, the feet brown, and the bill black.

Yellow-winged Philedon (*M. pyroptera*). This is another New Holland species, about six or seven inches long. The upper part shining grey, with a yellow spot on the ear covert, and a little brush of black feathers above it; the rump is yellowish ash; the quills and tail feathers are yellow with the exception of the two middle ones of the latter, which are black; the under parts are whitish, streaked with delicate lines of grey on the breast; the bill and feet are black. The female has the quills rusty red; and th under part yellowish, mottled with russet on the bell

Such are one or two examples of the genus *Philedo* and though we were to enumerate the whole six species, we should not be able to add much, or inde any additional information, numerous as the bir are.

PHILLYREA (Linnæus). A genus of evergree hardy shrubs, having diandrous flowers, and belon ing to the *Olcinæ*. They are some of our most co mon shrubbery plants, and are propagated by laye

PHLEUM (Linnæus). A genus of useful grass mostly natives of Europe. The *P. pratense*, maj and minor, are the cats-tail grasses of the Britis farmer, and are common in every meadow.

PHLOMIS (Linnæus). A genus of shrubs an herbaceous perennials, mostly European, and belongi to *Labiatæ*. The *P. fruticosa* is called the Jerusale sage, an ornamental plant common in our shrubb ries. All the species are more or less showy, an are all easily propagated.

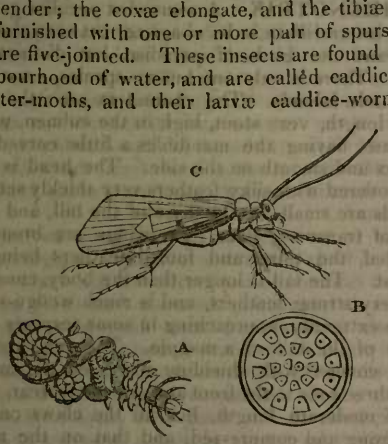
PHOCA, the genus seal, or perhaps more co rectly, *Phocidæ*, the seal family, an account which in their relations, habits, species, and comme cial uses, will be given in the article SEAL.

PHRENOTRIX. A somewhat peculiar genus birds, intermediate in its character between the cro tribe and the birds of paradise, but distinct fro both. There is only one known species, a native the Sunda Islands. The characters are: the bill mean length, very stout, high in the culmen, wide the base, having the mandibles a little curved, an convex and smooth on the side. The head is larg and covered with silky feathers very thickly set. Th nostrils are small, at the base of the bill, and in th form of transverse slits. The wings are broad an rounded, the third and fourth feathers being th longest. The tail is longer than the body, consists ten very strong feathers, and is much wedge-shape at the extremity, approaching in some respects to th shape of the tail of a magpie. The feet are ver stout, covered with shielding scales on the interio with three toes to the front and one to the rear. The are of moderate length, but all the claws on the are strong and compressed, and that on the middl front toe is rather longer than the others. Th whole structure of this bird points out that it is short flyer, practising a good deal of ascent an descent, and spending a considerable part of its tim on the ground.

There is only one known species, which is an ex ceedingly common bird in the Island of Java. It not a gaudy bird in its plumage; but still it is a ric one. Its general colour is a sort of brownish smok grey; but glossed with reflections of every tint colour between bright green and yellow. The hea is deep black; and the coverts of the wings an shining olive green. Its total length is betwee fourteen and fifteen inches, of which the tail occupi more than one half. Plentiful as it is in its nativ country, its manners have not been much studied and that such should be the case, is matter of regre It is unquestionably what is usually termed a con necting link between the crow tribe and the birds paradise. We know the habits of the crows abun antly well; but we are very ignorant of those of th birds of paradise. It is highly probable that if th habits of this one were diligently studied, they woul lead us to at least some knowledge of the habi

of the others, which are so interesting in their appearance, from the singularity of their plumage. See Bird of Paradise.

PHRYGANEA (Linnæus). An extensive genus of insects, constituting, in the system of Latreille, the third and last great section of the neuropterous order *Plicipennes*, but formed by Mr. Kirby into a distinct order, *Trichoptera*. Without entering into the question of the ordinal or other rank of this tribe of insects, it will be sufficient to state the chief characters in which they differ from the other neuropterous insects. The mouth is of an obsolete character, the mandibles being either entirely wanting or minute and membranous, as are also the under jaws and lip; the palpi are, however, present, which of course proves the presence of the organs of which they are appendages; the posterior wings are generally larger than the superior, and folded longitudinally when at rest, at which time the organs of flight are laterally deflexed, the anterior pair being more or less pilose, and the nervures are for the most part longitudinal, and branching with very few transverse connecting nerves; the eyes are prominent and globular, the ocelli two in number; the abdomen soft, and not furnished with terminal setæ; and the legs are long and slender; the coxæ elongate, and the tibiæ generally furnished with one or more pair of spurs; the tarsi are five-jointed. These insects are found in the neighbourhood of water, and are called caddice-flies or water-moths, and their larvæ caddice-worms, in



which latter state they reside in the water in cases of sand, shells, &c. (fig. A) as described in the article Caddice Worm. Both in their larva and perfect state they are excellent baits for fishing. The pupa is inclosed within the case formed by the larva; it is of that species termed incomplete, having all the limbs distinct, but folded upon the breast, the head being, moreover, furnished with a pair of curved mandibles, which appear to be applied to no other use than that of making a passage through an open-work grating of silk (fig B), which the larva had formed at the opening of its case previous to assuming the pupa state. This grating hardens in the water, and becomes indissoluble; strong threads crossing each other forming a small thickish circular plate of brown silk, which becomes as hard as gum, and fits exactly into the opening. De Geer has described and figured several of these cases thus grated at one end; and Reaumur has ascertained that the holes left in the grating were for the purpose of breathing, by admitting a current of fresh water, effected evidently by the spiracles of the pupa; and he actually saw the grate-work in alternate motion, from convex to concave, as the water passed out and in. When, therefore, the time arrives for the insect to quit its watery abode, and assume the winged state, it is endowed with powers of motion far greater than are possessed by any other incomplete pupa, so that it is enabled not only, in the first place, to cut through the grating of silk, but afterwards to creep out of its case, and ascend into the air, where it throws off its outer skin, and appears as a caddice-fly (fig. C.) The species are found flying, chiefly after sunset, about streams, ponds, &c. They are of a small or moderate size, and generally of obscure pale brownish colours. They greatly resemble each other in general appearance, although sufficient characters are to be found in the nerves of the wings, the form of these organs, colours, &c. Dr. Leach divided this tribe of insects, as an order, into two families, *Leptoceridæ* and *Phryganidæ;* but M. Pictet, in a very valuable work, recently published, upon the *Phryganeæ* of Switzerland, has divided them in the following manner, according to the structure and habits of their larvæ, which he confirmed in a subsequent table founded upon the characters of the imago.

I. Larva, with a case opening with a round hole.
  1. Segments of the thorax rounded, external respiratory organs isolated. *G. Phryganea.*
  2. . . . in tufts.
    a, Hind legs long, *G. Mystacida.*
    b, Hind legs short, *G. Trichostoma.*
II. Larva, with a case opening by a cleft, *G. Hydroptila.*
III. Larva, without a case.
  a, Pupa, with a double envelope, *G. Rhyacophila.*
  b, Pupa, with a single envelope, *G. Hydropsyche.*

In addition to these genera, Messrs. Stephens and Curtis have respectively proposed various others in their more recent works.

The genus *Phryganea*, as restricted, now comprises those species which have the posterior wings larger than the superior, and longitudinally folded, with transverse nerves; the maxillary palpi of moderate length, and slightly hairy. In the genus *Mystacida* the palpi of the males are very long, hairy, and porrected, resembling a pair of legs, and the antennæ very long; they are of small size, and fly in swarms over the surface of water. The genus *Hydroptila* comprises the species of smallest size, which have very much the resemblance of minute moths.

PHRYNUS (Olivier; Tarentula, Fabricius). An extraordinary genus of arachnidous insects, belonging to the order *Polymerosomata* of Leach (*Pedipalpi*, Latreille), and forming the type of the family *Phrynidæ*, in which the abdomen is attached to the thorax by a narrow peduncle, or by a portion of its basal diameter, without the curious comb-like appendages found in the other family of this order (*Scorpionidæ*); the antennal claws are small and incurved; the palpi very large and spinose, resembling legs, forming a kind of hook; they have eight eyes; the body is flattened, and the insects resemble large spiders; the anterior legs are very long, and terminated by a slender and multi-articulate tarsus. They are of considerable size, and inhabit the tropical parts of Asia and America. *Thelyphonus*, Latreille, differs in having the body longer, and terminated by a jointed tail. The *Phalangium reniforme*, Linnæus, is the type of the former genus; the *Phalangium caudatum* of the latter.

PHYLLIUM—Walking-leaf Insects—(Latreille). A genus of orthopterous insects, belonging to the family PHASMIDÆ (which see), and forming the type of the second sub-family *Phyllides*, which consists of the genera *Phyllium* and *Prisopus*, divided by Gray into several others. In *Phyllium* the females are not furnished with posterior wings, and their antennæ are very minute; whilst in *Prisopus* the females have both wings and wing-covers, and their antennæ are of moderate length. The *Prisopus horridus*, figured in our plate of orthopterous insects, is from Mexico, and has not before been represented.

PHYLLOSOMA (Leach). A genus of crustacea, belonging to the order *Stomapoda*, and forming the type of the second family *Bipeltata*, Latreille, (*Phyllosomidæ*). These curious animals are called glass-crabs, from the slender and transparent form of their bodies, which is very flat and membranous, divided into two shield-like plates, the anterior very large and oval, forming the head, and the second, or thorax, transverse and angulated. The legs are very long and slender, and each is furnished with a small ciliated branch. These delicate creatures are found in the tropical parts of the Atlantic and Indian Ocean, and one has been discovered in the Mediterranean. When alive they are entirely colourless, except the eyes, which are of a rich blue. There are several species described by Leach and Guerin.

PICUCULI (*Dendrocopus*). A genus of anizodactylic birds, nearly agreeing in the structure of the feet with the creepers of Europe, but in some other respects partaking of the characters of the woodpeckers. They have been variously classed by writers on ornithology, being distributed through various genera, and not agreeing very well with either of them. They were first brought out of this confusion and formed into a separate genus by Temminck; and, though they vary a good deal in size in the different species, the genus is far from being an ill-defined one.

The generic characters are: the bill depressed and triangular at the base, compressed or slender at the point, not furnished with a tooth, straight in some species and curved in others, and with scarcely any nasal grooves; the nostrils are placed laterally at the base of the bill, they are oval and open; the tongue is cartilaginous, but short, and has none of the peculiar characters of the tongues of woodpeckers; the feet are of mean size, and the tarsus is never longer than the middle toe, and sometimes a little shorter; the external and middle toes are of equal length, and united as far as the second joint; the inner front toe is very short; and all the toes are furnished with very sharp and crooked claws, furrowed on their under sides so as to be able to keep their hold upon very slight inequalities of the bark of a tree; the wings are of moderate length and rounded, the fourth and fifth quills being the longest; but the quills fall upon and support each other in a way which gives great firmness to the point of the wing; the tail is wedge-shaped, or rather oval, at its extremity; the shafts of the feathers in it are remarkably strong and stiff, and have firm points beyond the webs, as in the woodpeckers.

From the structure of the tail, we can easily infer that these birds can make use of that organ as a support, while they hold on with the claws upon the upright stem of a tree. In consequence of the structure of the feet, they cannot hold on so firmly or so long as the woodpeckers; but the same structure which renders them inferior in this respect renders them superior in another, namely, in running in all directions along the bark as the creepers do. It is probable that they are not quite so dexterous in this way as the creepers, the rapidity and variety of whose motions are truly wonderful; but the support of the tail enables them to perform severer labour at one place. Their bills, though rather firm and strong, are not equal to the task of making a hole in wood, or even in hard bark, and the absence of a notch shows that the birds do not feed upon large insects. We know but little of their manners, because they remain in the forests, and move so nimbly, that it is difficult to get a sight of them. It is the same with the creeper. It is far from being a rare bird in the extensive woods of Britain; and yet one may pass fifty times through a wood without seeing one. It is understood that the picuculis pick out, from the little crevices of the bark, the insects, larvæ, and eggs, which have been deposited there; and, from the numbers and activity of the birds, the services which they render in this way must tend greatly to preserve the trees. They are understood to nestle in the holes of trees, though they never excavate holes for themselves; their eggs vary from four to six, and they are very attentive to their nests.

They are distributed through all the wooded parts of South America, and so far as is known they are peculiar to that country. They also appear to be more numerous in Paraguay and Brazil, than in the valleys of the Amazon and Orinoco, or on the rich shores of Guiana, although in all probability the apparent difference arises as much from the difficulty of seeing them in the very close forests of the places last mentioned.

It is to be regretted that we know so little of a genus of birds containing seventeen or eighteen species, all confined to one locality of the world, and at work in preventing the trees from being attacked by their smallest and most dangerous destroyers. Their presence in South America and in no other place, shows that the trees there want protection in a manner a little different from those any where else. Before, however, any thing like correct information respecting the forests of South America and the living inhabitants can be obtained, the relations must be traced between all the races of birds which are at work upon and among the trees, and the relative value of each carefully estimated. If done, this would be a work of great value; but the labour of doing it would be immense, if not altogether insurmountable. We shall mention only one or two of the species.

Great Picuculi (*D. major*). This species is from Paraguay, and is the largest of the known ones, being more than twelve inches in length. The general plumage is a reddish-yellow brown, streaked with black and white on the fore neck and breast, and there are also some streaks of blackish colour on the rest of the under part. The bill is large, a little bent, and of a blue colour; and the feet are greenish.

Straight-billed Picuculi (*D. angustirostris*). This is also from Paraguay, and about three inches in length. It is russet-brown on the upper part; has a white streak over each eye; and the top of the head, the nape, and sides of the neck, mottled with black and white. Wing-coverts and tips of the quills brown, but the bastard wing white; the throat is also white, and the rest of the under parts whitish, clouded with brown spots. The bill is brown on the upper ma

dible, and whitish on the under; and the feet are lead colour.

Red-winged Picuculi (*D. rubicundus*). This is also of Paraguay, and the smallest and handsomest in its plumage of the whole genus. Its total length is five inches. The upper parts are brown, lightly glossed with gold; the sides of the head spotted with brown and white; the smaller coverts of the wings and the tail feathers are carmine red; the larger coverts brown with red borders, and the lower parts mottled with brown and white; the bill is black above, and whitish below.

White-throated Picuculi (*D. albicollis*). This species is of Brazil, and measures six inches in length. The upper parts and the breast are brown, streaked longitudinally with white; top of the head black, spotted with russet; wings russet-brown; bill and feet also brown.

Such are a few of the species; and, in the state of our information respecting the economy of the birds, an enlargement of the details would afford no useful information.

PICUMNUS. A genus of birds, containing three or four birds with zygodactylic feet, which were once confounded with the woodpeckers, though they are perfectly distinct. They are very small birds, most of them being less than four inches in length, and the very largest not much more.

The characters of this genus are: the bill straight, conical, pointed at the tip, higher than broad, and without any distinct crest; and the two mandibles are of equal size and strength, and entire in their margins without any notch; the nostrils are basal and lateral, linear in their form, and concealed by feathers which project forward from the front; the tarsi are short, and the toes three or four, always two to the front, and consequently one or two to the rear; the front ones are united as far as the first articulation, but the hind ones are entirely free; the wings are much rounded; and the shafts of the tail feathers are flexible, so that the tail cannot be used as a means of support upon the bark of trees, as it is in the preceding species and the woodpeckers. It is worthy of remark, that both these birds and the woodpeckers should have such a variety in the genus as that some should have four toes and some only three, though it does not appear that there is any considerable difference of habit connected with the different structure. Very little is known indeed of the habits of these birds; but it is said that they are found on the stems of bushes rather than those of trees, and that they perch crosswise. It is probable that, with this difference in the magnitude of the plants upon which they climb and seek their food, their general manners do not differ greatly from those of the other insectivorous climbers to which they are allied; and it is even said that they dig into the bark in the decayed places of trees, something after the manner of woodpeckers. They are found only in the woody parts of tropical countries, though they are more abundant in America than on the eastern continent. They have not been observed in Africa or continental Asia, though one species at least has been ascertained to inhabit the Sunda Isles. They have no general English name, having generally been regarded by English describers as small woodpeckers.

P. abnormis. The specific name is given to this one, because it has only three toes, in a state so developed, as to be of much use in climbing. The internal toe behind is nothing but a little callosity, marking the place of the toe, as in the three-toed woodpeckers. This is the smallest known species; and it is a very little bird, being only three inches in length, which is three quarters of an inch shorter than the golden-crested wren, the smallest of British birds. Indeed it is so very small, that it can with difficulty be seen in the thick forests, where it finds its food. The upper parts are beautiful green, clouded with ash colour on the hindhead; the forehead, the space on the eyes and the cheeks, are marroon brown, with a circle of naked red membrane surrounding the eye; the rump and under parts are russet, with reflections of yellow; the coverts are black, and the bill is black on the upper part, and reddish white on the under; the feet are reddish brown. Notwithstanding its diminutive size, it is a gaily attired little creature, but we know scarcely any thing of its habits.

P. minutus. This is rather larger than the Javese species; but we believe it was named before that was discovered. It is a native of the forests of tropical America, and is probably much more extensively distributed than has been hitherto ascertained. Its length is about three inches and a quarter; and like all the American species, it has four toes on each foot. The upper parts are brown, powdered over with a number of brown and white spots; and the cheeks and rump brownish, powdered in nearly the same manner; the forehead, and part of the top of the head, are exceedingly bright red; the quills are brown, and so are the coverts, but the margins of the first are paler than the middle of the feathers, and those of the last are darker; the under parts are yellowish brown, streaked with dark brown; and the feet are lead colour.

P. exilis. This species has been brought from Brazil, but it is highly probable that it occurs in many other parts of America. It is larger than the preceding one, though still a quarter of an inch shorter than our golden-crested wren; the upper parts are brownish ash; the top of the head black, delicately marked with very small white spots; the forehead, the nape, and the cheeks are orange red, passing into whitish on the sides of the neck; the primary quills have the exterior borders brown, the middle coverts are whitish, and the tail feathers black and brown; the under parts are whitish, the bill brown, with black at the base of the lower mandible, and the feet are russet.

P. cirratus. This also is from South America, and it is the largest of the known species, measuring fully four inches in length; the upper parts are brown, with the margins of the quills and wing coverts paler. The top of the head is furnished with long feathers, which are capable of being erected into a large and rather handsome crest. These feathers are intense black, finely spotted with pure white. The forehead is bright red; the cheeks are cream colour, with a white eye-streak, and a brown spot on the ear covert; the tail feathers are blackish, with a white band on each exterior, one mottled with black, and half the two middle feathers is entirely white; the under parts are whitish, clouded with brownish, and streaked with deep brown on the flanks; the blll is whitish in the greater part of its length, but black at the tip, and also at the base of the lower mandible.

The species above enumerated include all that are contained in this singular genus; and the birds are peculiarly interesting, as composing the last and

smallest genus which have the especial protection of the wood of trees committed to them. The woodpeckers, which we find in greatest abundance in temperate, and even in cold latitudes, stand at the head of this grand division of birds, which ought, in a natural system, to form a separate family; for though some genera are zygodactylic, and others anizodactylic, yet this difference of the feet is not sufficient foundation for distinguishing the groups. Besides this, we have seen that the zygodactylic have the feet differently modified, and consequently adapted for different kinds of motion upon the trees; some of the woodpeckers, and also of the genus under consideration, having only three toes, while the typical birds have four. From the difference in size between the outer and inner toe in the feet of the three-toed birds, the outer toe answers nearly the same purpose as the outer and middle toes of the anizodactylic foot. There is also a closer approach than this in the structure; for the two outer toes of the anizodactylic foot are united a considerable way at the bases. Both this foot and the three-toed foot have therefore a point of support less, than is possessed by the four-toed zygodactylic foot; and it is a remarkable fact in nature's mechanics, that whenever an organ is to have motion in an additional number of directions, the structure of the organ is always simplified. The woodpeckers, whose most laborious work, that of punching large holes in the trees, requires that they should remain firm and stationary, in an upright position, for a considerable time, have the feet with four points of support upon each, nearly equally balanced backwards and forwards. The parrots, and other birds which climb by grasping, and rarely if ever change their position by simple motion, have the grasp or clutch of the foot of the very best form for their habit. The birds which have the points of support in the feet reduced to three, whether the outer one in front is one single toe, or two partially united, are on the other hand formed for running in almost every direction upon the stems or branches of trees, without clutching or any other means, except holding on by the claws; and they may be considered as really having the hardest labour of the whole. The woodpecker may be compared to a mason on his scaffold; the parrot to a gardener on a tree gathering apples; but the bird which runs on the bark has nothing corresponding to it in human action.

We have purposely selected such names as should bring those three genera of birds together, in order that the grounds of all their agreements and disagreements might be at once understood by the reader; and we have entered somewhat at length into the particulars, because these birds, taken in conjunction with the trees which their labours so tend to preserve, are among the most interesting productions of nature.

PICUS—woodpecker. An extensive and well-defined genus of *zygodactylic* or yoke-footed birds, distributed over most parts of the globe, and performing a very important function in the economy of nature. Woodpeckers are generally speaking handsome birds, neatly and stoutly made, remarkably firm in the texture of their plumage, and generally speaking handsomely coloured.

The genus are very easily defined, both by their structure and their habits. The bill is long, straight, supported by angular ridges, and remarkably hard and firm in its texture, especially toward the tip, which is however generally worn smooth by the severe labour which the birds have to undergo; the tongue is slender and very extensile, being capable of being projected beyond the tip of the bill, by the action of the long horns of the *os hyoïdes*, or proper bone of this tongue. The point of this tongue is doubly furnished for capturing the prey upon which the bird feed: it is beset with cartilaginous barbs, approaching to the consistency of horn, and inclined backwards and it is furnished with a glutinous secretion, by means of which it can readily take up small substances, and convey them into the mouth of the bird, when the tongue is drawn backwards; the tongue can be withdrawn with great rapidity, by means of two muscles which are coiled round the trachea; and when these act, the horns of the *os hyoïdes* are drawn till they stand directly upwards, and the tongue is folded back towards the entrance of the gullet. This action of the tongue, by the muscles which move it not being in any way inserted in the bones of the head and neck, is quite a distinct motion from that of the bill and may be carried on independently of it; the muscles which move the bill and head are still more powerful, so that the point of the bill acts like a chisel or rather like a little pickaxe, by means of which the bird very speedily punches a hole in the wood of a tree. This is the means by which the race obtain by far the greater part of their food, which consists of insects and larvæ, especially the latter and those larvæ are most abundant in trees after they have passed the maturity of their vigour, and are in an incipient state of decay. The rapidity with which a woodpecker pecks away at its work is almost incredible, and the strokes cannot be counted, nor is it easy to see the motion of the head and neck. The feet are well adapted for holding on, or ascending the vertical trunk of a tree; but they are not so well adapted for descent, so that when the bird takes a more downward direction it must, generally speaking, have recourse to the wing. It can however make its way laterally with great ease; and a woodpecker can get round the bole of a tree much faster than one who is observing it can get round the root.

Woodpeckers have in fact the especial charge of forests which are allowed to perish by natural decay. In such forests they are exceedingly numerous; and in most parts of the world, whether the temperature is hot, temperate, or cold, woodpeckers are there to perform their labours. In America they are exceedingly numerous; though they are most so in North America, inasmuch as many of the trees there are very subject to decay. They occur also in all the wooded parts of Europe, of continental Asia, of some parts at least of Africa, and of the eastern islands more immediately connected with Asia. We are not aware that any true woodpeckers, or at most only one species, have been hitherto found in New Holland, or in the islands of the Pacific; and it should seem that decaying trees in these places and also in many parts of Africa, are attacked by insects in a different manner from what they are in those countries where woodpeckers are abundant. The attack there is made by the mature insect mining into the heart of the tree, reducing the internal part to dust, and leaving the external crust sound; whereas it is the larvæ which are hatched in the decaying wood, or which mine between the wood and the bark, of which the woodpeckers have charge.

Their labours in those countries where they abound

are easily observed, and the use of them in the economy of nature is well understood; but we are not so well acquainted with those characters of the vegetation of countries where there are no woodpeckers which enable them to be dispensed with, and still all the purposes of nature in the forest to be kept up.

As the woodpecker may be said to be made for the tree, the tree appears to be made for the woodpecker. In the former respect, the adaptation of the bird extends even to colour; for woodpeckers found in countries whose forests are different, are differently coloured. Then the bird is quite at home in the tree, which is to it the scene of all its operations. It is its dwelling, its pasture, the resting place for its young, and occasionally as is said a sort of rude musical instrument, by means of which the bird calls, and its mate answers to it.

The sound of the woodpecker is not so frequently heard in the winter; but when the spring begins to call the slumbering world to new life, the woodpecker soon partakes in the impulse of the season. Its first, or at all events its loudest labours, of hammering the tree, are not for the purpose of feeding itself, but seem rather to be a kind of pairing call; and it is not a little remarkable that this call should be a repetition of that sound which the bird most frequently makes in the performance of its appointed labour. The male woodpecker is said to be the one which practises, or at all events begins, this curious species of signal-giving. He finds a hollow portion of the tree, and beats it like a drum with varied pitches and cadences. If a female answers, a place for the nest is soon looked for; and if it be necessary to excavate any portion of the tree in order to make the nest big enough, the pair feed and labour by turns until it is accomplished. They seldom mistake their proper tree, or the proper place of the tree, either for nestling or for a supply of food. We must not wonder at this, or give the woodpecker credit for any forethought purpose; because there is no more approximation to reason in any thing that a woodpecker does after it comes out of the shell, than there is in its coming out of that shell a woodpecker and not any other bird. Still woodpeckers, both on their own account, and on account of the fact of their being closely associated with the majesty of forests, are highly interesting creatures, and we regret that we cannot, consistently with our limits, go farther into their general history. As little can we afford to enumerate all the species, which are very many; but must content ourselves with one or two of each great division of the world in which they are found.

The Green Woodpecker (*P. viridus*). This is by way of eminence the woodpecker of Britain, at least in those parts of the country where the woods consist chiefly of deciduous trees, and the same may be said of great part of continental Europe. As such it has been long known, and has as many names even, in the English language, as a Spanish hidalgo. The length of the green woodpecker is about thirteen inches, and the stretch of its wings about a foot and a half. The bill is two inches long, and of a dusky colour. The tongue is of considerable length. The irides is white, the eyes are surrounded with black, beneath which, in the male bird, there is a crimson spot bordered with black, which, in the female, is entirely black. The feathers on the top of the head are dusky, with cinereous tips. The lesser coverts of the wings, the scapulars, back, and neck, are green. The quills are dusky, the greater ones being spotted on each web with white, and the lesser faintly spotted with the same colour on the exterior webs, and richly bordered with green. The rump is pale yellow; the coverts of the ears and whole under parts are of a pale yellowish green; the feathers of the tail are strong and pointed, alternately barred with dusky colour and green, tipped with black, except the outer ones. The claws are pretty much hooked; and the naked parts of the legs are ash-coloured. This species generally have four or five eggs in a hatch. They are of a transparent white or greenish hue, marked with little black spots. They are placed among the rotten wood in a hole of a tree, generally some fifteen or twenty feet from the ground. Sometimes a little wool or soft vegetable substance is used as a bed for the eggs, but this is more frequently dispensed with. In the breeding season the pair are very affectionate, and seldom separate. They are uncommonly regular in their habits, go early to rest, and do not leave their nest till sunrise. The practice of early roosting is also observed by the young birds, which may be seen scrambling about the tree in which their nest is situated, some time before they are able to take wing. If it is intended to attempt the taming of these birds, it must be begun very early, and even then the chance of success is very slight. They are very strong, and very impatient of confinement; and they use their bills with great effect upon all wooden substances to which they have access. There is, however, no great inducement to the taming of them, as they have no song to compensate for the trouble.

There are two if not three woodpeckers which occur in Europe besides the green one, and one of them at least occurs in some of the upland and lonely woods of the British islands. None of these is so large as the green, and they are more broken in the colours, hence they are called spotted woodpeckers, and distinguished from each other by the spotted "greater," "medium," and "less;" though the comparatives must be restricted to themselves, and not in any way applied to the green one, though *major*, *medius*, and *minor*, have been used as their specific appellations.

Greater Spotted Woodpecker (*P. major*). This species is about nine inches long, a foot in the stretch of the wings, and weighs but half as much as the green one. The forehead, the sides of the head, the scapulars, a patch on each side of the neck, some of the wing coverts, the breast, the belly, and spots on the wings, and the tail feathers, except the two middle ones, are white. The occiput and vent feathers are dull greyish red, and all the rest of the plumage black. The female has no red on the head; and the young males have the red before the black on the head, while the mature males have them placed the other way. This is a hardy and active bird, residing more in cold situations, and in pine forests, than the former species; and as pines, from the turpentine they contain, have rarely insects so deep in the timber of them as deciduous trees have, this bird is not quite so exclusively a woodpecker as the other, but ranges more, and is more miscellaneous in its feeding. At one season, however, the cambium between the wood and the bark of the pine is remarkably sweet, and liable to be very seriously attacked by the larvæ of beetles. It is the same

with the outermost layer of the wood, when the tree begins to decay; for it should seem that this layer contains little if any turpentine; and therefore, if the trees stand too long, the insects marble over this part, by eating tracts in it, and the bark soon comes off in large patches, the rain gets into the wood and the tree falls. This catastrophe is in part prevented by the spotted woodpeckers. The females of these, like those of the former, make their nest in the holes of trees; the eggs are from four to six, and of a white colour. The young are as difficult to tame as those of the former, and there is certainly not more inducement to tame them. Woodpeckers of all sorts are strictly birds of the wild forests, very useful in their particular vocation there, but of no use whatever on cultivated grounds, or near cultivated habitations.

Medium Spotted Woodpecker (*P. medius*). This species differs but little from the former, except in size, in which it is inferior, and in having the bill more slender and sharper at the point. It is found in nearly the same situations with the larger spotted ones, but not so plentifully; and it is said to be less wild in its disposition. It is doubtful, however, whether the variation between them is sufficient to constitute a specific difference, and whether they ought not to be considered as one and the same species, accidentally varied in size.

Less Spotted Woodpecker (*P. minor*). This is a very small bird as compared with the others, being only five inches and a half in total length, of which two and a half are occupied by the bill and tail, leaving only three for the body. Its back is white, with cross bars of black; the rump white, the upper neck behind black; the top of the head crimson, and the under part reddish grey, of a pale shade, and streaked by black lines on the flanks. It is a very pretty little bird, and exceedingly active in its habits; but, as a British bird, it is rare and local; and, as a European bird altogether it has quite a different geographical distribution from the larger woodpeckers of the north. As a British bird this species is found only in the south and west of England; whereas the other one belongs rather to the west of Scotland. In taking a topographical estimate of the three species, which we have enumerated as British, we should be disposed to say that the green woodpecker is a forest bird of the richer parts of the country generally—that the larger spotted one is a mountaineer—and that the smaller one is a more delicate bird, and confined to the dry and warm districts.

In Europe it is probable that there are some others of larger dimensions than even these; and a black one is mentioned, which is four inches longer than the green, being seventeen inches in length, and weighing nearly double the weight of the green one. Its general colour is black, with the crown of the head scarlet, though this distribution of the colours is said to be not altogether constant. Some instances are mentioned of its having been shot in the west of England as a stray, but we are not sure that they are well authenticated. The bird belongs to a more easterly locality, is more powerful on the wing, and more a bird of wild nature and wild places than the others. It comes into Germany both by the line of the forests to the south and east of the Baltic, and by that of those in the valley of the Danube; though it is rare in France, or anywhere to the westward of the Rhine. Altogether, it is to be looked upon as a Siberian bird, or a bird of the confines between Europe and Asia, rather than as a European bird.

We regret that our limits will not allow us to go somewhat more at length into the geographical distribution of European woodpeckers; because the natural history of woodpeckers involves the natural history of forests, and this again involves much of the relative physical geography of countries as compared with each other, and their relative aptitude for being improved by man. This last is the great practical gist of all rational natural history; and if it is not kept in view, all that can be said is really not much better than an idle tale.

The centre of Europe seems most adapted to the green woodpecker, and it takes most abundantly the line of the deciduous forests, where the sap of the trees is sweet and kindly, and they are in consequence subject to the attacks of larvæ. The spotted ones more affect the pine forests, whether of the north, the Carpathian mountains, or the Alps and Pyrenees; but they have not been traced in a manner sufficiently continuous for giving much of absolute certainty to even their geographical distribution; though, were this done, they might be made a sort of index or artificial memory to a great deal of knowledge of a most valuable description.

At the north-east, Europe passes gradually into the character of Asia; and hence we may conclude that the forest-birds of the northern parts of both are nearly the same. In central Asia it is difficult to trace the general geography of any animal; and it is just as difficult to connect Asia, northward of the Himalaya mountains, with Asia to the southward of the same. We must therefore restrict our observations to the mere naming of one or two of the Asiatic species of woodpeckers. On the continent of India, whether eastward or westward of the Bay of Bengal, they do not appear to be very numerous; and, indeed, we could not expect it, because, over many parts of India Proper at least, the wastes are covered with bamboo jungles, and not with trees fitted for the pasture of numerous woodpeckers. The ones in the south of continental Asia are also generally of small size, not so small as the little spotted woodpecker of Europe, but smaller than any other of the European ones.

Green-crested Woodpecker (*P. chloropus*) is an Indian species, measuring about eight inches in length. The upper parts of its body are green; the hind head is furnished with a crest of green and yellow, and there are some lines or markings of yellow surrounding the eyes; the coverts of the wings are spotted with yellowish white; the throat and fore neck greenish, the under parts marked with zig-zag lines of green and white; and the bill and naked parts of the feet brown.

Bengal Woodpecker (*P. Bengalensis*). This is of the same size, and belongs to the same country, as the former, but the markings of its colours are very different. The upper part is black; the top of the head is mottled with a number of white spots; the crest, the middle of the back, and part of the wing-coverts, are bright red; the quills are brown, mottled with white; the tail-feathers blackish brown; the throat and breast brownish, with darker mottlings of the same; the bill is bluish grey, and the feet brown.

The wooded parts of Java, and the other isles of the Sunda group, which abound in forests, contain a number of species of woodpeckers, but they possess

little interest beyond the mere enumeration of their colours. We shall therefore only mention one or two.

Philippine Woodpecker (*P. Philippinarum*) is a native of the group of islands whose name it bears, and measures about eleven inches in length. It is green and brown on the upper part, with some pale red on the head; the wing-coverts are yellowish red; the rump and tail-coverts bright carmine red; the under parts white, mottled with black; and the bill and feet black.

Malay Woodpecker (*P. Malayensis*) is about six inches long. Its general colours on the upper part are reddish grey and brown, and the under parts reddish white and reddish yellow.

Short-tailed Woodpecker (*P. brachyurus*). This is a native of Java, and about eight inches in length. It is dull brownish red, streaked with black on the upper part; the hind head is furnished with a very long crest; the under parts are reddish brown, mottled with black; and the tail is very short.

What we have enumerated must suffice as a specimen of the woodpeckers of southern Asia and the Asiatic Isles. The African ones are not so numerous; but we shall mention one or two.

Cape Woodpecker (*P. aurantius*). This is described as being of southern Africa, and it measures ten inches and a half in length. The upper parts are orange-yellow; the rump and upper tail coverts blackish, as are also the hind neck, the sides of the neck, and the cheeks; the top of the head is red, bordered by a white stripe on each side; the wing coverts are brownish-black on the small ones, and olive-green with golden reflections on the large; the quills and tail feathers are black; the bill and feet bluish-ash.

Double-mustachioed Woodpecker (*P. mystacus*). This is another species of southern Africa, measuring about nine inches. The upper parts are olive waved with yellow; the cheeks and throat are white; the mustachios and front black, the latter dotted with red, and the hind head is red; the quills and tail feathers are brown, mottled with yellow on the webs, and have golden yellow shafts; the front of the neck is white, mottled with olive, the under parts brown, streaked with white, and the bill and feet brown.

There are one or two other species described as African; but as they differ from those mentioned in nothing but size and colour, it is unnecessary to allude to them; besides, in many of the species from southern Africa, it is not very easy to decide whether they are birds of that country, or brought from places farther to the east and north. It is also to be borne in mind, that the forests of India, of the eastern isles, and of great part of Africa, are not very decidedly woodpeckers' forests, and that the birds are consequently of inferior importance in the history of nature there, than they are in places where they are more characteristic.

When we turn our attention to America, especially to North America, we find the situation of things very much changed, and the woodpeckers very numerous and highly interesting. In this part of the world, too, we have the advantage of Wilson's description of their manners, as they were observed by himself in their native woods; whereas from the south and east we have nothing but dry details of colour. North America is indeed more of a woodpecker's country than any other now to be met with on the face of the earth; and their historian has thrown a very high degree of interest over the labours and services performed and rendered by the American woodpeckers. We shall glance at the principal species.

Ivory-billed Woodpecker (*P. principalis*). Wilson gives Linnæus credit for the descriptive nature of this specific name, the bird in question being the prince of the whole genus. His powerful bill is of polished ivory, and his splendid crest is carmine-red, giving him a commanding aspect, and his manners correspond. "His manners," says Wilson, "have also a dignity in them superior to the common herd of woodpeckers. Trees, shrubberies, orchards, rails, fence-posts, and old prostrate logs, are alike interesting to those in their humble and indefatigable search for prey; but the royal hunter now before us scorns the humility of such situations, and seeks the most towering trees of the forests, seeming particularly attached to those prodigious cypress swamps, whose crowded giant sons stretch their bare and blasted, or moss-hung arms midway to the skies. In these almost inaccessible recesses, amid ruinous piles of impending timber, his trumpet-like note and loud strokes resound through the savage wilds, of which he seems the sole lord and inhabitant. Wherever he frequents, he leaves numerous monuments of his industry behind him. We there see enormous pine-trees, with cart-loads of bark lying around their roots, and the chips of the trunk itself in such quantities, as to suggest the idea that half a dozen of axe-men had been at work for the whole morning. The body of the tree is also disfigured with such numerous and so large excavations, that one can hardly believe the whole to be the work of a woodpecker."

Wilson, however, takes the proper view of this most active and energetic bird, and shows that he is a preserver and not a destroyer. "The sound and healthy tree is the least object of his attention. The diseased, infested with insects, and hastening to putrefaction, are his favourites; there, the deadly crawling enemy have formed a lodgment between the bark and tender wood, to drink up the vital part of the tree. It is the ravages of these vermin which the intelligent proprietor of the forest deplores, as the sole perpetrators of the destruction of his timber. Would it be believed that the larvæ of an insect, or fly, no larger than a grain of rice, should silently and in one season destroy some thousand acres of pine-trees, many of them from two to three feet in diameter, and a hundred and fifty feet high? Yet, whoever passes along the high road from Georgetown to Charlestown in South Carolina, about twenty miles from the former place, can have striking and melancholy proofs of this fact. In some places the whole woods, as far as you can see around you, are dead, stripped of the bark, their wintry-looking arms and bare trunks bleaching in the sun, and tumbling in ruins before every blast, presenting a frightful picture of desolation."

This glowing description by Wilson of the havoc which insects commit in the American forests, shows in the most forcible manner the vast advantage which such forests derive from the labours of the woodpeckers in keeping down the numbers of those ruthless destroyers. There have been nearly parallel cases in some of the pine forests of Europe; and it is by no means impossible that the ravages of insects were the chief means of destroying those extensive

forests which once thickly covered the Grampians and other hills of Scotland, and the quality of the remains of which show how exceedingly valuable the timber of those woods would have been, had it been still remaining to be applied to the purposes of the arts. Not many years ago a large extent of the Hartz in Germany was denuded of its timber by insects in the course of a very short time; and the labours of those destructive creatures proceed so rapidly, and are so perfectly beyond every means of human care, that the people even of a country which is supported almost exclusively by its timber, would have nothing left but to stand still and mourn the ruin. Nor would it require more than a single season to destroy every pine-tree in the northern zone of the world, if the mischief were not prevented by woodpeckers and other insect-feeding birds.

The insect plagues defy all human prevention and resistance; and though the individual creatures seem insignificant, their powers are multiplied up, by the countless myriads of their numbers, till they are not only beyond arithmetic, but absolutely beyond conception. In their attacks upon a forest, too, especially upon a forest of pines, which do not produce suckers at the roots, but finally perish, when the terminal buds are destroyed, the destruction is complete; and not a tree of the same species springs again in the same situation. In building, for many parts of ships, and for various other purposes of the most useful nature, the pine is more valuable than any tree in the forest; and, therefore, it is impossible not to regard it as a special instance of the Creator's goodness, that the woodpeckers are specially set to watch over and preserve the pine forests, where the enemy is always in the bud, the cambium, or the newly-formed wood, and not external upon the leaf, or tented up in it so as to be accessible to the slender-billed birds, which take the chief care of deciduous trees. The bill of no such bird can reach the destroyer in the pine, or in the dead tree, after the bark is gone; and it is because of this that the beautifully constructed and powerful bill of the woodpecker is brought into requisition. It must not be supposed that the insects in a dead tree are harmless to the forest; for the fact is exactly the reverse. They pour their myriads upon the living trees till not one is left; and, therefore, whether the woodpecker applies himself to one kind of tree or another, his services are always of value.

The ivory-billed woodpecker is a large bird, as well as a handsome one. Its length is about twenty inches, and the stretch of its wings two feet and a half. The general colour is black, with a delicate reflection of green and greenish purple; the forehead is black, but the head is covered with a crest of rich and brilliant red; there are some white feathers over the nostrils, and the feathers of the crest are also mottled with ash colour, and then white near their bases; but as these mottlings are not seen, except when the crest is erected, it appears wholly of an intense red, when in a state of repose; the sides of the neck and the back are marked by two white lines, about an inch apart from each other, and extending nearly to the rump; the first five quills are wholly black, but part of the secondaries and their coverts are white, and this has procured for the bird the name of the white-backed woodpecker; the tail is black, and oval at the extremity, by the lateral feathers being three inches shorter than the middle ones; the coverts and shafts of those tail feathers are particularly strong, and the stiff webs turned downward, so as to form a hollow on the under side of each. By this means the tail acts with much better effect, in supporting the bird during its labours on the trees. The neck is long, and capable of very powerful motion; and perhaps there is no instrument among the whole feathered race equal to the bill, either in materials or mechanical structure. It is an inch broad at the base; it tapers in those curves which give the greatest degree of strength and stiffness combined; the ridges which strengthen it make it as strong as if it were twice as heavy, and consequently twice as fatiguing to the bird; and the substance of it combines the toughness of horn and the hardness of ivory; the legs are short, but very stout in the tarsi; the length is about an inch and a quarter, and the outer toe is nearly the same; the claws are strong, semicircular in their form, and both feet and claws are leaden blue; the female is rather less than the male, and wants the fine red crest, but in other respects her colours are nearly the same; the last half inch of the tongue is beset with barbs, and the tip of it is nearly as hard as the bill, so that it can draw larvæ out of their holes, much in the same manner as a shot is drawn by means of a ramrod. All woodpeckers have simple membranous stomachs, incapable of reducing hard vegetable matter; and those of all the individuals of this species which Wilson examined, had them well loaded with those large larvæ, two or three inches in length, whose ravages are so destructive to the trees, especially in the warmer parts of the United States.

This, which is by far the most interesting of all the woodpeckers, is not generally distributed indiscriminately over the United States, but is rather restricted to those southerly ones in which insects are so destructive. Virginia is their northern limit on the Atlantic side of the country, though they perhaps range a little farther north in the central valley. They do not migrate, but remain on the same grounds all the year, nestling in the holes of trees, and laying four or five eggs in a hatch, the young from which appear about the middle of June.

The habits of these birds in their breeding places have not been very carefully observed; and the observation of them is attended with some difficulty and labour, in consequence both of the situations in which they build, and of the places of the nests. In the Carolinas, where they are understood to be more numerous than in any other part of the United States, they build in the cyder swamps, that is, in those marshes which are so thickly overgrown with the junipers, which are called cyders in North America, that it is impossible so to explore them, as to ascertain what they contain, or what goes on in them. Such places are highly pestilent in the warm weather, and therefore few have the hardihood to enter them; nor is there any doubt that Wilson shortened his life by his zeal in exploring those unwholesome places, as he was only forty-one years of age when the world was deprived of his delightful, and, in some respects, inestimable labours. The nests are made in the thick trunks of the cyders, at a considerable elevation above the marsh; and it is not necessary that the nesting tree should be absolutely hollow, for the pair of birds working alternately with their powerful bills, can in brief space excavate the solid wood to the extent

which they require. They enter by a sort of winding passage, and then they work downwards to the nest, which must be of pretty large dimensions, and their depth into the wood is never less than two feet, and sometimes as much as five.

Their efficiency with the bill is proved by an anecdote which Wilson relates of a bird that he wounded in the wing, and then contrived to capture, not far from Wilmington in Carolina; but we must allow him to tell his own story. After he had got possession of the bird, "it uttered a loudly reiterated, and most piteous note, exactly resembling the violent crying of a young child; which terrified my horse so as nearly to cost me my life. It was distressing to hear it. I carried it with me in the chair, under cover, to Wilmington. In passing through the streets, its affecting cries surprised every one within hearing, particularly the females, who hurried to the doors and windows with looks of alarm and anxiety. I drove on, and on arriving at the piazza of the hotel where I intended to put up, the landlord came forward and a number of other persons who happened to be there, all equally alarmed at what they heard. This was greatly increased by my asking whether he could furnish me with accommodations for myself and my baby. The man looked blank and foolish, while the others stared with still greater astonishment. After diverting myself for a minute or two at their expense, I drew my woodpecker from under the cover, and a general laugh took place. I took him up stairs and locked him up in my room, while I went to see my horse taken care of. In less than an hour I returned, and, on opening the door he set up the same distressing shout, which now appeared to proceed from grief that he had been discovered in his attempts at escape. He had mounted along the edge of the window, nearly as high as the ceiling, a little below which he had begun to break through. The bed was covered with large pieces of plaster, the lath was exposed for at least fifteen inches square, and a hole large enough to admit the fist opened, to the weather boards; so that in less than another hour he would certainly have succeeded in making his way through. I now tied a string round his leg, and, fastening it to the table, again left him. I wished to preserve his life, and had gone off in search of suitable food for him. As I reascended the stairs, I heard him again hard at work, and on entering had the mortification to perceive that he had almost entirely ruined the mahogany table to which he was fastened, on which he had wreaked his whole vengeance. While engaged in taking a drawing, he cut me severely in several places, and, on the whole, displayed such a noble and unconquerable spirit that I was frequently tempted to restore him to his native woods. He lived with me nearly three days, but refused all sustenance, and I witnessed his death with regret." This anecdote is highly characteristic of this finest of all woodpeckers; and it is just as characteristic of the naturalist as of the bird. With it we must close our remarks, and shall advert to the others more briefly, only noticing farther, that it does not appear that any species, at all resembling this in power and spirit, is found in any other part of the world than North America.

Pileated Woodpecker (*P. pileatus*). This bird is rather smaller than the former, but still it is one which ranges much farther to the north; and endures all the varied climates from the southern States to the middle of Canada. The length of this one is a foot and a half, and the stretch of the wings two feet four; dull brownish black is the general colour; but there is a pointed cap of bright scarlet on the head, and two mustachios of the same colour appended to the lower mandible. The chin is white; and the white markings on the neck, back, and wings, are nearly the same. The feet are leaden blue, and the eyes golden yellow as in the former species; but the bill is a different colour, being bluish black in the greater part of the length, and bluish white at the point. This species is sometimes accused of attacking the plantations, especially those of Indian corn; but it does not appear that there is the slightest ground for the accusation. The birds build in holes of trees; the eggs are about six, of a brilliant white colour, and it is understood that there are two broods in the year. They are therefore much more prolific birds than the ivory-billed woodpeckers; and they seem to be rather more discursive as well as more generally distributed. They are exceedingly active birds, always in motion of some description or other.

Gold-winged Woodpecker (*P. auratus*). This is a smaller species than any of the two preceding ones, more gay in its plumage, and a little different in its manners. In the colder parts of the United States these birds are migratory, but in the milder parts they are permanently resident. The total length is about a foot, and the stretch of the wings twenty inches; the back, and upper sides of the wings, are rich brown streaked with black; the top of the head smoke-grey; and the cheeks with the space round the eyes crimson brown; there is a black stripe like a mustachio from each angle of the gape; the throat and chin are fawn, passing into bluish grey on the lower part; on the hind head there is a crescent spot of deep but pure red, and an intense and larger one of black on the breast; the rest of the under parts have a yellowish tinge, but mottled with bright black spots; the lower sides of the wings and tail, and the shafts of all the larger feathers, are rich golden yellow; and the rump and tail coverts are white. The markings of this bird are exceedingly beautiful as well as striking, but they are too varied for minute description. Though they appear to be migratory in some places, they winter far to the north, appear to be remarkably hardy, and are said to resort to wild berries, when the insect supply of the trees begins to fail.

Red-headed Woodpecker (*P. erythrocephalus*). This is an exceedingly abundant bird in North America, and stands accused of being a great plunderer of small fruits in orchards, and also a thief on the Indian corn. So notorious are those propensities on the part of the bird, and so persevering is it in the practice of them, that a price is set on its head. The wisdom of this is however very doubtful; for it is only at one season of the year that these birds live upon fruits, and they are busied all the other parts in looking after the trees and keeping them clear of insects. Now in all countries fruit trees are more liable to insect ravages than trees of almost any other description, because their juices are generally speaking sweeter, and their vigorous action in most of the species begins more early in the season. The suspending of this action by the reverses of the weather which are so common in the spring, is particularly favourable to the production of insect larvæ, both on the leaves of the tree, and in and under the bark. The early season in most parts of the United States, is remarkable for the great and rapid variations of the weather. North America is a country which literally

swarms with insects; and therefore, if there be one portion of the world where birds to clear the fruit-trees of insects are especially required, unquestionably that is the United States. As this bird comes more about houses and orchards than most of the species, it is obviously the most useful bird there; and therefore it deserves protection instead of persecution.

In many parts of the United States these woodpeckers shift their quarters with the season, though they move pretty far north in the summer. They appear in the middle States about the end of April, and leave them in October. They begin to build their nests about the middle of May; and, like the others of the genus, they construct these in the trunk or large branches of trees, generally speaking, without any other materials than what the tree furnishes, which being smoothed down to the proper shape forms a bed for the eggs. The eggs are six in number, of a white colour, and marked at the greater end with reddish spots. The young are hatched towards the end of June; for the first season the head and neck of the young birds are blackish grey; which circumstance has caused some European writers to mistake them for females. The white of the young is also spotted with black; but in the succeeding spring they recover their perfect plumage; when the only difference between the male and the female is that the colours of the latter are not quite so bright, and that it is rather smaller than the male bird: the head and neck of both are deep scarlet; the bill is strong, light blue at the base, and black towards the point; the back, the primaries, the wing coverts, and the tail, are black, shaded with steel blue; the lower part of the back, the rump, the secondaries, and the whole under parts from the breast downward, are white; the feet and legs are bluish green; and the claws are light blue; round the eye there is a narrow stripe of naked skin of a dusky colour; the iris is dark hazel. The length of the bird from the bill to the tip of the tail is about nine inches; and the stretch of the wings seventeen. Like the rest of the genus, this bird takes great pains to place her young in an elevated situation on the tree, beyond the reach of enemies; but notwithstanding this, there is one deadly foe, against whose depredations these precautions are no security; namely, the black snake, which though armed with no poisonous fang, is a great destroyer of eggs and young birds. This snake winds up the trunk of the tree, enters the nest, eats the young or the eggs as it happens, and coils himself up to doze where he has committed his depredation. Wilson says, "the eager schoolboy, after hazarding his neck to reach the woodpecker's hole, at the triumphant moment when he thinks the nestlings his own, and strips his arm, launching it down into the cavity, and grasping what he conceives to be the callow young, starts with horror at the sight of a hideous snake, and almost drops from his giddy pinnacle, retreating down the tree with terror and precipitation."

Red-bellied Woodpecker (*P. Carolinus*). This species is a very little larger than the red-headed one; and it is more woodland in its manners; seldom appearing in orchards or near houses, but keeping to the tall trees in the close forests. It is a restless and noisy bird, and very active in examining the trees; and perhaps it is a more expert climber than most of its congeners. The birds build high, in the hollow left by the stump of a broken branch, or in an excavation made by the birds themselves, if they cannot find a natural hole fitted for that purpose. They pair earlier than the preceding genus, and the young climb about the branches, and often fall to the ground, or are captured by those birds of prey which are in the habit of beating over the forests during the time when the tree birds have their nests and their young. It is understood that they have two broods in the course of the year, and there are generally five eggs in each hatch; but this more abundant production than in many of the woodpeckers, is in so far counterbalanced by the casualties to which we have alluded. The length is ten inches, and the stretch of the wings seventeen. The bill is an inch and a half long, strong and of a bluish colour. The nostrils are covered with tufts of brown hairs which curl forward. The feathers on the forehead form a sort of projecting cap, and are of a dull reddish yellow. Behind these, along the upper part of the head, down the back of the head, and spreading down to the shoulders, is golden red, of the most brilliant metallic gloss. The rest of the back is black, with cross bars of white, and the rump is white with some markings of black. The wings are black; but the lesser coverts have white tips, and the quills crossed with lines of white. The cheeks and sides of the neck are pale buff, gradually deepening into ash colour, and again passing into blood-red on the belly. Some of the small feathers are remarkably beautiful in their markings, but they are too minute for general description. These beautiful birds are found in the West Indies as well as in North America; and in all places where they are found, they are especial conservers of forest trees, and at the same time highly ornamental.

Yellow-bellied Woodpecker (*P. Varius*). This species is still smaller than the preceding one, being eight inches in length, and fifteen in the extent of the wings. The crown of the head is rich scarlet, bordered at each side with black, and the feathers are a little produced, forming an erectible but not very long crest. From near the gape a narrow stripe of white descends on each side, bending round, and gradually passing into the yellowish white on the breast. The enclosed portion of the throat is rich scarlet bordered with black, the same as the feathers on the crown. The back is dusky yellow waved and dotted with black, the wings are black, and the belly yellow. The minor markings upon the bird are beautiful, but numerous and intricate. It appears that the habits of these birds are somewhat different from those of the typical woodpeckers; for they have muscular stomachs, and swallow gravel apparently for the purpose of assisting in the trituration of their food, which food appears to consist more of full grown beetles than of larvæ, though the birds collect the greater portion of it from trees, especially fruit trees in orchards in places where such are to be found.

Hairy Woodpecker (*P. Villosus*). The habits of this bird pretty much resemble those of the species last mentioned. In winter and early spring, it is much in the inhabited grounds, and clears trees, posts, and all wooden erections from the depredations of insects. These last services are of no inconsiderable importance in a country like America, where so many dwelling houses and other buildings are constructed of wood. Insects destroy these to a very great extent; and therefore the woodpeckers which come about the wooden buildings and fences,

ought to be favoured birds with the inhabitants. About the month of May they retire farther into the woods; though some remain and build in holes of the fruit trees. The eggs are five in number and pure white; the body is nine inches in length, and fifteen in the stretch of the wings. The fore part of the head is black, and the nape scarlet; a black line passes across the eye, and increases in breadth as it proceeds toward the back, where the whole is black except a broad lateral stripe of white. The feathers on this part consist of small shafts like hairs, without any webs to them; and it is on this account that the bird is called hairy. There are also hair-like feathers of considerable length at the bases of both mandibles. The wings are black, variously spotted with white; and the tail is black in the middle and white at the edges. All the under parts are white. The female has no red on the head; and the under part is mottled with brownish.

This is understood to be a discursive bird, at least to a considerable extent; for a straggling specimen or two of it are reported to have made their appearance in England; and either it, or a species very similar, has been found in the eastern parts of Siberia. That an American woodpecker should find its way to Siberia is by no means unlikely, because the distance of the two continents is but small. Coming to England is, however, a different matter; and it is a known habit of woodpeckers never to carry on their migrations to any very great extent, or by long flights; their style of flying is very ill adapted for such a purpose. They leap through the air, ascending, and then descending a considerable way at each leap; and flying in this manner is of course far more fatiguing than smooth flight, in which no lifting of the centre of gravity is required. The leaping flight of the woodpeckers is well adapted to their general action in the wood, as their movements on the wing there consists chiefly of ascents and descents. We believe too that few or no instances have ever occurred of the woodpecker being seen flying higher than the tops of the trees, and very seldom as high. Long migrations are always made by lofty flights, where the birds are above the disturbances of the lower atmosphere, and get the advantage of those general currents of the upper air which assist them so much in their migrations. We are not of course disposed to question the authorities which mention the appearance of these birds in England; but it is rather a puzzling problem in animal mechanics to ascertain in what manner they performed their voyage.

Downy Woodpecker (*P. pubescens*). This species is very like the last-mentioned one in the markings of its colours, so like, indeed, that a description of them is hardly necessary. It is, however, much smaller, being only six inches and a half long, and about a foot in the stretch of the wings; but its diminutive size does not lessen its usefulness in the woods, and especially in the orchards.

This little woodpecker is a very diligent labourer in the last of these, and he goes about his work in a much more scientific manner than the larger ones. He takes the circumference of the tree in circles, working gradually round, and shifting a little higher after he has completed one circle. In this, however, he does not "girdle the trees," as it is called in America, but merely punches little holes about an inch or an inch and a half apart. These holes do no injury to the tree, but rather, by reducing the action of the stem, tend to make it more productive of fruit. This is not the special labour of the woodpecker; for he takes an insect, of some kind or other, in some stage of its growth, out of each of these little holes. Had these insects remained, the tree would have been very speedily destroyed. But the other effect is perfectly consistent with the mode in which fruit-trees are kept in a vigorous state of production by skilful gardeners. The natural action of even a fruit-tree is principally in the promoting of its own vegetation; and hence, in order to increase the production of fruit, it becomes necessary to lessen not only the production of wood, but the tendency to produce it; and this is very frequently done by removing portions of the bark.

There are still several species of North American woodpeckers remaining unnoticed, and there are many species in South America. Enough, however, has been given as a specimen of those of the north, and we have endeavoured to give it with reference to their uses both in the forest and the orchard. The larger ones are chiefly met with in the first of these situations; and there is no doubt that, had it not been for them, the forests of many parts of North America would ere now have been gone. Nor are the small ones of less value in the orchard and about the farm-house.

Of the manners of the South American ones, or the precise effect which they have upon the forests there, we know little. As the trees are different, the labours of the birds must be different; and they have many more assistants than their northern congeners.

There remain two genera of small birds, most of which have been, at one time or other, confounded with the woodpeckers. See the articles PICUCULI and PICUMNUS.

PIGEON (*Columba*, or rather perhaps *Columbidæ*, —The Pigeon family). The pigeon family, or COLUMBIDÆ, as we shall style them when we speak of them in general terms, are one of the most numerous, the most widely distributed, and in some respects the most interesting families of the feathered race. It is true that very many of them levy very extensive contributions upon the products of human labour, and none of them can be said to perform any very important service in return. They may be considered as among the greatest consumers of the fruits of the earth. They are all exclusively, or nearly so, vegetable feeders; all tribes of them are voracious feeders; and many of them congregate in flocks which are perfectly innumerable. It is true that the flesh of very many of them is good, rather abundant in quantity for the size of the birds, and somewhat racy in the flavour, though by some reckoned too stimulant for being healthy.

Notwithstanding their numbers, their general distribution, their beauty, and the proverbial kindness of their dispositions, which have been handed down from very remote antiquity, only one out of a great number of species, and indeed of genera, has yet been brought into subjection by man; and even this one is lodged and fed rather than domesticated. This one is the common pigeon-house pigeon, known as the rock-pigeon when in the wild state, and in that state abundant in several places of the cliffy and caverned shores of the British islands. This one has indeed broken down into a great number of varieties, differing much from each other in appearance, and

called by different names, one of which at least, the carrier-pigeon, is employed in bearing messages to places very remote from each other. It is doubtful, however, whether, under any circumstances, the keeping of pigeons is a matter of economy; but that circumstance does not lessen their interest in the estimation of the naturalist who wishes to study them in their free state; and the domesticated one, including all its varieties, is a mere drop in the bucket as compared with those which are still to be found in wild nature.

With the exception of the polar zones, pigeons are found not only on every broad land, in all torrid and temperate latitudes, but in the remote isles of the sea. With the exception of comparatively a few, and these mostly in countries which hardly know any winter's cold, the whole of the family are birds of powerful wing, capable of remaining long in the air at a time, and thus continuing their flight over long distances.

In such countries as Europe, where the soil is in pretty general cultivation, and the winter is comparatively severe, they are not very numerous. In North America they are much more so in individuals, if not absolutely in species; and yet, latitude for latitude, the winters of North America are far more severe than those of Europe. But, in North America, they migrate with the seasons far more than they do in Europe. In Europe, too, the larger seeds of faded plants, and the small fruits, upon which pigeons are fond of feeding, are much less abundant than in America. In the former part of the world the greater part of the harvest of the year is gathered in by man, or by animals in which he takes an interest; while in America, so comparatively small an extent of the surface is peopled and cultivated, that the far greater part of the harvest of the year is left to be gathered in by the children of wild nature. In South America, and the intermediate islands, there are also many species; and the same is the case in Africa; though in neither of those countries does any one species appear to be so abundant in numbers as some of those in North America. A new character, however, begins to appear in some of them. The pigeons of the north, though many, indeed most of them, feed upon the ground, are all birds of powerful wing, and capable of shifting their localities if the state of the season shall deprive them of food. Pigeons of this character are also to be found in the southern parts of America and in Africa; but in these places there are others much less formed for flight, and therefore much more habitually upon the ground.

New Holland and the isles of the Pacific, including among those New Guinea and the Sunda Islands, and a portion at least of the south-east of Asia, might be considered as the grand head-quarters of the pigeons; and in those regions some of them are far more gay in their plumage, elegant in their forms, and splendid in all their characters, than in almost any other part of the world, though they are everywhere a handsome race of birds. Among those islands they are discursive, shifting from region to region with the monsoons, as these bring about at different times a supply of those wild fruits upon which they chiefly subsist. In the same islands and countries too, especially if they are of considerable breadth, there are also pigeons of less powerful flight, and better adapted for walking, which find their food chiefly on the ground, and are rarely on the wing, except for low and short flights.

The *Columbidæ* were long considered as confined to the pigeons properly so called, and the turtles, or, as they were styled in popular language, doves and turtle doves. But as the birds of new lands began to be examined with attention, and species of forms, colours, and habits, very different from either of these two, began to be added to the collections and museums, the single genus *Columba*, to which the new ones were added when they were discovered, began to get cumbrous from its extent, and not very susceptible of correct generic definition, because a short summary of characters could not be so framed as to include the whole. This of course led to successive divisions of them; first into subgenera, then into genera, and ultimately into subfamilies and genera. The original method of having but one class was certainly imperfect and incorrect; and it could scarcely have been otherwise, because it could be founded only upon the species then known, and they have proved to be a very small fraction of the entire number. On the other hand, it is highly probable that some of the more recent arrangements have fallen into the opposite extreme. A few years ago there was an excessive, and as one might say an inordinate desire to multiply genera, and the same desire remains with many to the present time. Now this is a bar in the way of those who wish to learn natural history. It is desirable that every one, beginning with the classes of the animal kingdom, should pursue those classes downward through their orders and families, as far as the genera. Thus far may be regarded as the science of natural history, and as such ought to form part of every liberal education. Doing so, it ought to reach the general structure and habits of all the animals, their adaptations to climates and localities, and their uses in wild nature and to man. But it should stop there; and there ought not to be admitted into the system a single character as generic, for which a reason cannot be given. After this the matter is to be taken up by the professional, museum, or mechanical naturalist, whose business it is to describe every shade of appearance with the utmost accuracy, whether he understands any thing about the use of it or not. He is properly the collector and recorder of facts; and it belongs to men of more enlarged views, who are not fettered by petty details, to bring those facts within the philosophy of the science, in as far as they can be so brought.

We have stated briefly this distinction, because we think that, in the case of the family of birds under notice, as well as in other parts in the natural history of animals, there has been a tendency to mix up the mechanical details with the philosophy of the science, and thereby to vitiate the latter as a part of general education.

There is another point in which the natural history of the *Columbidæ* has been, and still remains, a little confused. This has arisen from pushing the doctrine of affinities a little too far. Pushing doctrines, which are hypothetical in their foundations, too far, is the cause of half the errors in every branch of knowledge; and yet there is nothing more difficult to be avoided. A man takes up the hypothesis fondly, makes it his own, and dotes upon it, until it spoils his perception for every thing else. Or, if we may so express it, the man runs away with the idea, and continues run-

ning till he is out of breath, and can run no more; and then the idea whips him up, and runs off with him so fast and so far, that his head is turned, and he loses his senses.

Upon this principle of the overstretching of affinities, the *Columbidæ* have often been regarded as a division of the *Gallinidæ*, and described as such. Cuvier says that they form an easy transition from his great order *Passeres* to the *Gallinidæ*, and he includes them in his order *Gallinaceæ*. But every one knows that Cuvier was as modest as he was mighty, and wished to make the fewest changes possible upon the established nomenclature of animals; and though he speaks of a transition or passage, he certainly does not imply what is called an affinity, either with the one or with the other. In avoiding the use of this term, Cuvier showed his usual science and sagacity; for in the two great foundations upon which alone a natural classification of animals, that is, a classification useful as an instrument in the study of nature generally, can be founded, there is little or no resemblance between the pigeon family and the poultry family. These two grand points are, how the animals feed, and how they propagate? The first is the one which goes directly to connect them with nature; because it is the fact of its consuming the surplus of certain substances which makes an animal useful in the general system of nature; and the second is useful only as it continues the animal to consume this surplus through successive generations. Now the pigeons are, as has been already hinted, nearly, if not exclusively, vegetable feeders, and feeders chiefly upon seeds or fruits. Many of the poultry, again, are of an omnivorous character, and some subsist, in great part, upon leaves.

The distinctions in respect of reproduction are still greater. The poultry tribe are, we believe, without a single exception, polygamous. The males fight battles of gallantry; but little or no affection subsists between them and the females; they take no concern whatever in the incubation, and some of them are prone to devour the eggs, if these are not concealed from them. The females also have large broods, and some of them very large; and though they are attentive mothers, and proverbially brave in the defence of their young, they never, in any instance, put food into their mouths with the bill, nor are there, we believe, any instances in which the young remain in the nest after they have broken the shell.

The pigeons, on the other hand, are, in every species of which the habits are known, strictly monogamous. The males fight no battles of gallantry, and the affection which subsists between the pair is so great, that doves have, from the earliest times, been regarded as the appropriate emblems, not only of love, but of all the peaceful and kindly affections. The male alternates with the female in the labour of incubation; the brood is, generally speaking, a single pair; they remain for some time in the nest, and they are fed there by both parents, not only with the bill, but from the stomach, and with the food prepared by solution and combination with a stomachic fluid. This feeding is continued not only until the young leave the nest, but for some time afterwards.

In these last circumstances there seem to be very substantial grounds for establishing a general structural distinction between pigeons and poultry. In every department of the feathered tribes it is found that the attention which the young receive after they break the shell is prolonged in proportion as the plumage, and especially the feathers of flight, are to be of a more perfect character, and consequently brought more into use, for in nature the use and the quality of that which is used always agree with each other. Now, any one who chooses to set a pigeon and one of the poultry tribe together, taking any of the numerous species of either, will not fail to observe, that there is a striking difference in the texture and gloss of the plumage. On the pigeon it is remarkably smooth and compact in the clothing feathers, and equally firm in the feathers of flight, and in the typical pigeons there is not a single supplementary or superfluous feather, nor are there many such upon the others, unless it be a light crest upon the head. Among the poultry there are differences, no doubt; but the plumage of all is comparatively loose and soft, and a considerable number are furnished with supplemental feathers, which, instead of assisting in their flight, must impede their progress. No doubt there is some similarity in the *sterna*; but it is confined to the posterior angles, and consists in there being two notches in each, and the keel of the sterna is much more developed and the articulation of the wing much better supported in the pigeon than in the other.

Those pigeons indeed, which feed chiefly upon the ground, and never range far in quest of their food at one flight, are inferior in their organs of flight to what may be called the air pigeons; but their clothing plumage still retains the pigeon character, and they do not display that toil and flutter which are so conspicuous in the others.

If we look at the action of the birds in the air, we shall soon perceive the difference in this respect; and perhaps the comparison could not be made upon a fairer average of the two families than upon the rock pigeon in its wild state and the common partridge.

Whoever has visited those bold and caverned cliffs where rock pigeons dwell, may have seen them out when the wind was so strong as that he required to guard both his head and his feet, to prevent him from losing his hat at the one extremity, and from staggering or tumbling through instability at the other. Not only are they out in tolerably fresh breezes, but they are quite at home in them, and wheel and double so as to fly upon all winds without turning a feather. But we believe nobody ever saw partridges rise naturally during a stiff breeze. They make toil and flutter enough on a calm autumnal day; and if they were to try upon a stiff breeze, a point or two abaft the beam, every windward feather would be up, and they would be compelled to drop helpless to the ground, and seek safety in their legs, from their wings being unfitted for the weather.

We have instituted these comparisons, both general and particular, in order to prevent the general reader from being misled by some of the modern works which profess to be accurate, and are sold at an easy price, by attempting to demonstrate for him a proposition which ought to have required no demonstration, and of which the enunciation is quite a facsimile of Katerfelto's well-known positive and negative definition of lightning and thunder. It might run thus: First, positively, a pigeon is a pigeon, and a pullet is a pullet; second, negatively, a pigeon is not a pullet, and a pullet is not a pigeon. We think

nobody will dispute this, and therefore we at once subjoin the Q. E. D., which is understood to seal the matter in every clear and satisfactory demonstration of truth. Having done this, we shall briefly advert to the *Columbidæ* in their proper character as a family, in their more obvious subdivisions, and in one or two of the most interesting species of each.

The general characters are: the bill arched, the nostrils pierced in a large membranous space, and each covered with a cartilaginous scale; this membrane is often enlarged to a considerable size at the base of the bill; the sternum consists of firm bone, but is deeply and doubly notched in the posterior part, though different in different species; the craw or crop is very large, and capable of great dilatation; and some of the varieties of the tame pigeon have the power of distending it to a very great size by inflating it with air; the larynx at the bronchial, or lower extremity of the windpipe, has only a single muscle, so that they have little or no voice except a sort of murmuring coo, which, however, is generally soft and pleasant, though melancholy, and some of them can give it a little modulation as to time, though scarcely any in pitch; the feet have three toes to the front, but they have no connecting membrane at the base any more produced than it is on the sides of the toes, and the hind toe is articulated on the same level with the three front ones; there is thus but little spring in the foot, and they cannot run fast, though many of them can walk well; their wings and style of flight vary considerably, according to the mode of life for which they are adapted; but whether their flights be long or short, high or low, they may all be said to be good flyers. We have already alluded to their monogamy and small brood, but the brood is repeated in the course of the year, and thus they are upon the whole very prolific birds. Their nests are not made with the greatest care, but they are much superior to those of the *Gallinidæ*, which, generally speaking, do not deserve the name of nests at all. They are placed in trees, or in the holes of rocks; the rock ones in general build high, and the tree ones in places where there is close foliage. Such are the leading characters which apply to the whole; and we shall now advert to the greater divisions.

Cuvier may be regarded as still the best authority in this respect, because, though not nearly so minute as that of others, his division is sufficient to reach a general character in each of the three genera into which he divides the family. We shall, however, reverse the order in which he takes these genera; because, while he places those first which bear the closest resemblance to the *Gallinidæ* in some habits, we shall consider them in their own characters as a distinct family, and, therefore, we shall place those first which have the most striking and decided character. Taking them in this order, the three genera will be: first, *Strong-billed Pigeons*, or those which subsist chiefly upon the fruits of trees and shrubs; secondly, *Common Pigeons*, or those which, though they are still discursive flyers, live more upon the seeds of herbaceous plants, which they pick either from the plants themselves, or from the ground; and, thirdly, *Ground Pigeons*, or those which reside chiefly upon the ground, and take only short flights, though they also nestle in trees and shrubs, only at smaller elevations than the others.

In each of these genera there are great diversities, and they have accordingly been divided and subdivided; but, for the reasons already assigned, we shall not go into the particulars of those divisions.

Strong-billed Pigeons (*Vinago*). The distinguishing characters of these are: the bill stout, very hard in the distal half, but flexible in the basal, strong in its substance, arched in the outline of both mandibles, hooked, and very sharp at the tip of the upper one, and compressed in its whole length; their tarsi are short and clothed with feathers, and their feet are adapted for perching on trees, and not so much for walking on the ground; in order to give them a firmer footing on the branches, the toes are margined by a pretty extensive membrane; the external front toe is the largest, as in climbers and tree birds generally; and the claws are strong, sharp, and very much hooked. All these characters are possessed in a greater degree by some of them, and in a less degree by others; but still they are sufficient in the whole to bring them together, if not as a perfectly-defined genus, at least as a group very distinct from the other two divisions of the family.

Their appearances and manners, and even their principal locality, may be said also to be different; and though there are other pigeons along with them they are the characteristic pigeons of the south-east of a part of the south of Asia, of the Eastern Isles of the Isles of the Pacific, of New Holland, and also of Africa, but chiefly, we believe, of the eastern half of it. They are altogether forest birds, and inhabit the tall trees, living upon fruits, which their powerful wings, the firm clutch of their feet, the hard texture of their bills, and their general strength, enable them easily to reach and secure. Their colours are in general very rich and beautifully marked; green and yellow are the predominating ones in almost every species; but many of them have also purple, brown, red, and white, though the latter rather sparingly, and some have a sort of cinnamon-brown and orange-red as the predominating colours.

The whole of them are birds of powerful wing, and in general their wings are pointed, and in many the tails are long. Indeed, the form of the tail differs so much, that it cannot be admitted as a character of the genus taken as a whole, or even of those subdivisions which have been made of it. Though many of them migrate, their general habit may be said to be habitual residence in the close forests of those countries where they dwell, and we are not aware that any of them reside in a place where the trees are not evergreens and capable of supplying some kind of nourishment at every season of the year. A considerable number of them have been for some time known to naturalists, and specimens are to be found in most collections of stuffed birds, while a great number of them are figured by Temminck, and some have been kept alive in Europe. Several species, however, are comparatively of recent discovery, and it is highly probable that future observation may discover many more. Their range being about seven thousand miles in longitude, and more than four thousand in latitude, besides being so extensive, their country, though all decidedly tropical, is much diversified in its character, and the retiring habits and colours of the birds render them not easily seen, although it were possible to beat the mighty forests of those parts of the world with the same ease as a pheasant-grove or cover can be beat in England. When they are discovered in deed, it is, as is the case with pheasants at night, by the ear and not by the eye, for they coo away in

perfect security under the thick shade of the luxuriant foliage. Generally speaking, their flesh is dark-coloured and tough, not very well flavoured, and, therefore, they are not very eagerly sought after as game.

Pointed-tailed Pigeon (*V. oxyura*). This bird is a native of the Sunda Isles; and it is remarkable for the form of its tail, which is very long, stout, much wedge-shaped, and has the two central feathers much produced beyond the others. The general plumage is green, most brilliant on the neck and belly, and crossed on the breast by a broad band of orange red, which fades gradually into the green both ways; the lower part of the belly and the under tail-coverts (which, taken altogether, are lancet-shaped and very pointed) are yellow, blending gradually with the green on the body, but well defined on the tail-coverts, the under sides of the tail-feathers being blackish green at their bases, and pale grey at their tips; the quills are black, and, though the wings are long, they do not when closed reach much beyond the two lateral tail-feathers, which are not above one-third the length of the two middle ones; the bill is black at the base and yellow at the tip; the feet are bright reddish orange, and the tarsi are mottled with green feathers; the space surrounding the eyes red and pointed, both in the direction of the gape and backwards. This bird is abundant in Java and the other Sunda Isles; but it is not known what difference of habit results from the form of the tail, which is peculiar among the whole of the tribe; for though many of them have the tails much wedge-shaped, and some have them very long, this is the only one which has the two middle feathers so much longer than the rest. Length twelve inches.

Aromatic Pigeon (*V. aromatica*). Though this species is only about nine inches long, it is really larger in the body, in consequence of the comparative shortness of the tail. Altogether it is a stouter bird, apparently less formed for rapid flight, and its bill is particularly strong and hard; the upper part is purple brown, passing into sandy yellow of a greenish tinge, which is the uniform colour of all the under part, including the sides of the head as high as the eyes; but the colour is a little paler than the last: the colour of the upper part passes into greenish ash n the nape, greyish ash on the top of the head, and bluish ash on the front; the quills are black, and the coverts of the wings brown, each feather with a very distinct border of yellow; the rump and middle tail-feathers are green, and the lateral tail-feathers black and grey; the feet are red, with a tinge of orange, and the bill yellowish green. It is, however, subject to varieties of colour.

It is a very common bird, both in India and the eastern islands, and the spreading shade of the banyan or Indian fig is one of its favourite habitations. Every one knows that, according to the Indian superstitions, this is a sacred tree, and also that it has a peculiar habit of growth in sending down perpendicular fibres from the branches, which enter the ground and take root, until the tree has a vast number of trunks, and becomes a grove of no mean dimensions, all united by solid wood at the top, and thus proof against the most violent winds, at the same time that its foliage is so close, that scarcely a sunbeam can find its way through.

They are birds of mild and timid disposition, and, like most of the pigeons, they live socially, except during the breeding season, at which time each pair retire to their own nesting-place, and construct a very rude and simple fabric of a few sticks, which is the general structure of nests among those pigeons which nestle in trees and shrubs.

Parrot Pigeon (*V. psittacea*). This is a species belonging to the Molucca Islands, measuring ten inches and a half in length, and having all the clothing plumage of a beautiful green. The principal quills are black; the secondaries are the same, margined with yellow; the bill is reddish-grey, and the feet blackish brown. Though there is little variety of colour in the parrot pigeon, it is one of the most beautiful of the whole race; and we may remark, in passing, that many of the pigeons of the Moluccas, in which islands they are very numerous, are remarkable for the greenness of their colours.

The Commander Pigeon (*V. militaris*), is an Indian species a foot long. The upper parts are pale green; the neck yellow, marked with a band of ash colour; the rump grey, a spot of purple brown on the bastard wing; the quills black, bordered with yellow; the lateral tail-feathers bordered with grey, the under part bluish grey, the thighs yellow, the tail-coverts russet, with blue tips; the bill of a grey colour, and very stout; and the feet red.

Abyssinian Pigeon (*V. Abyssinica*). This species was first made known to Europeans by Bruce. It is yellowish green on the upper part, bluish green on the head and neck, violet red on the smaller wing-coverts, yellow, bordered with black, on the large. The quills are black, with yellow borders. The tail-feathers are bluish grey on the upper side, and blackish on the under, with grey toward the tips. The under parts are yellow, clouded with orange, and the under tail-coverts are mottled with bluish grey and maroon brown. The bill is yellow at the tip and red at the base, and the feet are orange. The length is eleven inches and a half. The female has the upper part green, the under and also the head olive yellow, the smaller wing-coverts sandy violet, and all the rest of the markings much duller than those of the male.

Purple-crowned Pigeon (*V. purpuratus*). This is an exceedingly beautiful bird, a native of the Society Islands, and may be taken as a specimen of the pigeons of that part of the world. Its bill, though still hard at the tip, is by no means so powerful, in proportion to the size of the bird, as those which we have previously mentioned, and its general aspect is more light and delicate. Its notes are also more soft, and are said to resemble those of the turtle. The upper part, including the tail, the neck and head as far as over the eyes, and the sides and flanks, are very rich and glossy green. The top of the head is lilac purple, surrounded by a narrow line of rich yellow. The chin and throat are yellowish, and the green toward the head is of a lighter shade than on the body, and glossed with grey. The feathers on the breast have also reflections of grey toward their extremities, and their terminations are peculiar, as the shaft ends abruptly, and the webs on each side project beyond it, as if a triangular piece had been cut out of the feather. The primary quills are black and green, margined with bright yellow. The tail-feathers are also black and green, except the two central ones, which are wholly green, with some markings of yellow; and the lateral tail-feathers have the same form of tips as those which are mentioned on the breast. The tarsi are feathered down to the toes, and the toes are much margined, and furnished with

strong claws. The bird is decidedly a tree bird, living upon fruits, but it is understood that they are fruits of a softer character than those upon which the species formerly mentioned subsist. There are a good many other species, resembling this one in their structure and habits, to be met with in the Molucca and South Sea Islands but as they differ but little from this one except in colour, we need not allude to them.

Magnificent Pigeon (*V. magnifica*). This one differs in several respects from those tree pigeons of the east, of which we have mentioned one or two specimens. It is much larger, measuring seventeen inches in length; and it has the bill differently formed, though still of the same consistency with those of the others. The membranous enlargement at the base of the bill is exceedingly small; and the bill itself is slender in the flexible part, though compressed and hard toward the tip. The forehead is also lower in proportion, indicating that the muscles which close the bill are not so powerful, and that the work which it has to perform is of a more easy description. In consequence of what has been now stated, this pigeon, and a few others which resemble it in most of the particulars, though one of them has the enlargement on the base of the bill swelled out to a considerable knob, have been called fruit-eating pigeons by way of eminence. They are found in all the eastern islands and in New Holland, and it is probable that they migrate seasonally between New Guinea and the few rich spots which occur on the east coast of New Holland.

The upper parts of the magnificent pigeon are rich golden green, which shows various shades of brown and purple, and even of yellow and red as the light falls differently upon it. The wing-coverts are spotted with yellow, the quills and tail-feathers are of a most intense green, varying in its tints in the same manner as the green on the back. Altogether the upper part of this bird is pre-eminently splendid; the other parts are not much inferior. The head and upper parts of the neck are bluish grey, passing gradually into the green on the lower part of the neck backwards. From the base of the lower mandible or near it there begins with a point, but gradually increasing in breadth, a very beautiful port-coloured streak, which spreads over the breast and all the under part. The basal parts and the feathers in this are deep bluish green, and the margin of each feather is very rich bluish purple. The feathers are broad and rounded at their extremities, and the purple arches which the borders on these form, show off the green in an exceedingly pleasing manner. A small portion at each side on the fore part of the neck has the basal parts of the feathers pale greyish green, and the margins broader and more red. The lower part of the belly, the thighs, and all the under coverts of the wings, are exceedingly rich yellow, with a slight tinge of orange. A skin which the writer of this article got direct from Moreton Bay, in Australia, had a faint dash of yellowish red on the bastard wing; but that is not mentioned in the general description, so that it is probable that this splendid species is, like many others of the family, subject to variations of colour. The basal part of the bill is orange brown, but the hard part toward the tip is yellowish white. The feet are bluish black, with short tarsi thinly clothed with yellow feathers down the front half of their circumference. The toes are stout, and the claws strong and much hooked, but the external front toe is not so long in proportion as i those formerly described. The foot, though thus good perching foot, wants the climbing characte which the others have. Altogether this is one the most gorgeous of the feathered race, whether w regard the intense colour and rich glosses of the upp part, or the beautiful diversification of the under. should seem that these birds are subject to variatio in size as well as in colour, or that there is a speci considerably smaller bearing a very great resemblanc to this one.

There are a few other species, approaching th one in size, and resembling it in the upper plumag but greyish green dashed with vinous red on th upper part, and having the bill and feet differentl coloured, which have been met with in the isles good way to the eastward; but as no difference manners has been observed, and the essential par of their structures are very much alike, they do n require to be enumerated. Some of these have th membrane at the base of the bill swelled into a knol but as this is the case in some varieties of the comm pigeon and not in others, it cannot be regarded forming a specific character, or in fact as being an thing more than accidental. One species remain resembling these in some respects, but differin from them in others, which deserves a short notic This is

The Pheasant Pigeon (*V. Phasianella*). In th structure of its feet and the form of its bill it does n differ greatly from the species last described, but th tail and the colours of the plumage are very differen Its length is altogether about fifteen inches, of whi the tail occupies at least a half, so that it is muc shorter in the body than the magnificent pigeon; is also more slender in proportion, and therefo altogether a much smaller bird. The upper part it is reddish brown, and the sides and top of the he pretty bright red; on the upper part of the ne especially there are rich reflections of violet purpl varying in different lights. The coverts of the win are brown bordered with red, and the quills are near the same colour only a little darker. The two midd feathers of the tail are entirely brown, and the later ones, which are of the same colour for the greater pa of their length, are crossed by a bar of browni black. The throat is yellowish white, and the r mainder of the under part yellowish brown, passi first into orange brown and then into reddish brow The tail is very strong at its base, and well fortifi by coverts, but it is much wedge-shaped, or rath has the appearance of the half of a very lengthen oval. The bill is reddish brown, darker in the ha part, and the toes and naked parts of the tarsi a deep orange red. In the shortness of the tarsi, a the general structure of the bird, it very much resembl the magnificent pigeon. The shape of the head different, however, being more flattened on the to and meeting the bill less abruptly, which gives the b the appearance of greater length.

It is found in the very same countries as the ma nificent pigeon and those which resemble it in stru ture. The form of the tail is also the same, only it much larger in this one. What difference of hab may be connected with this is not known, but th general agreement of the birds is such that in all pr bability it is not very great.

PIGEONS PROPERLY SO CALLED (*Columba*). Th is by far the most numerous genus, and the membe

of it differ greatly from each other in appearance. In consequence of these differences it has been divided and sub-divided various ways. There is not much apparent advantage in these divisions; and when we consider the vast number of varieties into which the common pigeon has been broken, and the great differences of form, colour, and habit, which are found among these, we ought not to lay much stress upon the differences which we find in those which inhabit countries of different characters, and consequently live upon different kinds of food.

The most important natural difference in the whole genus, numerous and various as it is, is that between the common pigeon and all the rest. The nesting places of some of the rest are not known, but so far as is known they all build in trees, and the whole of them perch or roost for the night. The common pigeon again, whether in the wild state as the rock-dove, collected in pigeon-houses, or in any of the numerous fancy varieties, never nestles in trees, and never perches in them for the night. Its natural dwelling is in the rocks; and the pigeon-houses, whether on a large scale or on a small one, which it prefers, are those which contain little cavities or boxes, in which the birds can sleep and nestle. So well is this known, that "pigeon-holes" has become the common name of a little collection of vertical openings whatever may be the use to which they are applied.

There is still another distinction which is worthy of being attended to; all the others are wild birds, and cannot be made to return to an artificial habitation if they are once allowed to escape from it. There is no exception to this; and though many of the species seek their food in seeds that are scattered upon the ground, they all betake themselves to the thick shades of trees when they are to repose. They may be often seen on the wing in different kinds of flight, according to the differences of their habits; but they are never found resting on the house tops, or on the rocks, and they maintain their characters. With the others it is very different; for if a convenient pigeon-house is built nearer the feeding-grounds than the rocks which they naturally inhabit, the wild ones will quit the rocks and very speedily fill the pigeon-house. They are therefore birds which seek the vicinity of man, though not his society, while all the rest of the genus belong strictly to wild nature; and when man clears and cultivates to the full breadth of the land, their habitations and their place in nature may be said to be gone. These distinctions apply to the general habits of the birds, and they do not admit of change; so that they are of far more importance than distinctions of shape, colour, and size, which, as we have said, have been artificially produced to a very great extent, in the only case to which artificial means can be applied.

The pigeons properly so called, are not only more numerous in species and in individuals than any of the other two genera of the family, but they are also far more widely distributed. We mentioned that the pasture of the strong-billed pigeons of the east is very extended, but it is really nothing when compared with that of the present genus. The whole land, with the exception perhaps of some remote islands, is their pasture, from near the north polar circle to as far south as habitable land extends; and if we except some of the crow tribe, and the birds of prey, there are perhaps no birds so generally spread over the world as the pigeons. We shall now notice a few of the species as briefly as possible; and though we ought perhaps to begin with the common pigeon, the dove *par excellence*, which is the type to which the popular mind refers, yet we shall take some of those which are more remote in their localities and less known in their manners. Before we do this, however, there are some general characters of the genus which deserve to be noticed, notwithstanding the extent to which they vary in the species. The bill is of moderate length and strength, flexible in the basal part, and hard at the tip, but not so hard, for so much of its length, or trenchant, as the bills of the former genus. The upper mandible is more or less hooked at the tip, and both mandibles are more or less arched in their outlines. The nostrils are, near the base of the bill, partly covered by a large projecting membrane; and there is a lore or naked space around the eyes. The feet too are walking feet, as well as perching feet, though in different species they take more of one character or of the other, according to the habit. The feet of the common pigeon are for instance walking feet, with very little of the perching character. The external and internal front toes are of equal length, the hind toe is short, and the claws are not hooked, as in the decided perchers, but so placed as that the foot may be wholly planted upon the ground.

There are one or two pigeons included by Cuvier in this section of the genus which do not appear to come very correctly either within it or any of the other two. They are, however, birds of distant lands, and very little is known of their habits. None, we believe, of the true pigeons, of which the rock pigeon may be regarded as the type, are inhabitants exclusively of warm countries, nor are they found, very much resembling the common pigeon, in the south and the east, where the true strong-billed pigeons of great beauty, the nectar-sucking pigeons, and the ground pigeons are so very numerous. The species which most resemble them there, are woodland birds, not ground birds, and, as we said, some of them are but little known, except in their external appearance, and their general agreement with the genus as pigeons and not any other birds.

A further distinction has been made between pigeons and turtles; and the birds to which the last of these names has been given, differ a little from the pigeons properly so called, both in their geographical distribution and in their manners. The turtles, of whatever part of the world they may be natives, and however much they may differ from each other, are inhabitants of warmer climates than the pigeons. Their bills are smaller also, their bodies are more slender, their tails are, in many of the species, more produced; and they are more discursive and inclined to be migratory. In all the species too, to which the name of turtles have been applied, whether correctly or incorrectly it is not for us to decide, there is an exclusive disposition to be woodland in their repose and nesting, though some generally, and many at most times, find their food upon the ground or near it, in the fruits of bushes and the seeds of herbaceous plants. But those distinctions, though of great importance in the estimation of those who are great sticklers for nice differences, are of no value whatever to the general reader, and therefore we shall pass them, and proceed to our selection of this species.

Goura Pigeon. In respect of size, and from the very elegant crest with which the head is ornamented,

this is one of the most splendid birds of the whole family; and there have been a good many puzzles about it as to the place in the system of ornithology it should occupy. It has been called the crested pigeon, the great crowned pigeon, the Indian crested pheasant, the pigeon hocco, the gallinaceous pigeon, and a number of other names, all of which are calculated to mislead the tyro in natural history.

It is a large bird, measuring two feet three inches in the extreme length, and rather stoutly made in the body. The head and neck are not very large, and the bill, though of moderate length, is slender, though fortified with a slight enlargement towards the tip. The tarsi and toes are stout, but the tarsi, though longer than the middle toe, are not very long as compared with those of some of the ground pigeons; and from the general form of the feet, the bird cannot be a very swift walker. The crest is of a peculiar form, consisting of long and beautiful feathers, placed longitudinally on the mesial line of the head, spreading like a fan, and reaching over the bill and the nape, forming a continuous curve at their distal extremities. The bill is about two inches long, black in the basal part, but inclining to greyish-white at the tip. The crest, head, neck, and all the under part of the body, are pale bluish grey, glossed with reflections of blue and purple. The back, the shoulders, and the smaller coverts of the wings, have the basal part of the feathers black, and the terminal parts rich purple with bronze reflections. The greater coverts are black at the base, white in the middle, and purple at the extremities, the white making a very conspicuous bar in the closed wing. The quills and tail-feathers are deep grey, the latter being marked with pale greenish grey at the tip and distal margins. The tail, though not very long, is strong and rounded as in the common rock pigeon; but the wings are not nearly so long in proportion, or so pointed as in that bird.

This splendid bird is a native of the Indian Archipelago, over the wooded parts of which it is very generally distributed. It occurs as far west as Java, if not as Sumatra, and eastward as far as the Molucca Islands, and it is very abundant in New Guinea. It is a wood pigeon, but feeds on the berries and seeds of more lowly plants than the strong-billed pigeons. Its short and rounded wings, and broad and strong tail, show that the habit of its flight must consist in a great measure of ascending and descending; and therefore we naturally conclude that it is not so discursive as the light-bodied pigeons with long and pointed wings. It builds in trees, the eggs being two in a hatch, but how many hatches occur in the course of a year has not been ascertained. During the breeding time the male and female pay the same attention to each other as is done by pigeons generally. The general voice of the male is also that of the pigeons, being a deep but not unpleasant cooing. He also utters occasionally another sound, like that of a slight explosion from the wind-pipe. This is one of the reasons why these birds have sometimes been classed with the hoccos, but the manners of the birds are totally different; for this, like all the other wood-pigeons, is untameable by any known process, whereas birds of the other genus are, generally speaking, tamed with the greatest ease, and some of them are capable of some training. Besides they are ground birds, and natives of America. This large and splendid pigeon is a valuable as well as a handsome bird, its flesh being highly esteemed, and in considerable quantity, in consequence of the large size, and t perennial supply of food in the native country. T Dutch, who have been longer and more intimate acquainted with the oriental islands than any oth European nation, have paid a good deal of attenti to this bird, and they have frequently brought spe mens of it to Europe, in the hopes of naturalising in Holland. Their attempts have, however, alwa failed, because the bird, being a native of the easte isles, is not able to bear the rigour of a Europe climate; and probably, from its habits, it would n thrive, how well soever it might be protected fr the cold.

Double-crested Pigeon. In some respects there a slight resemblance between this species and t former, though in others they differ, and this o makes a nearer approach to the common pigeons. is a native of the east, and, though specimens Britain have chiefly been brought from Australia, has we believe been fonnd in New Guinea, and ev as far north as New Holland. Though by no mea equal to the former in size, this is still one of t largest of the pigeon family, sometimes extending a foot and a half in extreme length. The tail is n so strong as in the former; but the wings are mu longer and more pointed, indicating a bird of power flight. The bill is shorter and stouter than in t last; of an orange colour, and having the tip of t under mandible shorter than that of the upper. T crest consists of thread-like feathers, and, though no means so handsome as that of the former, y gives an interesting appearance to the head. The are not so properly two crests as one crest continu along the middle line of the head, from the bill to t hind head, the frontal portion of it being bluish-gr and the occipital portion reddish-brown. The upp parts are very dark grey, and the under parts blui ash. The head is ash; the quills and tail-feathe are blackish, crossed by a band of pale reddish gr near the tip; the tarsi and toes are crimson; and t hind toe is very stout. The feathers on the sides a front of the neck are bluish-black at their bases, a pale greyish-ash where exposed. Their terminatio are of a peculiar shape; the broad part of the w parts off towards each side in a curving fork, and t shaft is continued in a small feather which has t appearance of being let in between the other tw The habits of this species are not very well know but it is supposed that they in part resemble those the goura pigeon, though this bird is much bet adapted for flight, and on that account ranges greater distances.

Chestnut-shouldered Pigeon. This species is larg than the double-crested, measuring about twenty inch in length. It belongs to the Eastern Isles, but has be met with much farther east than the goura or t double-crest. It is a beautiful bird, and all the colo of its plumage on the upper part are finely gloss with reflections of metallic lustre. The bill is yello ish-grey; the head, fore neck, sides of the neck, a breast, are deep green richly glossed; the back of t head and hind neck is reddish-green; the back a scapulars are reddish-brown, with rich reflections; the under part from the breast is pure white; t wings are greyish, with green reflections; and t middle coverts of the same are rich green. The ta feathers are brown, with purple reflections for t greater part of their length passing into dull yellow the tips. This bird has been found in the islands

to the eastward; and, from its resemblance to the wood pigeons, it is presumed to have habits not very different from theirs, but those habits are not known.

We now proceed to the pigeons of the other parts of the world, of which the habits are better known, and therefore the descriptions of them can be rendered more interesting. In so far as man is connected with them, the rock pigeon, as the parent stock of all those varieties into which pigeons which know their homes, and return to them of their own accord, have been broken by artificial treatment, is undoubtedly the typical bird; in wild nature, however, the case is very different, because the habit which makes this pigeon so manageable by man, and so ready in coming about his dwelling, is peculiar to itself, and, so far as we know, not in the least partaken off by any of the others. It must therefore have been the dove which was sent out of the ark and returned again with the olive branch; for there is none of the rest which would have returned, if it had once escaped from a place of confinement. For these reasons, we think that the rock-pigeon is better entitled to be regarded as a separate section or subgenus than any of the others, because it is distinguished not only by a well-known habit, but by a habit which it never loses, and which may be improved by training, of which the carrier-pigeons afford a very remarkable instance. As any one may observe, there is an elevation of the frontal line, and an air of sagacity in the head of the rock-pigeon, not to be observed in any other member of the family, numerous as they are.

The Ringed Pigeon is the most abundant species in the groves and thickets of the cultivated parts of Britain; and, though it still retains as much of the wild character as to resist every attempt at domestication, it seems to prefer artificial plantings in the midst of rich fields of grain, leguminous plants, and turnips, to those woods which the hand of nature plants in the wilds. Accordingly it is rare in those parts of the country where there is little cultivation; and its numbers increase always as improvement and culture extend. It is one of the most interesting birds of our groves, beautiful in its plumage, and soft and melodious in the tones of its cooing. Every schoolboy is acquainted with the note of the *cushat;* and, if we except the cuckoo, there are few birds which have so many human imitators.

It is not a bird of the colder latitudes, and cannot brave the elements in such style as the rock-dove when in the wild state. Its locality is therefore a little farther to the south, though it does not appear to reach nearly to the equator. The central and southern parts of Europe appear to be its headquarters, though the authorities mention it as ranging from Siberia to Madeira. There is little probability of its occurring to the southward of the African desert; and those parts of central Asia and Siberia which are destitute of timber are also unsuited to its habits. Copses broken by open spaces where the trees are thick and shady, but not too lofty, are the places for which it is adapted. Hence it would be vain to look for it in the tangled and lofty forests of tropical countries, or on the wide plains seasonally burned up with drought, with which those forests are interspersed. It has not been found in America, and we should suppose that there would be little use in looking for it there. It is pre-eminently a European bird, stationary in many places, but migratory in a few, yet not to any very great distance. In many parts of Britain its habits are in so far migratory, and there may be said to be a general movement southward as the winter sets in, and northward as the warm weather begins to return. This, however, is not to be regarded as the principal movement of these birds, their progress being from the colder parts of the same district to the warmer; and if the very early spring is moderately mild, they speedily take their departure for the groves, and commence the labours of the year. As is the case with the whole family, they then disperse in pairs, having congregated into considerable flocks during the winter, and flocks always the more numerous the more completely that the severity of the winter drives them from the woodlands. As is the case with all birds which collect in flocks during the winter, and disperse in pairs during the breeding season, the whole flock does not disappear at once, but gradually melts away, according as the lands are differently affected by the genial influence of the stimulating season. Being early breeders, they prefer copses of firs and evergreen to those of deciduous trees; and the song of the male, if song it can be called, does not begin till there is cover in which he may be concealed. Previous to this, however, he gives a very peculiar demonstration of his energy by evolutions upon the wing, in the course of which he bounds upward and plunges downward with great rapidity, as if to convince his partner how well he is able to bear his part in the maintenance of the family; and when he is to drop down in nearly a perpendicular direction, he dashes the tips of his powerful wings against each other behind his back, with a very audible sound, and down he drops with motionless wing, for a good many yards. The instant, however, that the wings strike downward, the length and power of their stroke give him great buoyancy, and he shoots upward with not a great deal more slope than that on which he descended. This peculiar kind of flight is perceptible with lapwings and other species of energetic birds, in the early part of the season, and when nothing is disturbing or threatening them. Therefore it may be considered as connected with the pairing energy; but whether it tends to stimulate that energy, or to exhaust the excess of it until the nest is formed, it is impossible to say. When the season advances so far, both birds betake themselves to their cover, and the song is begun. This song is very soft and plaintive, though it consists only of four notes at the most. These notes are really in substance the repetition of a single note, but the first and second are long, and the third and fourth short, and the two notes of each time are varied by modulation. Where there is a cover of evergreens, this song begins in February; and, while it is uttering, the songster is rarely seen. Whenever the song begins it may be understood that the construction or repairing of the nest begins also. This is an operation which is short in time, and by no means severe in labour. The nest consists of a few twigs, loosely put together, and so open that, if it can be got sight of, the eggs may be seen by an observer below. This circumstance indeed occasions the loss of very many of the eggs, especially of the first brood of the year. Sometimes they fall down, but more frequently they are observed by boys; and, as the kind of trees which the ring-dove prefers can be climbed to the height of the nest by even a very timid urchin, they are taken without mercy; and thus, though the ring-dove builds in so shadowy places, perhaps more of its eggs are plundered, at

least in copses in the neighbourhood of villages, than of almost any other bird. The eggs are always two in number, of a white colour, rather lengthened in form, with both ends about equally thick. The male does not feed the female while on the nest, but takes his turn with her in the incubation, which is perhaps nearly equally done by the pair. Notwithstanding the open structure of the nest, the warmth of the birds, the limited number of the eggs, and the constant sitting of one or the other of the parent birds upon them, bring forward the incubation in rather less than three weeks. When the young first break the shell, they are in a very callow and immature state, blind, of a dark lead colour, and covered with a thin sprinkling of yellowish down. While they are in this state the parent birds do not feed them with food in its natural state, such as they themselves subsist on. They give them a sort of milky pap from the stomach, which is the food of the parent birds, or rather part of it, reduced to chyme and mixed with the gastric fluids of the parents. It has been said that not only in these but in several other species of pigeons, the craw or first stomach secretes a fluid during the time when the young require this sort of feeding, which it does not secrete at other times, and that there is thus in them a slight resemblance in this respect to the mammalia; but this point, though a curious one, is not very clearly established. It is certain, however, that as the young advance to maturity the nature of their food, which is still delivered from the craw of the old birds, becomes less and less changed from the state in which it was taken by these birds for their own nourishment, so that, by the time that the young are fledged and have strength to shift for themselves, their digestive powers are fitted for that kind of nutriment which their own exertions can find for them. The young are usually fledged by the end of April; and after this there is generally a time of silence and retirement into the depths of the forests, until about the end of July, or the beginning of August, according to the earliness of the season and the plentifulness of food, the labours are renewed, and an autumnal brood is reared. In very favourable places, where of course the spring brood is earlier, there is an intermediate or summer brood, and of course two pauses or times of silence during the season.

The beauty, the size, and even the apparent familiarity of the ring-dove, in preferring the cultivated parts of the country to the wild ones, have led many to wish, and not a few to conclude, that it would be brought into a state of domestication. Accordingly, the eggs have been procured from the nest, and placed under tame pigeons, which have sat upon them and hatched them, and also reared the young with as much tenderness as if they had been their own offspring; but whenever these young attained the proper power of flight, they invariably made off to their place in wild nature, and returned no more. Attempts have also been made, we believe, to obtain hybrids, but they have never succeeded; and there is a line of distinction between the two, especially in their manners, which is sufficient to convince any one that all such attempts are hopeless. As to the domestication again, it is equally hopeless; for, in order that a bird may be readily domesticated, or dwell with man without confinement, that bird must be social the whole year round; and if this sociality is to be judged of from one season, the breeding season is the one upon which the judgment ought to be founded. The reason of this is quite apparent, from the fact that at that particular season all the energies and propensities of the bird are most completely developed. It is the same with by far the greater number of the mammalia; and indeed it seems to be a very general law of nature.

In autumn, indeed, the ring pigeons do begin to associate in flocks. They do this about the time when the fields are cleared of the grain and leguminous crops, and when beech mast, and various other fruits of the forest trees, begin to be strewed upon the ground. This is seldom later than November in many parts of the country, and in some places it is as early as October. The grains and seeds left, and the small fallen fruits, are their first subsistence; but, as they are ravenous feeders, they, if in great numbers, very speedily exhaust these. After this they migrate lower down, and attack the more succulent green leaves which are left in the fields, such as those of field greens, turnips, and mangold wurtzel, and as they get very fat and vigorous during the time that they are feeding on the grains and small fruits, they are well prepared for enduring the severer and less abundant part of the winter. During these flockings they never nestle upon the ground, but always betake themselves to trees in order to perch for the night; and though at this time they fly with rapidity from pasture to pasture, they make no sound except with their wings. The ring-dove measures about a foot and a half in the stretch of the wings. The weight is not so great in proportion to the dimensions as in some of the other species, but it is more graceful in its form. The colours are very fine, and remarkably uniform in the different individuals, for a species so widely distributed. The head and neck are of a very peculiar grey colour, which reflects green in some lights, and greenish black in others, and it is marked with bars of darker colour on the hind neck. The ring from which the bird gets its name is not a complete collar surrounding the neck, but consists of two patches, one on each side, approaching each other in the front and nearly meeting behind. The under parts are purplish red, with reflections varying from deep purple to clear green. The upper parts are grey, of the same changing colour as the head, but consisting of two different shades which pass gradually into each other. The mantle, or upper part of the back, together with the coverts of the wings, are darkish grey; and the lower part of the back, the rump, and tail-coverts, are pale grey, passing into purple grey on the last. The tail-feathers, which are nearly squared over, or at least very slightly wedged at the extremity and blackish in the middle, are margined with bluish grey, and have faint reflections of purple and greenish brown. The bill is orange, but the cere or naked skin at the base is covered with a mealy powder of a white colour. This bill is of a moderate length, slightly arched at the tip of the upper mandible, and without any margin. The feet are pale red and the claws black. In their form the feet are neither those of the typical tree pigeons or of the typical ground pigeons, but something intermediate between the two; the outer and inner toes are of equal length and the hind toe is rather stout, but not furnished with so broad a margin as it is in those pigeons which seek their food on trees, it being understood that this one is almost, if not altogether, a ground feeder.

Such are the leading particulars of this the most interesting perhaps of our copse birds; and we have

only to add, that though there is no hope of the bird being brought into a state of domestication, yet a pair which were confined in the gardens of the Zoological Society of London, produced a couple of eggs in 1834, though the birds were in a sate of confinement.

The Wood Pigeon—This is also known as a British bird, though it is much more rare than the ring pigeon, confined to more peculiar localities, and more confined in its manners. This species still remains to be popularly called the *stock dove*, and the *wood pigeon*, both of which names imply, that when they were given to it it was understood to be the parent stock of the tame pigeons in all their varieties. The names tend to keep up a belief in the mistake, and therefore the sooner they cease to be used the better. In some of its habits it bears a considerable resemblace to the ring pigeons, but it differs considerably in others, and also in its habits, its size, and its form. It is by no means so handsome a bird, and it is inferior in size, being only about fourteen inches in length, and twenty-six in the stretch of its wings. It is, however, better winged for its length than the ring pigeon, and its habits correspond. In Britain it is, as we have said, rare, and almost confined to the midland counties, whereas the ring pigeon is found in almost all the cultivated parts where there are plantations, and the rock pigeon reaches the extreme north. On the continent of Europe it is much more common and also much more discursive than it is with us. In winter it seeks the middle and southern latitudes, but in summer it is distributed much farther to the northward than even the ring pigeon. Its manner of nestling is very similar to that of the former species, and the eggs are the same in number, colour, and shape, but smaller. The broods are also two in the year, one before and the other following the midsummer rest. Flocks accumulate in the autumn, in the same manner as the ring doves do; and the food of the two species is, at these times, precisely the same. Indeed the two often mingle together in the same flock, and seek their food on the same pastures. The wood pigeon is just as incapable of domestication as the ring pigeon; but though it is a woodland breed, it is said to be more constant to its breeding place than the ring pigeon, the pair resorting to the same one for a number of years. We must not suppose that this is inconsistent with the more discursive habit of the bird; for birds which never by any chance migrate, or range above a mile or two, are known to change their breeding places every year; whereas the same pair of house martens, which in all probability go to the distance of many miles in the winter, return every summer, from year to year, to the same corner of the same window.

In very many of its characters the wood pigeon appears to hold an intermediate place between the ring pigeon and the rock pigeon, as we have said it knows its resting place better than the ring dove does, but in this respect it is vastly inferior to the rock. It also occasionally builds in the hollows of old trees, which the ring pigeon never does, but it is not known ever to build in the cleft of a rock. Its note has not the soft expression of that of the ring dove, neither is it heard at so great a distance. It utters no sound but a low and harsh grunt, and the fact of there being no temptation for the ear in its voice may be one reason why it is so seldom discovered, and this again may cause its numbers to be rated much below what they are in reality. As food, too, it is superior to the ring dove, but inferior to the common pigeon. As this bird and its eggs are rather more difficult to procure than those of the ring dove, we are not aware that any attempt has been made to procure a mixed breed between them; but the habits of the birds differ so much that there is no question of the failure of the experiment, even if it should be tried. The bill of this bird is rather longer in proportion than that of the former, and the upper mandible is tumid in the middle and curved at the point. The upper parts are dull bluish ash, the head dull bluish grey, and the back and sides of the neck green, with reflections of purple and bronze red. The rump, the wing-coverts, and also the belly, are bright grey. The primary quills are black with white margins, and the middle ones are ash-coloured tipped with black, forming two spots of that colour on the wing. The tail-feathers are black ash-coloured at the base, and marked on the under side by a band of grey. The lower neck and breast are vinous red, the bill orange red, the feet dull red, and the claws black.

The Rock Pigeon. Though, as we have hinted, this species ought to stand distinct from all the tree pigeons and perching pigeons, yet, as it resembles in shape and in some of its characters, at least when in the wild state, the ring and wood pigeons much more than it resembles any other, we shall introduce our short notice of it here: and as the numerous artificial varieties belong to bird-fancying rather than to natural history, we shall chiefly confine ourselves to the bird as in a state of wild nature, and as a sort of voluntary dweller in artificial pigeon-houses. If we have occasion to say anything more than this, it will only be to point out the curious deviations from the simple form in the natural state, which artificial treatment has produced in this species of bird. Even in pigeon-houses, where almost the only thing which art does for them, is to provide them with an artificial dwelling more comfortable than those in which they naturally take up their residence, and situated in the closer vicinity of rich pastures for their feeding, even there they are very prone to break into varieties of colour, and in proportion as they are brought nearer and nearer to the house, they deviate farther and farther from the appearance of the bird in a state of nature; and some of them become so fantastic in appearance, as to differ more from the parent stock than other species with which that stock is little if anything allied. Amid all these varieties, however, there are certain characters of the wild bird which are never entirely obliterated. There are two dusky bars across each of the closed wings, and some white in the rump. If the general colour is white, the superior whiteness on the rump is of course not easily discerned; but even then the bars on the wings may be traced. In the state of nature, the appearance of these birds may be briefly described in the following terms: the body very compact, the shoulders tapering finely to the neck, the top of the head flat, the front elevated, and the bill of moderate length; the tail long and more rounded at the extremity than in either of the other British species, and the wings long and pointed; the head and throat are bluish-grey, and so are the lower part of the breast and the belly; the upper part of the breast and sides of the neck are brownish-purple, with reflections of purplish red and green; the mantle and smaller coverts of the wings are bluish-grey; the lower part of the back

is white, passing into bluish-grey on the tail-coverts, and into deeper grey on the tail-feathers, which are crossed by a dusky band near the tips; the greater coverts and the secondary quills are crossed with black, and form the bars already alluded to, when the wings are closed; the principal quills are blackish; the bill and feet are reddish; the length is about thirteen inches, and the stretch of the wings not much less than two feet; the plumage over the whole body, both in the clothing feathers and in the feathers of flight, is remarkably close and compact, and the birds have great power of themselves in the air, even when the wind blows with considerable violence.

They would require this preparation at the hand of nature in consequence of the severe storms which they often experience at those places where they reside and nestle. It does not appear that there is, generally speaking, much food for them in the close vicinity of these their natural habitations. But in order to keep up the powerful and long-continued muscular action which they must exert, they require a high degree of action in the vital system, and, consequently, a copious and frequent supply of food. In order to obtain this they must range about in all weathers, and consequently they require to have great management of themselves in the air. On their long flights in a state of nature they are not very often seen; but after they have taken up their abode in pigeon-houses, their flight is lower; yet even the ones which live in small numbers about houses, and are fed without much effort on their part, may often be seen wheeling and driving very gracefully through the air, apparently for no other purpose than that of exercising their wings.

It is highly probable that the labour which they feel in returning from long distances when they are heavy with feeding, is one of their great inducements to take up their abodes in artificial pigeon-houses. The general belief, and we have no reason to doubt the truth of it, is that they are attracted by whitened pigeon-houses, much more than by those which are of a dark colour. There may be two reasons for this; first the whitened pigeon-house is a more conspicuous object than the other; and, secondly, a considerable quantity of carbonate of lime *may* be required for the eggs of the females, which, though only two in each hatch, are often numerous in the course of the year. Even under the most unfavourable circumstances, there are seldom fewer than three hatches in the year, and sometimes there are as many as a dozen. The latter of course takes place only in rich pastures; but still the birds are highly prolific.

In those lofty cliffs overhanging the sea, which are the favourite resorts of rock pigeons, caves are the places in which they repose and nestle, and rear their broods; and the darker the cave is, it is understood to be the more favourable for them. Such caverns are chosen as nesting places by many sea-birds which find their food on the waters; but though the rock pigeon takes nothing from the water, it inhabits farther into the cave than the most habitual diver, or the bird most discursive over and dependent upon the sea. It is true that these birds are often found on the beaches walking about and picking up something; but whether they pick up any part of their food there, or merely bits of shells and small pebbles, it is not easy to say.

Upon the rocky parts of the west of Scotland, and the bold shores of the western isles, some of which are rocky and caverned enough, these birds abound perhaps more than in any other parts of the British islands. As the shores of the main land are exposed to the winds of the Atlantic, and the comparatively small islands are surrounded by that ocean, the low grounds exposed to the west are seldom covered with snow for any length of time, and thus the birds easily find a supply of food. The numbers which congregate on one shore, and even in one cave, if it be large and lofty enough, are often very great; and the boatmen who convey strangers to visit the caves into which the tide enters for a considerable distance, very generally take advantage of the pigeons, as a means of giving their fare a surprise, which is rather startling to those to whom it is entirely new. They row into the cave as silently as possible until they have advanced some little way. Then the steersman seizes a fowling piece which has been stowed away, and the rowers cease pulling. In an instant, and before the passengers have time to inquire what is the matter, the musket is discharged; the rowers thunder on the gunwale with their oars, and out dash the pigeons in a torrent flood, making so loud a rustling and rumbling with their wings, that those to whom it is a novelty, can hardly persuade themselves that the whole materials of the cave are not hurling down, in order to entomb them in a majestic sepulchre. But the din, though loud and not unalarming, does not last long, as the pigeons are fully as much affrighted as the passengers; and as far as the roof of the cavern can be seen, it is as stable as ever, and not an ounce of stone is loosened from its place. Fingal's cave, in the wild and beautifully green Isle of Staffa, which isle is perforated through and through under the low-water mark, and absolutely rocks, like an unstable thing, before the swell of the Atlantic, when the majesty of that ocean is up, used to be, if it is not still, a favourite place for this kind of exhibition. The cave is large and lofty, and if the interior of it is not absolutely dark, it is dim twilight; and as much of the roof consists of portions of basaltic columns hanging as it were by simple contact with each other, there are few roofs of caverns, the fall of which would be more likely to be expected by one who does not understand the firm texture and stable union of this wonderful architecture of nature. Another thing, basalt is perhaps the most sonorous of all rocks, and therefore the echoes of the cave itself go to swell the sound made by the numerous wings of its inhabitants.

When the birds are thus disturbed, it is generally in the time of their repose; and hence, after they have escaped from the cave, they fly no farther than they may apprehend that the danger is to follow them. They do not, however, return immediately, but rise to a considerable height in the air, and keep wheeling about as if to show how vain it would be to follow them in that element. Although, however, they are by this means quite safe from the alarm below, and would of course have been so though they had remained in the cave, there is sometimes an enemy above them far more dangerous, at least to one or two, than that which has caused them so much alarm. If one of the large and powerful falcons of the north happens to be above the pigeons in the sky, down he comes with the rush of a thunderbolt, and, striking right and left, tumbles two or three of them down, and then alights to eat them at his leisure.

The love of home, and certainty of return to it, which, in this species, secures the flock to the pigeon-house, and the more wonderful return of the carrier pigeon, even when it has been carried away from home in a basket or hooded, is very conspicuous in the wild rock pigeons, or *bisets*, as they are called by the French. Flocks from different parts of the coast often meet on the feeding grounds; but when the time of returning to rest comes round, each one keeps to its own party.

It is in vain for man to attempt any solution of this upon the principles of human philosophy, any more than it is possible upon the principles of such philosophy, why this pigeon should possess it, and the greater number, if not all the rest, should be without, or than it is possible to explain why a pigeon is a pigeon and not any other bird. But still, though we can arrive at no conclusion upon this subject by reasoning, it is one which is both open and inviting to our observation; and it is perhaps more so in the case of this species of pigeon than it is in any other animal. That the animal does not return in consequence of any remembrance of the way similar to what we call remembrance, is quite evident; because, as we have mentioned, the carrier pigeons are usually brought from their homes, shut up in baskets, or muffled in hoods, so that they can see nothing even on the ground. Besides this, they take the air on their flight at so lofty an elevation, as that they can see nothing upon the ground; and the proof that they would avail themselves of nothing of the kind if they did see it, is perfectly clear from their passing as readily and as certainly over hundreds of miles of sea where there are no marks as over a few miles of land. The instinct, for we have no other name for it, which enables them to do this, appears to be substantially the same in all; for the migratory birds, unless when the strength of the wind happens to drive them from their courses, arrive at their breeding places with the same certainty as the pigeon arrives at its home.

There is, however, a difference in the mode in which the instinct operates; and this difference is the important part of the matter, because it is that which shows that the bird or other animal will come to an artificial habitation to which it is accustomed, whether that habitation be native to it or not. It is true that we can no more explain the reason of this, than we can explain the reason of the general instinct, and it is impossible that we could, inasmuch as there is no reason in the matter; but we do know that whatever bird or other animal can range to a great distance, and return to an artificial home, is always capable of being domesticated to some extent or other. There are few, if any, which have it, and are not serviceable to man in some way or other; and all that have it strongly, are social when in the natural state.

Domestic pigeons, which are nothing but the rock pigeon in a state of greater or less domestication, are kept, that is, encouraged, in pigeon-houses in most parts of the civilised world. We have already expressed doubts as to the profit of having numerous pigeon-houses in districts which are entirely cultivated, and we still lean to the opinion, but would not be so dogmatical upon it as to advise any one to demolish a pigeon-house. Except where there are extensive market gardens, and constant culture, the pigeons must find their own food for the greater part of the year; and it may be said to be only for two or three months from the first ripening of the early crops to the last gathering in of the late ones, and while the seeds are sowing, or nearly sown in the spring, that they can be said to be very destructive. While the ground is clear and there are no crops to destroy, and this is the time when they are in the best condition for the table, they are really serviceable to the farmer. It is not possible to remove crops, whether cereal or leguminous, from the fields, without leaving a pretty large fraction of the seeds upon the ground. These seeds are not only not wanted there, but if not picked up by pigeons or some other seed-eating birds, they would be a nuisance to a farmer who farmed in a proper manner. If the kind of grain is not changed every year, the farming is bad; and if the seeds which strew the ground, and which often amount to a sowing were allowed to remain, they would grow up, and not only render the future crop foul with the mixture, but diminish its quantity. Examples of this are to be met with in cold and upland places where the crops are long in ripening and the birds are driven away by the cold before the fields are cleared. In such countries one seldom finds a patch of oats without an admixture of barley in it, or a patch of barley without an admixture of oats. Nor is this the worst, for there is a want of little birds upon the fields to pick the seeds of those noxious plants, by which the crops are greatly diminished and their quality injured, and sometimes rendered unwholesome. The people of the midland and southern counties of England, and of rich and warm districts in other parts of the country, may thank the flocking birds of winter that their meadows are so exclusively covered with grass, and their crops so free from weeds—the more so, that in some of the places alluded to, the agriculture is very slovenly, so that, but for the birds, weeds would in a very short time be the staple crop.

It is upon this principle that the utility of pigeon-houses admits of defence; and then the extreme fertility of the birds, the goodness of the flesh of the young ones, and the great value of the clearance of the pigeon-house as a warm and stimulating manure, plead powerfully to the same effect. In districts where pigeons are numerous they also come in in the best condition when the people of the districts have comparatively little time to go in quest of other food, from the necessity of attending to the gathering in of their crops, at the time when the weather begins to break in prelude to the autumnal rains, by which, if the crops are overtaken, the result is always very disastrous. For these reasons we suppose that, after all, we must give our advice in favour of the pigeon-house, though it would be foreign to our purpose to describe minutely the construction and management of a pigeon-house. The house should be on a slope facing the south, and the roof should be a pretty steep southern slope, to enable the birds to bask in the sun. Water should be near, and it should not be shaded, or closely surrounded by trees; it is better, indeed, to stand by itself, so that the birds may not be disturbed in their labours. Though most of the old pigeon-houses are square, a circle is preferable; and it might be defended both inside and out by a projecting ledge below all the pigeon-holes, to prevent destructive animals from reaching there; and, besides this protecting ledge, there should be others higher up for the birds to alight upon as they enter

their abode. Cleansing the inside frequently, and whitewashing the outside as occasion requires, are also very necessary operations. The fact is, that pigeon-houses are like all other things, if they are expected to be profitable they must be attended to; and there are many known instances in which the slovenly keeper of a pigeon-house has found the greater part of his flock go over to the establishment of his neighbour merely because it was in better order, and the reproving deserters made no hesitation in coming to levy their contributions upon the crops of their slovenly master. We have, however, said enough of the wild and the domesticated economy of these birds when allowed to remain in numerous flocks.

Of the fancy varieties we shall do little more than barely mention the names; because there is no certain information upon the only point which, in a natural-history view of the matter, is of any importance, namely, the particular means by which the variations were produced and have been continued. The last part of this is a curious fact. We do know, not from pigeons only, but from many other animals, both birds and mammalia, which break into varieties under the hand of man, that, when the variety is once obtained, it can be continued; and the most curious part of the matter is, that the artificial change may be directed to the size and modified form of the animal, or to the farther development of any of its particular actions or instincts. Thus, in the dog, there is not the slightest doubt that there is only a single natural species of the animal; and yet the sizes, the powers of motion, the disposition, and the senses, are varied to an extent which one can hardly imagine; and yet, excepting in some crosses which have been obtained in times comparatively modern, nothing is known of the matter with anything like certainty. It is the same with the different breeds of fancy pigeons; and yet there could have been no cross in the first splitting into two breeds in either of these or in any other.

The principal breeds or varieties of fancy pigeons (and the distinction between a breed and a variety is really a distinction without a difference) may be briefly enumerated as follows, though to enumerate the whole would be a hopeless task, as they may be increased without end:—the Roman, which is of very varied colours, and has the naked skin at the base of the upper mandible nearly white;—the Norway, which has the body pure white, the feet feathered, and a crest on the head;—the Barbary, which has a naked tuberculated space round the eye, and two dusky spots on each wing;—the Persian, which has the naked skin at the base of the bill red and tuberculated;—the Broach-tailed Shaker, which has a vast number of feathers in the tail, often more than three dozen, with the power of erecting and spreading them like the tail of a turkey-cock; and when it does this, it shakes with violent agitation;—the Narrow-tailed Shaker, a cross with the female of the last, retains the trembling action, but has the tail narrower, consisting of fewer feathers, and incapable of the same spread and erection;—the Jacobin, which has the feathers of the hind head and sides of the neck thread-shaped and erected;—the Laced, which has small standing-up feathers scattered over the back and wings;—the Smiter, which turns over when it flies, and strikes its wings against each other with considerable violence;—the Turner, which has the feathers on the middle of the hind neck reversed, and standing up like a mane;—the Panter, which has the power of inflating the craw, till it projects forward as far as the point of the bill;—the Houseman, which has also the power of inflating the craw, and the naked skin at the base of the bill warty;—the Turbit, with the feathers on the breast reversed;—the Tumbler, which, while it flies, performs the operation after which it is named much in the same way as the Smiter, but which does not, like that, make a noise by striking the wings against each other;—the Rough-footed, with hair-like feathers on the feet, but without any crest of produced feathers on the head;—the Crested, which has the feet feathered in the same manner as the preceding, and has, in addition, a crest upon the head. These are but a specimen out of many; and as they have no peculiarity of habit answering to their peculiarity of form, or no useful property answering to their peculiarity of action, they are worthy of attention by the bird-fanciers only. There is, however, one other variety which has, from very remote times, engaged so much celebrity, that we cannot pass it over without some slight notice. This species is—

The Carrier Pigeon, or the *Messenger*. In consequence of its celebrity, and also of the differences between it and the wild rook and pigeon-house pigeon, there have been many disputes about it. Some have maintained that it is a distinct species, but for this there appears to be no good foundation. Many of the other fancy breeds differ as much from the wild bird as it does. It possesses the love of home in a very high degree; and there is no known species in wild nature at all answering to it. Besides, carrier pigeons differ from each other; they vary in size, and the small ones resemble the common pigeon in more points than the large ones do.

The carrier is a larger bird than most varieties of the common pigeon. It is about fifteen inches in length, and a pound and a quarter in weight. The shape of its body is graceful. Its neck is long, and its pectoral muscles are very large, indicating a power of vigorous as well as long-continued flight. Its plumage is remarkably compact, but no general description of the colour of that plumage can be given, as the bird is subject to much variety in this respect. This, of itself, is sufficient to prove the fact that the bird is a mere variety. Black, and a sort of dim sand-colour, are most common; but the blue and pie-bald blue are more rare, and therefore more prized by the curious in birds. The naked skin upon the bill of the carrier pigeon is very large, of a whitish colour, and scurfy or warty appearance, and hanging down as a sort of wattle on each side of the lower mandible. This appendage extends forward, and terminates in a point about the middle of the length of the bill. The cere on the Turkish or Persian pigeon is also large, and scurfy or warty, as in this one; and this circumstance has led some to mistake it for the carrier pigeon. It is, however, a bird of very different habits, low and heavy in its flight, and possessing no particular attachment to its home, not more at least than is possessed by the wild rock or the common pigeon-house pigeon. The fleshy appendage to the bill of the Turkish pigeon is different in appearance from that of the carrier; it extends into a wider naked space round the eye, and it is blotched or mottled with reddish. The colours of the bird are in general different; but, as we have

said, there is no such thing as describing the positive colour of any of the artificial varieties of the pigeon, though in each variety, as forming the breed of a particular place, there is usually one colour which is more prevalent than any other.

The amateurs of carrier pigeons estimate their goodness by the wattle. According to them, it should be broad across the bill, rise high at the head, and have the portion round the eyes as broad as possible. The second of these forms is supposed to be the most valuable; and therefore the dealers sometimes contrive to insinuate a piece of cork below the hind part, and fasten it with a bit of wire, which is of course very injurious to the bird.

As the carrier is unquestionably a species, it is useless to speak about the country in which it is found in the wild state; for, though the country in which these varieties were originally obtained may properly enough be considered as their native country, yet not one of them is to be found continuing its variety in the wild state.

The carrier pigeon has been known and celebrated from the most remote antiquity, and its use as a messenger is repeatedly celebrated by the poets of Arabia, Greece, and Rome. Nor is it confined to them, for the historians make frequent allusions to it as in some instances carrying intelligence with wonderful rapidity, and in others in performing the same office where hostile armies, or other impediments, prevented communication along the ground. Ælian mentions that, when Taurosthens was victor at the Olympic games, a carrier pigeon bore the tidings to his father with wonderful celerity. As a contrast to this use of the carrier among the ancient Greeks, it may be mentioned that, at no very remote period, carrier pigeons were employed in England to convey intelligence of the result of games of a very different kind. In the times alluded to, Tyburn was the place of execution for the British metropolis; and, in consequence of the wretched state of the police in town, and the total absence of anything like police in the country, Tyburn was kept pretty constantly at work. It not unfrequently happened, too, that, though the punishment of death was awarded, it was not really intended to inflict more than the disgrace of being drawn on the hurdle from Newgate to Tyburn, or perhaps, in addition to this, a longer or shorter imprisonment. Hence pardons and respites were very frequently given at the foot of the gibbet; and the relations of the criminals, who, in the days of daring highwaymen, were often persons in comparatively elevated situations, naturally felt great anxiety for the fate of the condemned. Hence they used to have some one there with a carrier pigeon, and the instant the result was known, that pigeon was let off, and winged its way at the rate of twenty or thirty miles an hour.

Pliny mentions the use of carrier pigeons to beleagured cities. When Modena was invested, he says—"Of what avail were centinels, circumvallations, or nets obstructing the river, when intelligence could be conveyed by aërial messengers?" In the time of the Crusades these pigeons were extensively employed by the people of the invested cities; and there are instances mentioned in which the pigeon was captured by the besiegers, and made the bearer of a very different message from that with which it was originally charged. In some instances hawks were kept by the besieging parties for the express purpose of being flown at the pigeons; and, as the noble hawks do not strike on the ground, the pigeon dropped like a stone uninjured, and allowed itself to be captured; and the hawk being recalled to the lure, the pigeon was charged with false intelligence, and sent to its original destination.

But these extraordinary birds have been used for the purposes of commerce as well as for those of war; and, when the Turkey Company of England was flourishing, and a number of English merchants were resident at Aleppo, the grand emporium of the trade, carrier pigeons were employed to bring intelligence from the port to the city. Scanderoon, the port of Aleppo, is distant about eighty miles as the pigeon flies. The pigeon could bring intelligence over this distance in not much more than three hours, while it could not come by any other channel in much less than the same number of days. Thus, those merchants who employed pigeons could, upon the arrival of ships, obtain information which they had abundant time to turn to advantage. One case is mentioned, upon authority which there is no reason to doubt, where a merchant killed one of these pigeons by accident, and learned from the billet which it bore that there was a great scarcity of galls in England. Taking advantage of this, and buying up nearly the whole quantity in the market, he at once cleared a sum which, in those days, was considered an ample fortune.

In the east, intelligence was, in former times, communicated by these pigeons much in the same manner as is now done by telegraphs. Slight towers were built along the line, at thirty or forty miles distant from each other, and pigeons were employed in flying from tower to tower. These pigeons wore a very small box of gold, of extreme thinness, suspended from the neck; and, as the pigeon wore this box always, it could carry the message and bring back the intelligence. Centinels were kept constantly watching on the towers; and, as each flew from its own tower to the next and back again, the information, though not so expeditious, certainly could be rendered much more effective than that which the telegraph affords. In England, and we believe we may say in Western Europe generally, in modern times, pigeons have been little, if at all, used for what may be called useful purposes; but they are often employed as matters of curiosity, and as conveying the results of questions upon which bets continue to be taken until they are decided.

Our limits will not, however, allow us to enter farther into the history of these highly interesting birds. We may mention, however, that though there is much in the breed of the pigeon, yet each individual bird must be trained before it can perform its office rightly. Turkey may be considered as the country where these pigeons are more especially employed, and the mode of training them in Turkey is this:—the bird is first taken out in a basket, or hooded, to the distance of about half a mile, and then let go; if it did not return directly from this distance, it was considered as of no value; if it did return directly and swiftly, it was taken to greater and greater distances, until at last it could manage thirty or forty miles with certainty. Those to which we have alluded, as being used by the merchants of Aleppo, were trained all the way to Scanderoon; and if they came directly back, they were counted birds of great value, and brought a high price. As in the case of carrying

intelligence, of which advantage, either military or mercantile, is to be taken, it is of the utmost consequence that the pigeon should not alight upon the ground, means were taken to prevent this. The most urgent necessity which the bird had to descend was in quest of water; and it was found that if its feet were well bathed in vinegar before it started, its tendency to alight was prevented. We have felt it necessary to go a little into the details both of the character and history of the carrier-pigeon; first, because they are very curious; secondly, because they are but little known to ordinary readers; and thirdly, because, rightly studied, they afford much light upon the training of animals so as to make them useful to man. We believe that this kind of training (we allude to the training of carriers) is not confined to this variety of the rock-pigeon, but might be applied to any variety if proper care were bestowed. It is not even confined to pigeons, but seems to be applicable to any bird which habitually lives in a social manner at the same place, and mention is made that the rook has been employed as a carrier in some of the eastern countries, but not frequently we believe.

There are many pigeons bearing some resemblance to those which we have noticed, beginning with the ring-pigeon and ending with the carrier; but, as we have rather exceeded our limits in what we have already said, and as there is very little to be said on the others, except of the differences of size and colour, we shall pass to the remaining subdivision of this branch of the family, namely, those birds to which the appellation *Turtles* is given. They vary much in their forms, appearances, and sizes; the species of them are exceedingly numerous; and they are distributed over every quarter of the world, with the exception of the colder latitudes. They agree, however, in certain general characters: their bills are more slender than those of the typical pigeons; they are in general smaller and more lightly made, altogether more delicate-looking birds, and their tails are less even at the extremity. In all they are longer than the tails of the pigeons, and in many they are very long and wedge-shaped. This is not the case with what may be called the typical turtle, namely, the one species, or rather the two species, which have been known and celebrated from the remotest antiquity. They have the tails rounded at the extremity, and are clad in far more simple attire than the long-tailed ones, which resemble, in the brightness of their plumage, the length of their tails, and partly also in their habits, some of the more slender-billed of the tree pigeons, and on account of this resemblance these tree pigeons have sometimes been called *Turtellines;* but neither these nor the long-tailed turtles are entitled to any share of the poetic fame with which the typical turtles have been invested. Many of the eastern writers celebrated the gentleness of the turtle; and it is long since it was the rival of the nightingale, with allusion to the attachment of the pair. The celebrity of the turtle is not confined to profane writers; for it is enumerated in the catalogue of the beauties or attractions of the sweet season of the year, in that glowing enumeration of them which is given in the second chapter of the Song of Solomon:—"Rise up, my love, my fair one, and come away." The coming was forth into the fields, to enjoy the beauties of nature, and the inducements are as follows:—"For, lo, the winter is past, the rain is over and gone; the flowers appear on the earth: the time of the singing *of birds* is come, and the voice of the turtle is heard in our land. The fig tree putteth forth her green figs, and the vines *with* the tender grape give a *good* smell. Arise, my love, my fair one, and come away." We have quoted the entire passage, as well for its beauty as from its tending to illustrate a point in the natural history of the turtles, namely, that the turtle alluded to in it is not the common turtle of the warmer parts of Europe, which comes as a summer visitant to a small portion of the south of England, but another turtle whose native locality is still further to the south. Having done so, we may remark, in passing, "that the words of birds," "with," and "good," are not in the original, but have been interpolated by the translators, and, few though they are, they mangle sadly the beauty and power of the passage. The "time of singing" applies to the song of all nature, and the addition of the words "of birds" ties it down to a single class. In like manner the interpolation of the word "with" spoils the beautiful reduplication, the two expressions for the one subject, "the vine—the tender grape." Nor is the word "good" less objectionable, for if it mean anything as applied to a smell it means fragrance, whereas a vine with tender—that is with young grapes, has no fragrance, though it has the *freshness* of a healthy plant in a state of vigorous growth. But we must notice a few, and it shall be only a few, of the species.

Common Turtle.—Considered as a British bird the common turtle is the smallest and the most local of all our pigeons. The male bird is but twelve inches long, and the female is still smaller. The upper parts are brown; the top of the head and the hind neck ashen grey, each side of the neck garnished with a flat patch of small black feathers with white tips; coverts of the wings brown bordered with russet; quills blackish with whitish borders; tail-feathers brown with white tips to the lateral ones; throat, neck, and breast tinged with vinous red; rest of the under part white. The male generally has a white patch on the forehead, which is wanting on the female; and all the colours of the female are duller than those of the male. The naked skin round the eye is red, the bill bluish, and the feet red. Turtles are, however, subject to considerable diversity of colour, which is understood to depend upon age, upon season, and upon original differences in the individual.

The common turtle is found in Europe, in Asia, and in some parts of Africa, and it ranges much farther to the north on the continent than it does in Britain, though it never extends its summer journey within the arctic circle. It is a delicate as well as a gentle bird, and retires, not only from northern and middle Europe, but even from Greece and Italy, if the winter is severe. As a British bird it comes late in the spring, or rather just about the beginning of summer, never before the end of April, and sometimes not till the middle of May. They occur in pairs, and soon betake themselves to the thick groves, in the closest shadow of which they construct their rude nest, deposit their two eggs, and perform their incubation. During this time their plaintive and tender cooing may often be heard in the neighbourhood of those thickets where they nestle; but the birds themselves are very seldom seen, as in wild nature they are exceedingly shy and retired. They are, however, mild and gentle creatures, and though they cannot be

domesticated, they very soon become tame in confinement. If the pair is caught, their attachment for each other continues, they caress the hand which feeds them, and their whole manners are beautifully simple, and their attitudes remarkably graceful. As we have mentioned of some of the other species, it has been well ascertained, that immediately before the young break the shell the inner coat of the craw becomes glandulous, and secretes a fluid, by means of which the young are fed when in their unfledged and helpless state. When the leguminous plants begin to have seeds in their pods the turtles come more abroad, and it is understood that by this time the young accompany them. They feed upon the ground, or reposing upon herbaceous plants, just as pigeons do ; but they roost in the thick cover of the groves, both in their mid-day *siesta* and during the night. In England they have no time to rear a second brood, for in August they begin to appear in little flocks upon Romney Marsh, and other open places near the south-eastern shore, and about the latter end of August they take their departure. Kent is their grand head-quarters with us ; and small and gentle as they are, they sometimes commit pretty extensive ravages upon the fields of peas. The number of the broods in warmer climates has not been ascertained.

The Collared Turtle.—This is a smaller and more delicate species than the former, and it dwells nearer the land of the sun. It is pretty well ascertained that this species is the turtle alluded to in the Bible, and also the bird which was considered by the mythologists of old as sacred to the goddess of Love. The delicacy of its habits will be readily understood from its being represented in the passage which we have quoted, as a migrant bird, appearing only at the commencement of summer, even in Syria. It has been a great favourite from the earliest recorded times, and it has been in so far domesticated. It is true that it requires to be kept in confinement, but still it will breed in captivity, and it is very prolific if proper attention is bestowed upon it. But though the descendants of the domesticated ones have been continued for many generations, the tendency to escape has never been overcome ; so that though it is sometimes called the domestic turtle in distinction from the other, it is really not a domesticated bird, but one which no continuance of breeding in confinement has the least tendency to domesticate. It has not the habit in wild nature upon which domestication depends ; and experience has satisfactorily proved, that if an animal has not this habit it cannot be domesticated, however gentle it may be in a state of confinement. The climate of Britain is unfavourable to the breeding of so delicate a bird, without more attention than most people have either time or inclination to bestow upon it ; but in warmer climates, where the task is easier, and the labour of man is of less value, it is very extensively kept as an ornamental house bird.

In its habits it is fully as migratory as the common turtle, ranging occasionally through the whole of Africa, and being met with as far south as the Cape. It comes into Europe during the summer, but only into the warmer countries, and there is no instance of its being found in any part of Britain even as an occasional straggler. The length of the bird is rather more than ten inches, its form is light and delicate, its wings long, its tail long and rather rounded, and it is altogether well organised for flight. The colours, as in the former species, are subject to variation, but the following may be regarded as the average. The clothing feathers on the upper part grey, glossed with a rosy tinge. The coverts of the wings cream yellow, and the tail-feathers ash colour, having white tips to all except the two middle ones, and white margins to the two exterior. The head is bluish grey, darker on the forehead and paler on the front ; the cheeks, neck, breast, and belly, are grey, with a purplish shade ; there is a half collar of black on the hind neck, terminating in points forwards ; and the vent-feathers and under tail-coverts are white. In some specimens, however, the whole plumage is white, with a simple indication of the collar, and the coloured ones are of a great variety of shades. Though this turtle has been celebrated, and justly celebrated, for the gentleness of its manners, and the tenderness of its attachments, it is the common turtle which is the bird of plaintive song ; and the voice of this one has more the character of a merry than of a mournful sound, for it has been compared to a short and subdued laugh ; and this harmonises with its voice being enumerated among the joyous signs of the coming summer in that passage of the Song of Solomon which we have quoted on a preceding page. This difference of voice, independently altogether of size, colour, and locality, would be sufficient to establish a specific difference between the two ; but the point has been further demonstrated by the mixed progeny being capable of self-continuation.

Carolina Turtle. This of course is a North American bird, ranging in the summer as far as Canada, but moving southward in the winter, partially even from the middle states of the American Union. Their great winter quarter appears to be in the Carolinas and states to the south, where they appear in great numbers. They are interesting birds on three accounts : first, on account of the melancholy and affecting sound of their notes during the breeding season ; secondly, on account of the high estimation in which the flesh is held, and the ease with which it can be procured in consequence of the familiarity of their manners ; and, thirdly, because, in form, they hold a sort of intermediate station between the turtles with the tails rounded, such as the two species which we have noticed, and those with the tails very long and exceedingly wedge-shaped. There is a farther advantage—Alexander Wilson is the historian of their manners.

The following is his description of the birds :—
" The turtle-dove is twelve inches long and seventeen in extent ; bill black ; eye of a glossy blackness, surrounded with a pale greenish-blue skin ; crown, upper part of the neck, and wings, a fine silky slate-blue ; back, scapulars, and upper wing-coverts, ashy-brown ; tertials spotted with black ; primaries edged and tipt with white ; forehead, sides of the neck, and breast, a pale brown-vinous-orange ; under the ear-feathers a spot or drop of deep black, immediately below which the plumage reflects the most vivid tints of green, gold, and crimson ; chin pale yellow-ochre ; belly and vent whitish ; legs and feet coral-red, seamed with white ; the tail is long and cuneiform, consisting of fourteen feathers ; the four exterior ones on each side are marked with black, about an inch from the tips, and white thence to the extremity ; the next has less of white at the tip ; these gradually lengthen to the four middle ones, which are wholly dark slate ; all of them taper towards the points, the two middle

ones most so. The female is an inch shorter, and is otherwise only distinguished by the brilliancy of her colour; she also wants the rich silky blue on the crown, and much of the splendour of the neck; the tail is also somewhat shorter, and the white with which it is marked less pure."

These birds do not begin their winter migration from any part of the United States until the frost begins to set in; and except it be the states of the extreme north, they do not entirely quit any place during the winter. In the Carolinas and Georgia the woods swarm with them at this season, and the rustling of their wings is heard in all quarters. They are not very timid then; and as they are in numerous flocks very close together, they become an easy prey to the fowler at the very season when their flesh is in the best condition. They move northward in March or early in April, and by this time the large flocks are broken up. "Here," says Wilson, "they commonly fly in pairs; resort constantly to public roads to dust themselves and procure gravel; are often seen in the farmer's yard before the door, the stable, barn, and other outhouses in search of food, seeming little inferior in familiarity, at such times, to the domestic pigeon. They often mix with the poultry while they are fed in the morning, visit the farm-yard and adjoining road many times a day, and the pump, creek, horse-trough, and rills for water. Their flight is quick, vigorous, and always accompanied by a peculiar whistling of the wings, by which they can easily be distinguished from the wild pigeon (Passenger Turtle). They fly with great swiftness, alight on trees, fences, or on the ground indiscriminately; are exceedingly fond of buck wheat, hempseed, and Indian corn; feed on the berries of the holly, poke, huckle berries, partridge berries, and the small acorns of the live oak and shrub oak. They devour large quantities of gravel, and sometimes pay a visit to the kitchen garden for peas, for which they have a particular regard." In different latitudes of the long range of the United States, they of course begin to breed at different times; but in the Middle States they begin in the end of April and beginning of May. Their nests are formed of sticks and very rude; they are always in concealment, but they do not confine themselves to the depths of groves like the eastern turtles, for they nestle in gardens if the trees are close enough, in ivy upon wall, or in some instances under a bush upon the ground. In their habits they are thus very different from the turtles of the east; but the greater number of them are in the woods, and we must allow their unrivalled historian to describe their song in his own language. He mentions hat those who wander in the American woods in the spring, will there hear many a singular and sprightly performer, "but none so mournful as this. The hopeless woo of settled sorrow, swelling the heart of female innocence itself, could not assume tones more sad, more tender and affecting. Its notes are four; the first is somewhat the highest and preparatory, seeming to be uttered with an inspiration of the breath, as if the afflicted creature were just recovering its voice from the last convulsive sobs of distress; this is followed by three long, deep, and mournful moanings, that no person of sensibility can listen to without sympathy: a pause of a few minutes ensues, and again the solemn voice of sorrow is renewed as before. This is usually heard in the deepest parts of the woods, frequently about noon and towards evening." None but a master of the highest order, both as an observant naturalist, and as deeply read in the feelings of the human heart and their sources, would have rendered the song in this strain. Yet, after all, it is rendered according to the manner of men, and not according to the physiology of the bird; for it must be recollected that these notes, sad as is their tone, and mournful as is their cadence, are the epithalamium of the delighted turtle.

Passenger Turtle. In some respects this bird is the marvel of the whole Columbidine race, highly interesting as many of them are, and as all would doubtless be, were we acquainted with their manners. The bird is beautiful in its colours, graceful in its form, furnished to admiration in its powers of flight, and far more a child of wild nature than the Carolina turtle. The especial marvel, however, is in its multitudes—multitudes which no man can number; and when Alexander Wilson lays the wand of the enchanter upon the mighty valley of the Mississippi, and conjures it up to the understanding and the feeling of the reader, with far more certain and more concentrated and striking effect than if it were painted on canvas or modelled in wax, these pigeons form a feature in it which no one who knows can by possibility forget. It is probable that the multitudes may not be more numerous than those of the petrels in Bass's Strait, of which Captain Flinders, who also was a kind of Wilson in his way, gives so graphic a description. But, vast as the multitude of these was, it was only as a passing cloud to the gallant captain; he was not able to follow it up; and, even though he had, the flight of birds over the surface of the sea is lame and storyless as compared with the movements of the unnumbered myriads of those pigeons in the great central valley of America.

None of the names which have been bestowed upon this species is sufficiently, or at all descriptive of it. Passenger, the English expression, and "*migratoria*," the Latin name, fall equally short, inasmuch as every known turtle is, to a greater or less extent, migratory as well as this one. The "swarm" turtle, the "flood" turtle, or even the "deluge" turtle, would be a more appropriate appellation; for, as we shall see, the weight of their numbers breaks down the forest with scarcely less havoc than if the tide of the Mississippi were turned against it.

Birds so numerous demand both a wide pasture and powerful means of migration, and certainly these are not stinted in either of those respects. In latitude their pasture extends from the thirtieth to the sixtieth degree, which is upwards of two thousand miles; and the extensive breadth in longitude cannot be estimated at less than fifteen hundred. Three millions of square miles is thus the extent of territory of which the passenger turtle has command; and that territory has its dimensions so situated as that the largest one is the line upon which the birds migrate.

These birds in so far resemble the rock pigeon, that they are social both in their breeding-places and on their migrations; but we are not aware that a proper experiment has been made to ascertain whether this sociality of theirs could be made the basis of domestication. As the case stands at present, indeed, there is but little temptation to make such an experiment, because their numbers are so great, and they can be procured, and often actually gathered from the ground in such abundance, that there is little or no

temptation whatever to rear them artificially. Their flesh, too, is not of the very best quality, and their numbers and voracity are such as to render them little short of nuisances upon the cultivated grounds. Even in Canada their numbers are so great, and the ravages which they commit upon the cultivated ground so extensive, that instances are recorded in which the Bishop has been seriously and earnestly implored to *exorcise* them by "bell, book, and candle;" that is, to cast them out of the land by the same means whereby unclean spirits, in the days (happily now gone by) when they were troublesome to individuals, were cast out of their possession of the bodies of men and women. As the possession in the case of the individual human beings was, according to our modern notions, quite imaginary, it is highly probable that the exorcism of bell, book, and candle, which was also imaginary, might produce the desired effect. But, as the passenger turtles were material beings, and not spiritual, we rather suspect that the Bishop had the good sense not to try the experiment upon them; at least La Houtan, who records the matter, is perfectly silent as to the success or failure of the experiment.

Before we begin to give a short outline of the manners of these extraordinary birds, it may be as well to describe their personal appearance. They are birds of particularly handsome form, with long and pointed wings, and the tails also particularly long and wedge-shaped, the lateral feathers being not more than half the length of the central ones. The male bird is sixteen inches long, of which, however, the tail occupies a half, or at least nearly so; the stretch of the wings is two feet, so that, altogether, the flying feathers are very large and powerful in proportion to the size and weight of the bird, and consequently well suited to its migratory habits; the head, upper part of the neck, and chin, are of a fine slate-blue colour, paler on the chin than the other parts, but altogether forming a well-marked head; the back, rump, and tail-coverts, are deep slate-grey, dotted on the scapulars with a few dusky marks, and tinged with brown over the insertion of the wing; the greater coverts of the wings are light slate colour; the quills are blackish, the primaries margined and tipped with brownish white; the tail is long, and, as has been said, much wedge-shaped by the feathers increasing in length from the sides to the middle; the two middle feathers are plain black; the other five, on each side, are bluish at their bases, passing into a sort of greyish-white toward their tips, and marked with a black spot on the inner web of each near the base, and with a rust-coloured one still nearer; the bastard wing is black, and there are some black spots on the wing-coverts; the throat, breast, and sides, as far as the thighs, are very pale reddish chestnut, passing into a pale wine-red on the lower part of the breast, and also on the feathers of the thighs; the belly and vent feathers are white; the lower part of the neck behind, and the sides of the same, are crimson, inclining to purple, but with changeable glosses of green and gold; the bill, which is slender, but has the upper mandible considerably arched, is black, and the high naked skin in which the nostrils are pierced is nearly of the same colour, and forms a rounded protuberance; the irides are brilliant reddish orange, and the small portion of naked skin around the eyes is deep purple; the contrast of these colours, with the delicate slate-blue in which they are set, gives the eye a very striking and expressive appearance; the naked parts of the tarsi and the toes are clear lake-red, streaked with white. The female is half an inch shorter than the male, and an inch less in the stretch of the wings; the breast is brownish ash, the upper part of the neck slightly ash-coloured; the changeably-coloured portion of the neck is of smaller extent, and not nearly so brilliant; the tail-coverts have a brownish tinge; and all the other parts of the plumage, which resemble those of the male in their disposition, are duller in the tint, and have more or less of brown in them. Still both sexes are beautiful birds. Their value, in an economical point of view, is not, however, in any way equal to their beauty or their numbers. The flesh of the old ones is dark, dry, hard, and unpalatable, as is very generally the case with birds which are much on the wing; but the young, or "squabs," as they are called by the inhabitants of the United States, are remarkably fat; and as, in the places where the birds congregate, they may be obtained without much difficulty, this fat is obtained by literally melting them, and used instead of lard, to which, however, it is inferior, as there is a rankness of flavour about it. As they nestle in vast multitudes at the same place, their nesting-places have many attractions for birds of prey, which indiscriminately seize upon both the old and the young. The nests are very flimsy fabrics, and, though they are placed in the very closest trees, the young may readily be seen by those who pass into the forests under them. The eggs, like those of most of the pigeon tribe, are usually two in number; but the number of birds at one nesting-place is so great, that the young, when they begin to branch and feed, literally drive along the woods like a torrent. They feed upon the fruits, which, at this time, they procure in the middle height of the forests, and do not venture upon the open grounds. The nests are far more closely packed together than in any rookery, and are built one above another from the height of twenty feet to the top of the very tallest trees. Wilson says—"As soon as the young were fully grown, and before they left the nests, numerous parties of the inhabitants, from all parts of the adjacent country, came with waggons, axes, beds, cooking utensils, many of them accompanied by the greater part of their families, and encamped for several days at this immense nursery. [This nursery was near Shelbyville, in Kentucky, forty miles long and several miles in breadth]. Several of them informed me that the noise in the woods was so great as to terrify their horses, and that it was difficult for one person to hear another speak without bawling in his ear. The ground was strewed with broken limbs of trees, eggs, and young squab pigeons, which had been precipitated from above, and on which herds of hogs were fatting. Hawks, buzzards, and eagles, were sailing about in great numbers, and seizing the squabs from their nests at pleasure; while, from twenty feet upwards to the tops of the trees, the view through the woods presented a perpetual tumult of crowding and fluttering multitudes of pigeons, their wings roaring like thunder, mingled with the frequent crash of falling timber; for now the axemen were at work cutting down those trees which seemed to be most crowded with nests, and seemed to fell them in such a manner that, in their descent, they might bring down several others, by which means the falling of one large tree sometimes produced two hundred squabs, little inferior in

size to the old ones, and almost one mass of fat. On some single trees upwards of one hundred nests were found, each containing *one* young only—a circumstance in the history of this bird not generally known to naturalists. It was dangerous to walk under these flying and fluttering millions, from the frequent fall of large branches, broken down by the weight of the multitudes above, and which, in their descent, often destroyed numbers of the birds themselves; while the clothes of those engaged in traversing the woods were completely covered with the excrements of the pigeons."

This is a scene to which we are aware of no parallel in the nesting-places of the feathered tribes, and certainly there is nothing bearing the slightest approximation to it among the birds of the British islands. In many of those detached isles, especially of the north, such as Sula's Skerry and its stack, and Cradle Island in Shetland, where sea-birds "most do congregate" for the rearing of their young, it is not easy for the adventurous traveller to get a foot-fall without breaking an egg; but these birds build on the rock, and their weight never injures its stability; nor are we aware of any other part of the world where the trees are broken down by the multitudes of birds which nestle in them.

Where the birds roost for the night, although they do not breed, and they are understood to have select places for this purpose, the congregating, though not permanent, day and night, is often as great and as destructive of the forest. The native Indians rejoice in a breeding or a roosting place of the migratory turtle, as one which shall supply them with an unbounded quantity of provisions, in the quality of which they are not particularly chary. Nor are these roosting places attractive to the Indians only, for the settlers near them also pay them nocturnal visits. They come with guns, clubs, pots of suffocating materials, and every other means of destruction that can well be imagined to be within their command, and procure immense quantities of the birds in a very short time. These they stuff into sacks, load their horses with, and so return home.

On the subject of the migration of these birds we have nothing to add to the following quotation from Wilson:—"These migrations appear to be undertaken rather in quest of food than merely to avoid the cold of the climate; since we find them lingering in the northern regions, around Hudson's Bay, so late as December; and since this appearance is so casual and irregular, sometimes not visiting certain districts for several years in any considerable numbers, while at other times they are innumerable. I have witnessed these migrations in the Gennesee country, often in Pennsylvania, and also in various parts of Virginia, with amazement; but all that I had then seen of them were mere straggling parties when compared with the congregated millions which I have since beheld in our western forests, in the states of Ohio, Kentucky, and the Indian territory. These fertile and extensive regions abound with the nutritious beech nut, which constitutes the chief food of the wild pigeon. In seasons when these nuts are abundant, corresponding multitudes of pigeons may confidently be expected. It sometimes happens that, having consumed the whole produce of the beech trees in an extensive district, they discover another, at the distance perhaps of sixty or eighty miles, to which they regularly repair every morning, and return as regularly in the course of the day, or in the evening, to the place of their general rendezvous, or, as it is usually called, the roosting place. These roosting places are always in the woods, and sometimes occupy a large forest. When they have frequented one of these places for some time, the appearance it exhibits is surprising. The ground is covered for several inches with their dung; all the tender grasses and underwood destroyed; the surface strewed with large limbs of trees, broken down by the weight of the birds clustering one above another; and the trees themselves, for thousands of acres, killed as completely as if girdled with an axe. The marks of this desolation remain for many years on the spot, and numerous places could be pointed out where, for several years after, scarce a single vegetable made its appearance."

We have no more space for entering into the details of the habits of those very extraordinary pigeons. There is little doubt that they could be domesticated, at least as much as the common house-pigeon is domesticated; though, as their natural habit is to nestle in trees, it is very doubtful whether they could be made to make a pigeon-house their home. The fact of their being found lingering as stragglers during the winter, in latitudes where the temperature is considerably below zero, is sufficient proof that they would bear any climate of the eastern continent. It may seem that the dark colour, dryness, and hardness of the flesh of the old birds, would render them of comparatively little value in an economical point of view, but no positive conclusion can be drawn from the quality of a bird's flesh in a state of nature, as to what might be its qualities were it domesticated. It is the violent and frequently-repeated labour to which they are subjected that hardens the muscles of birds in a state of nature; and if the birds are brought up from their earliest age, and kept upon rich pastures where they have occasion to use the wing but little, the tenderness and also the flavour of their flesh are greatly improved. This has been established by actual experience, in the case of the pigeon-house pigeon and the wild-rock, the second being greatly inferior to the first, though dressed in precisely the same manner, and served up at the same time, which prevented any part of the decision from resting upon the judgment of mere memory, which is never an exact subject of comparison with present sensation. Even in the case of pigeon-house pigeons, there is a considerable difference in the quality, depending on the kind of country in which the pigeon-house is situated. If that is a poor district, where leguminous and other farinaceous seeds are few and of small size, and where consequently the birds must use the wing much in procuring their subsistence, then the flesh is hard and in small quantity, and has its flavour sharpened almost to bitterness. On the other hand, if the pigeon-house is in a rich country, where cultivated legumes and grain, the larger wild vetches and beech wort, are to be had in abundance, with comparatively little labour, then the flesh is not so dark in the colour, it is much more abundant in quantity, more juicy, and though not so pungent yet more agreeable in flavour. The same law holds in the flesh of all animals, and of course the quality may be carried to an extreme both ways. Increase of fatigue on the part of the animal invariably produces hardness, dryness, and pungency of flavour, and if carried to excess the flesh ceases to be eatable. In a similar

manner increase of ease relaxes the muscles, and swells and softens their fibres, so that they become tasteless, and when this is carried to excess they become noxious from their insipidity, and do not stimulate the stomach. This is a principle that runs through the whole of living and growing nature, and applies to vegetables as well as animals; and there is a fine moral in it, for it is a practical demonstration that the middle course is always the best. When these circumstances are considered, there seems little doubt that, at least after a generation or two, the passenger turtle might become as desirable for the table as the common pigeon; and, as it is so much more elegant and beautiful, it would make one of the finest rural ornaments in the country. Nor would it be at all amiss to introduce these birds into our forests. It seems indeed somewhat strange that the forests, which are in some respects the richest of our pastures, should never hitherto have been turned to any useful purpose in the way of maintaining birds. The only really good forest bird which we ever had—the wood grouse, or *capercailzie* as it was called in the Highlands—has been exterminated; and all that remains is the wood pigeon. Forests are in themselves highly interesting; there are thousands of acres in the three kingdoms which would be much more profitably applied to the growth of timber than to any other purpose; and, were they so applied, there is no question that it would add greatly to the value of the remaining part of the land, inasmuch as it is, in a great measure, to the bare places, where trees alone would be profitable, that we owe the burning drought of our summers, and the extreme cold of our winters, both of which are often highly disastrous. Now if we had the forests, and it is a disgrace to the proprietors of the soil that we have them not, there is no reason why they might not be peopled with every forest bird, whether useful or ornamental, that could stand the climate. The birds of America are especially adapted for this purpose, because the extremes of the seasons are more wide there than they are with us; and had it not been for the barbarous and most unpatriotic havoc which the boors of the back woods have committed on the wild turkeys, our forests might in time have been stocked with them. We must leave the subject, however, and notice one or two more of this section of the pigeons.

Of these we shall notice only two species, one of them a native of Southern Africa, and the other of New Holland. They agree in their general structure with the long-tailed turtles of America; but they depart further from the colours of the European pigeons. They are birds of very small size, slender and elegant in their forms, very well winged, and have the tails very long and acutely wedge-shaped, with the two central feathers projecting far beyond the rest, and narrowed toward their tips. Like the passenger turtle of America, their tails consist of twelve feathers. It has been proposed to make a separate subgenus of them, but we are convinced that this would be merely adding to the number of words without increasing the quantity of knowledge, and thereby rendering the study of ornithology more intricate.

The Cape Turtle. This species, as its name imports, is of Southern Africa. It is very small, but exceedingly handsome. Its length is about seven inches, but more than the half of that is occupied by the tail. The bill is of moderate size, straight in the greater part of its length, but with the tip of the upper mandible curving over that of the under one, and it is of a yellowish-brown colour. The wings are of moderate length, but not so long in proportion as those of the passenger turtle; they are pointed, the second quill being the longest, and both the first and the third being considerably shorter. Both the tarsi and the toes are short, and the claws are blunt and nearly straight. From this structure of the feet it follows as a matter of course, that the chief labour of the bird, namely, the finding of its food, must be upon the ground, though the shortness of the tarsi must make it a slow walker, as the whole of the pigeon tribe, like the gallinaceous birds, walk with the alternate foot and do not hop. One of the most striking marks of colour in this bird is a large patch of deep black, which passes over the forehead, the sides of the head as far as the eyes, the chin, throat, foresides of the neck, and the breast, extending in breadth upon the last, and rounded at its termination. The top of the head, which is much flatter than in most of the species, the sides of the neck, the lower part of the breast, the flanks, and the smaller coverts of the wings, are pale French grey. The rest of the under parts and the thighs are white. The clothing feathers on the upper part are brownish-grey, and so are the nape and hind part of the neck. The feathers of the wings are brown with an orange tinge, gradually deepening toward the primary quills, and passing into black. On the wing there are two well-marked spots of deep brownish purple, with metallic reflections; the under coverts are orange-brown; two black bars cross the feathers of the rump, and between them there is a stripe of pale grey; the basal half of the two central feathers of the tail is brownish-grey, and thence they gradually deepen into black. The other feathers are bluish-grey at their bases, and pale grey for a small portion of their tips, with a black band between that and the former colour. They are rounded at their tips, and graduated, the difference in their length diminishing as the external ones are reached. The feet are yellowish-brown, the same as the bill.

It is necessary to pay particular attention to the difference between the male and female of this bird; because inattention to this, or seeing only the one sex and not the other, has led different naturalists to describe the most conspicuous marking of them in very opposite colours. The frontlet and gorget, which are black in the male, are pure white or nearly so in the female. The other colours are distributed in the same manner, but they are much paler in their tints. The young males have the throat and breast brown with white bars, and black bars on the back and wing-coverts, the top of the head brown, and the chin white. On account of these differences of colour, they also have been sometimes mistaken for a separate species, and we believe that there are some books in which the species taken generally are described as having the mottled colour.

This is a very interesting bird, from its being, in its character and habits, a member of the pigeon family, and yet being very little weightier in the body than a sparrow. Though it is very generally distributed over Africa southward of the desert, and even down to the valley of the Nile as far as Nubia, very little is known of its habits farther than that it follows the general law of the other turtles, by nestling in trees, and seeking its food upon the ground. The eggs are

understood to be two in number, of a white colour, nearly transparent, and so delicate that they can hardly be touched without being broken. The common English name of Cape turtle is very inapplicable to this bird, and the French name of Hottentot turtle is still more so, because the whole Cape territory is but a fraction of its pasture, and the country of the Hottentots is of course a still smaller one.

The Macquarrie Turtle. This is an Australian species, and would have been more correctly named if it had been called after its country, and not after Governor Macquarrie. In size and shape it very much resembles the turtle of Southern Africa last described, but the markings of its colours are different. Notwithstanding this, it may be the same identical species; for it is a pretty general law among birds that those in which the sexes and the old and the young differ much from each other in colour are the most liable to have their colours altered by difference of climate. This one has the whole of the upper part brownish, and the head, neck, and breast bluish-grey; the smaller coverts of the wing are also brownish, but spotted with white, each spot surrounded by a black circle; the greater coverts are ash colour, but spotted in the same manner as the others; the quills are reddish-brown; the tail-feathers are similar in shape to those of the preceding species, the central ones are blackish-brown, and the lateral ones bluish-ash colour; all the under part below the grey on the breast is pure white; the bill is black, the naked space round the eyes orange, and the feet reddish. Differences of colour in those naked parts of the bird are much more specific than differences of the plumage; but even they are not altogether to be depended on. So far as the manners of this species have been observed, they appear to be the same as those of the African bird, making allowance for the difference of the countries which they inhabit.

Thus it may be said, that there are turtles in three distinct localities: first, southern Europe, northern Africa, and western and central Asia; secondly, America, chiefly the northern part of it; and thirdly, Southern Africa and Australia; and it is not a little remarkable that those of the north-west and south-east should resemble each other much more than either of them does the intermediate ones.

Ground Doves. These form the third section of the great family of pigeons; but, as in the others, the line of separation is by no means clear and definite; and, notwithstanding the fondness which many naturalists show for extreme minuteness of division, there is a distinct character which runs through the whole family, from the most lofty inhabitant of the tall forests, to the most lowly dweller upon the ground. We have seen that the pigeons and the turtles are chiefly ground feeders, and some of the turtles, we may say, are exclusively so, though they all nestle at some elevation above the ground, except the rock pigeon, and some of the others when there are no trees conveniently situated for them. The ground doves very generally, if not exclusively, find their food upon the ground, but very many of them perch, and it is probable (for we know little of the habits of most of them) that not a few of them nestle in trees, or, at all events, in bushes. Generally speaking, they are birds having their flying feathers less developed than those of the other sections; because, of their terrene habit, they have been described as approximating the gallinaceous birds; but though they do partially correspond with these in this particular habit, they, in their essential characters, and in the air and aspect of their bodies, differ materially. Their clothing feathers are also much looser, and in one species, which differs much in its general aspect, the feathers are much produced, and hung loosely apart from each other. Although, as we have said, many of them perch, and some probably nestle in trees, yet they are much better fitted for walking than any others of the family. Their tarsi are longer and stronger than in these, and their feet are by no means well adapted for grasping, the claws being straight and blunt. Their flight is low and fluttering, though not so much so as in the gallinaceous birds; and they flit from place to place upon the wing, but always alight at short distances, and range the spot where they alight on foot. They are thus adapted to peculiar localities; namely, open plains interspersed with bushes and thickets, and consisting alternately of barren and fertile spots. In this respect they are certainly intermediate between the other divisions of the family and the gallinaceous birds. Even those of the former, which most habitually feed upon the ground, can dash rapidly on the wing over considerable distances; while the gallinaceous birds very seldom have recourse to the wing, unless when they are alarmed, or flying to their perches. This intermediate habit of the ground doves determines in some measure their localities. The prairies of North America are very often alternate hummock and bare surface. It is the same in all countries within the tropics, at least for a considerable period of the year. Hence, North America is, we believe, the only temperate part of the world in which ground doves occur, and they occur also in the south and south-east of the old continent. There are none in Europe, and, we believe, there are none in Asia northward of the mountains which lie between Persia and Upper India and the central regions.

In consequence of the dissimilarity of size and colour in these birds, authors have subdivided them into various groups; but the grouping does not convey much information, and our space will allow us to notice only a few of the most strongly marked of the species.

American Ground Dove. Though this bird is found in temperate America, it does not reach so far north as Virginia. It is, however, abundant in the southern states, and also in the West India islands. In the West Indies it is sometimes confined in cages. The French planters give it the dignified name of Ortolan; the bird is most numerous in the islands on the coast of Carolina and Georgia, where they fly in coveys of from fifteen to twenty. They are most commonly met with in the open fields and plantations, which they prefer to the forests; they are generally seen on the ground; and though scared off, they only fly a little way and again alight. They feed on rice, seeds, and berries of the toothache and other trees, under whose shade they are almost sure to be met with in the proper season. Their flesh is esteemed as excellent food. Their note is a low plaintive one, which is accompanied by the usual gestures of their tribe. They are migrant birds, and, on the approach of winter, retire to the islands and to the more southerly parts of the continent, and return to their former haunts about the beginning of April. They are of a more delicate and slender form, and less capable of enduring the severity of cold than either of the other two species met with

in the United States, both these being found in the northern parts of Canada, as well as in the temperate climate of Florida.

The length of the ground dove is six inches and a quarter; the bill of a yellow colour, with a black tip. As is usual with the genus generally, the nostrils are covered with a protruding membrane; the iris of the eye is orange red; the breast, throat, and sides of the neck are of a pale wine-coloured purple; the feathers are deeply marked by semicircular margins, those on the throat being dusky blue in the centre; the crown and back of the head are of a rich pale blue, intermixed with purple, and marked with detached spots of a glossy blue, with reflecting tints of purple; the belly is pale wine-coloured brown, becoming dark cinereous towards the vent, where the feathers are margined with white; the wing-quills are dusky at the outsides and the tips; but the whole interior varies, and the lower sides are of a rich red chestnut, which appears a little below their coverts; the tail, which is rounded, consists of twelve feathers, the two middle ones being cinereous brown, and the rest black, margined and tipped with pure white; the feet and legs are yellow. The back and tail-coverts of the female are of a mouse colour. She has scarcely any of the wine-coloured tinge on the breast and throat, nor of the light blue on the back of the head; the throat is spotted with a dull white, pale clay colour, and dusky; the sides of the neck are of the same colour, and the plumage is strongly marked; the breast is of a cinereous brown colour, faintly tinctured with purple; the scapulars are strongly marked with big drops of a dark purplish blood colour, which reflects fine and delicate tints of blue; the rest of the plumage differs very little from that of the male.

Rust-coloured Ground Dove. This is a South American species, of diminutive size, but a very neat and handsome bird. It inhabits the open ground rather than the woods, though it always perches when at rest, and nestles in a bush or branchy tree near the ground. Paraguay and Brazil are the chief places of its residence, and it is not found in the richly-wooded districts by the rivers, or upon the mountain ridges. It is a very familiar little creature, and does not hesitate to come close to the dwellings of the inhabitants in search of its food. It is also quite at home, and breeds freely in a state of confinement, though it cannot be domesticated so as to leave its home and again return to it. One might expect this from its habits in wild nature, because it is not very social at any season. In the breeding time the pair live quite solitary, and at no season of the year are more than half a dozen seen together, and these are understood to be the old pair and two broods. Its plumage consists principally of two colours. The head and a small portion of the upper neck all round are ashen grey, with a tinge of purple on the front, and reddish white on the throat; the rest of the plumage is orange brown, passing into dark purple brown on the under part; there are a few streaks of black on some of the coverts of the wings, and the bastard wing and under wing-coverts are of the same colour; the principal quills are dark brown inclining to black; the quills are remarkably broad, and the inner web forms a projecting lobe about the middle of its length; the tail-feathers are the same colour as those of the wings, with the exception of the two middles ones, which are the same colour as the back, only a little lighter in the shade; the bill and naked skin round the eye are bluish grey, and the tarsi and toes pale purplish red. The female has the head very dull grey, and the under plumage the same; the back and all the upper part are dull brown with reddish blotches; and the wings, tail, and naked parts are coloured the same as in the male birds; the length is very little more than six inches.

Picui Ground Dove. This species is an inhabitant of the same countries as the last mentioned, and its habits are nearly similar, but it is rather larger and differently coloured. Its length is seven inches and a quarter; the upper parts are brown, and the front and sides of the head whitish; the quills are blackish brown, and the wings are mottled over with small spots of brilliant blue; the middle tail-feathers are brown, and those next them are brown with white tips, except the two lateral ones, which are white altogether; the under parts are whitish, clouded with brown on the neck, and wine colour on the breast; the naked space round the eye is blue, and the bill and feet reddish.

There are many other species of small ground pigeons in South America; but the habits of all are so nearly the same, that the specimens we have mentioned must suffice for the whole.

Bronze-winged Ground Dove. This is a very handsome species, remarkable for the variety of its colours, and for the distinctness with which every individual feather comes out, in consequence of the margin being in all cases paler than the middle part of the feather. It is also remarkable for the brilliant glosses which appear on some of the feathers. It is a much larger bird than the two species which we have mentioned, and its wings are more powerful and more pointed than those of any of the ground doves of America. It is about fifteen inches in length; and the bill, which is blackish at the tip and reddish toward the base, is about an inch in length, which is long in proportion as compared with many of the pigeon tribe. The forehead is whitish and a streak under the eye and the chin are pure white; the top of the head is reddish brown, surrounded by a margin of deep red; the cheeks and sides of the neck down to the scapulars are blackish grey, which becomes paler, and has a purple or lilac tinge on the throat, and breast; the rest of the under part is grey, glossed with greenish purple; the clothing-feathers on the upper part are blackish brown, passing into pale orange brown on the margin of each feather; the coverts of the wings are bluish grey, and each feather has upon its exterior web a spot, of which it is impossible to describe the colour, because it varies in every tint, from intense blue to deep red, according to the angle on which the light falls upon it; the upper plumage, generally speaking, has this property, though brown and green are the limits of the colours on the back. In consequence of these variations of colour, it is impossible to give a pictorial representation which shall be like this bird in the particular light in which an observer may see a specimen. The quills are brown, passing into orange red on the margins of their inner webs; and the bastard wing and under coverts of the wings are of the same colour; the tail is grey in the principal colour, but crossed by a band of black near the tip; the tarsi and the toes are dark red.

It is a native of Australia, of New Guinea, and of various other islands in the eastern sea. It is a bird

of sterile places, being found on the arid plains which contain only a few bushes and stunted trees. It feeds upon the berries of some of the singular shrubs which occur in these countries, especially upon those of *Lissanthe*, one species of which, by the way, is the only shrub in Australia which bears any thing like an eatable berry. The resting-place is either in a hollow tree near the ground, or on the ground itself, and hollow trees are understood to be far more abundant in Australia than in any other part of the world. It makes scarcely any nest, the eggs are two, and of a white colour. During the breeding time, which of course is in our winter, as that answers to the Australian summer, the pairs never part, and are much attached to each other; and it does not appear that at any time these birds flock. The note of the male is decidedly that of the pigeon tribe, and it is so loud as to be heard at a considerable distance. Though these birds are generally seen upon the ground, yet they perch during the night on trees or bushes, but never at any very great elevation. It appears that they are in so far migratory, moving southward, or into colder latitudes, during the summer, and northward into warmer ones during the winter; for though they are common enough in the neighbourhood of Sydney during the summer half year, or from September to February according to the calendar, they disappear during the remaining months. They are exceedingly beautiful birds; but it does not appear that they could be domesticated. We shall now notice one or two of the ground doves of southern Africa and the warmer parts of America, which have still more of the ground character than those which we have already noticed, though they do not, as has been alleged, make the slightest approach to the gallinaceous birds, either in their appearance or habits. It is true that their wings are hollow and round, and their tarsi long and strong, so that they are incapable of long flight, though very dexterous at rising, and they can run with much celerity. In consequence of this, they have been called pigeon pullets, and sometimes pigeon partridges; but these additions to the names are inaccurate, inasmuch as the bill and head, and indeed the whole expression of the bird, are decidedly those of a pigeon. They live chiefly upon the ground, and sometimes nestle there if they cannot find low bushes for that purpose. Their domestic establishments have not been much observed, but it is generally understood that each hatch consists of only two eggs. This point is not, however, absolutely ascertained. But, though they feed habitually upon the ground, and sometimes nestle there, they generally, if not always, perch for repose; and though their wings are short and rounded, they are still decidedly pigeon wings. We shall notice two or three of the species.

White-bellied Ground Dove.—This species is found in South America, and also in Jamaica, and various other of the West India Islands. Its length is about twelve inches. The upper plumage of the body is brown, glossed with a greenish tinge; and the under plumage is white, shaded with purple red on the breast and fore part of the neck. The forehead, chin, and throat, are bluish white; the top of the head and the occiput are greenish grey, but purple in some lights. The sides of the head, from the eyes downward, and the back of the neck, are deep purple red, with rich reflections of lilac and golden green. The roots of the quills, and under coverts of the wings, are pale yellowish brown. The middle tail feathers are greyish brown, and the three exterior ones on each side are grey, with white tips. The bill is black, and the feet reddish. The claws are short and blunt, indicating the habit of the bird as seeking its food upon the ground, though it generally perches upon low bushes or the lower branches of trees for repose. Its food is wholly vegetable, consisting of the seeds of grasses and other plants. It runs with much more celerity than any of the tree or rock-building pigeons, but it is not so decidedly a dweller in the arid places as the eastern species last mentioned. It is generally found in those bushy tracts which are intermediate between the bare plain and the forest, and it picks up more of its food after that has dropped on the ground than when it is on the plant or bush.

Copper-coloured Ground Dove.—This is another inhabitant of the warmer parts of South America and the West India Islands, but it differs considerably from the former, being considerably smaller in size, and inhabiting different localities. Its pastures are on the elevated and rocky mountains; and as food for it is but thinly scattered there, it is endowed with great swiftness of foot. But though it runs something after the manner of a partridge (and the inhabitants of Jamaica call it the mountain partridge), it always perches on a bush or low branch of a tree when it reposes. It seldom takes the wing except when alarmed, and then its flight is low and fluttering, and performed with a great deal of noise. It cannot continue long on the wing; but when it is pursued it alternately flies and runs, and, as is the case with many ground birds, it flies in one direction and runs in another, in order to throw the pursuer out. It generally nestles upon the ground, under a bush, or in the shelter of a projecting piece of rock, but its eggs are understood to be only two. It is reported that the young are much sooner able to provide for themselves than the young of those pigeons which are better winged; and this is in strict accordance with the general analogy, or the general principle, that running birds are always sooner able to shift for themselves than flying ones, which is always more the case in proportion as the birds are more upon the ground, their pastures more barren, and their food consequently more laborious in the finding. One cannot help admiring the beauty of this adaptation, simple though it be; for otherwise the decidedly ground bird, which is appointed to gather in the scanty harvest of a comparative desert, would not be able to carry a sufficient quantity of food to the nest for the supply of its young. In consequence of this the instinct of maternity is modified in such birds; and the mother, instead of bringing food to her young in the nest, is instructed by nature to lead them to the places where food is to be found. It does not appear that even this dove, which has probably a more decidedly ground habit, and a less productive pasture than any other of the family, comes out of the shell so completely matured for running as a pullet or a partridge, but still it differs remarkably from those species of the family which depend much upon the wing.

The copper-coloured ground dove is about nine inches in length. Its bill is rather short, and its tarsi comparatively long, and both are of a red colour. A portion of the upper mandible towards the face is thickly beset with very small feathers. The head, neck, and whole upper part, are bright orange, but glossed with reflections of rich purple, which give it

the coppery appearance implied by the name. The throat is reddish white, and so are the fore neck and breast, but the latter is glossed with purple, and the colour of the rest of the under part is pale and dull brown, slightly washed with purple red.

White-fronted Ground Dove.—This is a much larger species than any of the ground doves of the American continent. It is a native of Africa, and though by no means a rare bird it is difficult to be seen in consequence of its habit of concealing itself among the bushes. It is about eleven inches in length. The forehead, the cheeks, and the throat are white or whitish, from which it gets the trivial name. The clothing plumage on the upper part is brown, but glossed with green reflections, which come out in certain lights. The under plumage is orange brown washed with purple, but not showing reflections as the upper part does. The top of the head and the neck are of the same colour as the under parts, but with green reflections, particularly strong on the sides of the neck. On the lower part of the neck behind there is a half collar of purple black, with golden green margins to the feathers. The two middle feathers of the tail are brown, and all the remaining ones are black at the bases, and bluish grey at the tips. The bill is bluish black, and the tarsi and toes brown red. Though not a gaudy species this is an exceedingly beautiful one, and it is one which is sought after with some avidity, the more so that it cannot be obtained without considerable difficulty. As is the case with the whole section of the ground doves, it feeds upon the ground, or upon the seeds of herbaceous plants, and the berries of low bushes, but its resting place is in the brush or close shrubbery which lies between the dry karoos and the rich forests on the Orange River. It is understood to be especially a bird in the Nimagua country, at the mouth of the Orange River, which is one of the best districts from which to obtain all the choicer birds and mammalia of Southern Africa. Its flight is low and fluttering, somewhat resembling that of the *Gallinidæ;* but notwithstanding the lowness of its flight it is extremely difficult to obtain, because it glides into the thick bushes with so much rapidity as to elude the aim of the keenest sportsman. It nestles in the bushes, and also resorts to them always when it reposes. Its eggs are described as being only two in number in one hatch, and the nest is rudely constructed of a few sticks at a very little above the surface of the earth. Some writers on birds have described this as an American species; but there is not in any part of America or its islands any ground dove of the same size as this one, or in the least resembling it in the markings and glossings of its colours.

We shall now notice one or two species, which, though they preserve the pigeon character in the bill, the head, and all the essential parts of their organisation, are even more terrestrial in their habits than those to which we have alluded. According to some writers, these pigeons form a nearer approach to gallinaceous birds than any others of the family, by which nothing more is meant than that a resemblance can be traced by imagination between them in a few more particulars. These resemblances, or "affinities," as the sages term them, put one strongly in mind of Fluellen's proof of the identity of Macedonia and Monmouth:—"Look you, there's a river in Monmouth, and I'll be pound there's a river in Macedonia, and they call it Wye at Monmouth, and it's out of my prains what they call it in Macedonia; but it's as like as my fingers to my fingers, and there's saumons in them poth." These pigeons live upon the ground, but roost in low bushes, and their eggs are not confined to two in a hatch, but are understood to reach as many as eight or ten. The nest is on the ground, and the birds are very soon able to pick up their own food, though it is some time before they are sufficiently winged for being capable of flying. They still preserve so much of the pigeon habit as to roost on low bushes, which is a decided distinction between them and the grouse department of the gallinaceous family, which they are supposed most nearly to resemble. Like those last mentioned, they are found in America and in Southern Africa, and one very peculiar species occurs on the Eastern Islands.

Blue-headed Ground Dove.—This is a very beautiful species, a native of the West India Islands, where it is by no means rare, and also of some of the warmer parts of continental America. It measures about eleven inches in length, and weighs about the same as our common partridge. The general plumage is deep brown, with a shade of purple; the throat, fore neck, and breast, are black, with a white margin between it and the brown; the head is clear and rich azure blue, and there are three or four lines of feathers of the same colour extending from the gape as far on the sides of the neck as the black extends; between these and the eye there is a patch of pure white, which shows off the blue to great advantage; the feet are red; and the bill is reddish at the base and grey at the tip. This bird is generally seen upon the ground, where it runs with great celerity; but it does not readily take the wing, nor is it very dexterous in flying, as it is obliged to move its wings rapidly, and with a great deal of noise and flutter, as if it were out of its proper element. When upon the ground its attitude something resembles that of a turkey or a guinea fowl; but still its essential characters are those of a pigeon.

Carunculated Ground Dove.—With the lovers of affinities this bird makes a still nearer approach to the *Gallinidæ* than the former, inasmuch as there are crimson wattles pendant from the neck. These, however, have no similarity to the wattles of the common domestic cock; and the head, bill, and general air of the bird, are decidedly those of a pigeon. The crimson naked skin surrounds the bases of both mandibles of the bill, that from the upper mandible passing backwards, and surrounding the eye, and that from the lower passing, in one branch, two-thirds across the sides of the neck, and in another forming a loose wattle on the breast.

The full-grown bird measures about eleven inches in length, and is rather thick in the body; the head, cheeks, and neck, as far as the shoulders, and also the coverts of the wings, are grey, margined with a fine line of white, which makes the individual feathers tell very conspicuously; the under part, and also the upper tail-coverts, are white; the tail is reddish brown; and the quills of the wings have a shade of purple on them. The female is of the same size as the male, and marked with the same colours; but she entirely wants the bright naked skin on the head by which he is characterised. There are certainly some resemblances between this species and the gallinaceous birds, though there are others in which it more resembles the pigeon family, of which its organisation

of sterile places, being found on the arid plains which contain only a few bushes and stunted trees. It feeds upon the berries of some of the singular shrubs which occur in these countries, especially upon those of *Lissanthe*, one species of which, by the way, is the only shrub in Australia which bears any thing like an eatable berry. The resting-place is either in a hollow tree near the ground, or on the ground itself, and hollow trees are understood to be far more abundant in Australia than in any other part of the world. It makes scarcely any nest, the eggs are two, and of a white colour. During the breeding time, which of course is in our winter, as that answers to the Australian summer, the pairs never part, and are much attached to each other; and it does not appear that at any time these birds flock. The note of the male is decidedly that of the pigeon tribe, and it is so loud as to be heard at a considerable distance. Though these birds are generally seen upon the ground, yet they perch during the night on trees or bushes, but never at any very great elevation. It appears that they are in so far migratory, moving southward, or into colder latitudes, during the summer, and northward into warmer ones during the winter; for though they are common enough in the neighbourhood of Sydney during the summer half year, or from September to February according to the calendar, they disappear during the remaining months. They are exceedingly beautiful birds; but it does not appear that they could be domesticated. We shall now notice one or two of the ground doves of southern Africa and the warmer parts of America, which have still more of the ground character than those which we have already noticed, though they do not, as has been alleged, make the slightest approach to the gallinaceous birds, either in their appearance or habits. It is true that their wings are hollow and round, and their tarsi long and strong, so that they are incapable of long flight, though very dexterous at rising, and they can run with much celerity. In consequence of this, they have been called pigeon pullets, and sometimes pigeon partridges; but these additions to the names are inaccurate, inasmuch as the bill and head, and indeed the whole expression of the bird, are decidedly those of a pigeon. They live chiefly upon the ground, and sometimes nestle there if they cannot find low bushes for that purpose. Their domestic establishments have not been much observed, but it is generally understood that each hatch consists of only two eggs. This point is not, however, absolutely ascertained. But, though they feed habitually upon the ground, and sometimes nestle there, they generally, if not always, perch for repose; and though their wings are short and rounded, they are still decidedly pigeon wings. We shall notice two or three of the species.

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Copper-coloured Ground Dove.—This is another inhabitant of the warmer parts of South America and the West India Islands, but it differs considerably from the former, being considerably smaller in size, and inhabiting different localities. Its pastures are on the elevated and rocky mountains; and as food for it is but thinly scattered there, it is endowed with great swiftness of foot. But though it runs something after the manner of a partridge (and the inhabitants of Jamaica call it the mountain partridge), it always perches on a bush or low branch of a tree when it reposes. It seldom takes the wing except when alarmed, and then its flight is low and fluttering, and performed with a great deal of noise. It cannot continue long on the wing; but when it is pursued it alternately flies and runs, and, as is the case with many ground birds, it flies in one direction and runs in another, in order to throw the pursuer out. It generally nestles upon the ground, under a bush, or in the shelter of a projecting piece of rock, but its eggs are understood to be only two. It is reported that the young are much sooner able to provide for themselves than the young of those pigeons which are better winged; and this is in strict accordance with the general analogy, or the general principle, that running birds are always sooner able to shift for themselves than flying ones, which is always more the case in proportion as the birds are more upon the ground, their pastures more barren, and their food consequently more laborious in the finding. One cannot help admiring the beauty of this adaptation, simple though it be; for otherwise the decidedly ground bird, which is appointed to gather in the scanty harvest of a comparative desert, would not be able to carry a sufficient quantity of food to the nest for the supply of its young. In consequence of this the instinct of maternity is modified in such birds; and the mother, instead of bringing food to her young in the nest, is instructed by nature to lead them to the places where food is to be found. It does not appear that even this dove, which has probably a more decidedly ground habit, and a less productive pasture than any other of the family, comes out of the shell so completely matured for running as a pullet or a partridge, but still it differs remarkably from those species of the family which depend much upon the wing.

The copper-coloured ground dove is about nine inches in length. Its bill is rather short, and its tarsi comparatively long, and both are of a red colour. A portion of the upper mandible towards the face is thickly beset with very small feathers. The head, neck, and whole upper part, are bright orange, but glossed with reflections of rich purple, which give it

the coppery appearance implied by the name. The throat is reddish white, and so are the fore neck and breast, but the latter is glossed with purple, and the colour of the rest of the under part is pale and dull brown, slightly washed with purple red.

White-fronted Ground Dove.—This is a much larger species than any of the ground doves of the American continent. It is a native of Africa, and though by no means a rare bird it is difficult to be seen in consequence of its habit of concealing itself among the bushes. It is about eleven inches in length. The forehead, the cheeks, and the throat are white or whitish, from which it gets the trivial name. The clothing plumage on the upper part is brown, but glossed with green reflections, which come out in certain lights. The under plumage is orange brown washed with purple, but not showing reflections as the upper part does. The top of the head and the neck are of the same colour as the under parts, but with green reflections, particularly strong on the sides of the neck. On the lower part of the neck behind there is a half collar of purple black, with golden green margins to the feathers. The two middle feathers of the tail are brown, and all the remaining ones are black at the bases, and bluish grey at the tips. The bill is bluish black, and the tarsi and toes brown red. Though not a gaudy species this is an exceedingly beautiful one, and it is one which is sought after with some avidity, the more so that it cannot be obtained without considerable difficulty. As is the case with the whole section of the ground doves, it feeds upon the ground, or upon the seeds of herbaceous plants, and the berries of low bushes, but its resting place is in the brush or close shrubbery which lies between the dry karoos and the rich forests on the Orange River. It is understood to be especially a bird in the Nimagua country, at the mouth of the Orange River, which is one of the best districts from which to obtain all the choicer birds and mammalia of Southern Africa. Its flight is low and fluttering, somewhat resembling that of the *Gallinidæ;* but notwithstanding the lowness of its flight it is extremely difficult to obtain, because it glides into the thick bushes with so much rapidity as to elude the aim of the keenest sportsman. It nestles in the bushes, and also resorts to them always when it reposes. Its eggs are described as being only two in number in one hatch, and the nest is rudely constructed of a few sticks at a very little above the surface of the earth. Some writers on birds have described this as an American species; but there is not in any part of America or its islands any ground dove of the same size as this one, or in the least resembling it in the markings and glossings of its colours.

We shall now notice one or two species, which, though they preserve the pigeon character in the bill, the head, and all the essential parts of their organisation, are even more terrestrial in their habits than those to which we have alluded. According to some writers, these pigeons form a nearer approach to gallinaceous birds than any others of the family, by which nothing more is meant than that a resemblance can be traced by imagination between them in a few more particulars. These resemblances, or "affinities," as the sages term them, put one strongly in mind of Fluellen's proof of the identity of Macedonia and Monmouth:—"Look you, there's a river in Monmouth, and I'll be pound there's a river in Macedonia, and they call it Wye at Monmouth, and it's out of my prains what they call it in Macedonia; but it's as like as my fingers to my fingers, and there's saumons in them poth." These pigeons live upon the ground, but roost in low bushes, and their eggs are not confined to two in a hatch, but are understood to reach as many as eight or ten. The nest is on the ground, and the birds are very soon able to pick up their own food, though it is some time before they are sufficiently winged for being capable of flying. They still preserve so much of the pigeon habit as to roost on low bushes, which is a decided distinction between them and the grouse department of the gallinaceous family, which they are supposed most nearly to resemble. Like those last mentioned, they are found in America and in Southern Africa, and one very peculiar species occurs on the Eastern Islands.

Blue-headed Ground Dove.—This is a very beautiful species, a native of the West India Islands, where it is by no means rare, and also of some of the warmer parts of continental America. It measures about eleven inches in length, and weighs about the same as our common partridge. The general plumage is deep brown, with a shade of purple; the throat, fore neck, and breast, are black, with a white margin between it and the brown; the head is clear and rich azure blue, and there are three or four lines of feathers of the same colour extending from the gape as far on the sides of the neck as the black extends; between these and the eye there is a patch of pure white, which shows off the blue to great advantage; the feet are red; and the bill is reddish at the base and grey at the tip. This bird is generally seen upon the ground, where it runs with great celerity; but it does not readily take the wing, nor is it very dexterous in flying, as it is obliged to move its wings rapidly, and with a great deal of noise and flutter, as if it were out of its proper element. When upon the ground its attitude something resembles that of a turkey or a guinea fowl; but still its essential characters are those of a pigeon.

Carunculated Ground Dove.—With the lovers of affinities this bird makes a still nearer approach to the *Gallinidæ* than the former, inasmuch as there are crimson wattles pendant from the neck. These, however, have no similarity to the wattles of the common domestic cock; and the head, bill, and general air of the bird, are decidedly those of a pigeon. The crimson naked skin surrounds the bases of both mandibles of the bill, that from the upper mandible passing backwards, and surrounding the eye, and that from the lower passing, in one branch, two-thirds across the sides of the neck, and in another forming a loose wattle on the breast.

The full-grown bird measures about eleven inches in length, and is rather thick in the body; the head, cheeks, and neck, as far as the shoulders, and also the coverts of the wings, are grey, margined with a fine line of white, which makes the individual feathers tell very conspicuously; the under part, and also the upper tail-coverts, are white; the tail is reddish brown; and the quills of the wings have a shade of purple on them. The female is of the same size as the male, and marked with the same colours; but she entirely wants the bright naked skin on the head by which he is characterised. There are certainly some resemblances between this species and the gallinaceous birds, though there are others in which it more resembles the pigeon family, of which its organisation

clearly shows that it is a member. The eggs are six or eight in number, which answers to a gallinaceous bird rather than to a pigeon. The young are covered with down when they break the shell, and the parent birds gather them under their wings. Thus far there is a slight resemblance, but here it ends. The birds pair, which the true *Gallinidæ* never do; and the male and female sit alternately on the eggs, and pay equal attention to the young, which is not the ease with any of the gallinaceous birds. Indeed, in all the essentials of their character, these birds are as distinct from the gallinaceous birds, and as decidedly pigeons, as the best-winged and most aërial of the family.

The wattled ground dove is a native of Southern Africa, most abundant in the Nimagua country, which, as we have already stated, is the grand natural museum for the animals of Southern Africa. They are less exclusively vegetable feeders than some of the others, and readily eat insects and worms as well as seeds and berries; and it is understood that the young are at first fed upon animal substances, and that they soon learn to pick up their own food, which is of a miscellaneous character. When the breeding time is over they assemble in packs, but they always separate in pairs, and each pair dwells apart during the breeding season.

Nicobar Ground Dove. The common name of this species is incorrect; for, instead of being confined to the small islands of Nicobar, it is pretty generally distributed over the whole of the Oriental archipelago. It is a beautiful bird, and remarkable for the length and apparent looseness of all its plumage, with the exception of the quills and tail-feathers, which preserve the firm character belonging to the pigeons. It roosts and nestles in trees, though the nest is generally near the ground, and the young are very soon able to find their own food.

It is a very beautiful bird, and one of which it is scarcely possible to describe the colours. The clothing-feathers are one colour, namely, deep bronze green, but, as the light falls differently upon it, this shows every shade of colour from golden yellow to intense purple. The feathers on the head and neck are loose and silky; and the clothing, on the upper part of the body especially, has the feathers very distinct; the tail is white, and the quills are bluish black. It is rather larger, and does not partake much of that timidity which is so common among the pigeon family. There are several other ground doves; but our limit is reached, and we must close.

PILEOPSIS (Lamarck; PATELLA UNGARICA, Linnæus). This genus of molluscs is one of the many instances of Linnæan error; it was confounded with many others in the genus *Patella*, from which it may be distinguished by the shell being an oblique sharp-pointed cone, bent forward with a recurved, almost spiral summit, finely striated longitudinally, and wrinkled transversely; the aperture a round oval; the anterior margin shorter and sharper than the posterior; the base nearly round, more or less regularly crenated and indented; the anterior with a lengthened arched transverse muscular impression, In the fossil examples of this genus a testaceous deposit or support, apparently the result of successive accumulations, is visible upon the surface to which they are attached, leaving, as it were, the impression of the shell's margin. As this deposit has never been seen on the spot whence recent specimens have been removed, it may be concluded that the animal inhabiting them seldom, if ever, removed from one spot to another. The *Pileopsis ungarica*, commonly called in this country the foolscap limpet, and its congeners, may more properly be considered to belong to the genus *Hipponix*, according to Sowerby's opinion. There are twenty-one species not known to possess the basal accumulation observed in the fossil species. The mollusc inhabiting this genus is nearly allied to the *Patella*. It possesses two conical tentacula, and the eyes at their base; the branchia are formed in a row, under the anterior margin of the cavity, near the neck. They are found in the European seas principally, but some very large species are inhabitants of the tropical climates.

PIMELIIDÆ. A family of coleopterous insects, belonging to the section *Heteromera*, sub-section *Melasoma*, having the elytra soldered together, the wings being obsolete, the palpi filiform, or terminated by a slightly-dilated joint, and not forming a large hatchet-shaped club. These insects are of a moderate size, and generally of black or obscure colour, and of a robust form; their legs are thick and their motion slow. Many of the species are found in the sandy districts of the shores of the Mediterranean, west and southern Asia, and Africa. The genera are *Pimelia*, *Platyope*, *Diesia*, *Trachyderma*, *Cryptocheile*, *Erodius*, *Zophosis*, *Nyctelia*, *Hegeter*, *Tentyria*, *Akis*, *Elenophorus*, *Eurychora*, *Adelostoma*, *Tagenia*, *Psammetichus*, *Scaurus*, *Scotobius*, *Sepidium*, *Trachynotus*, and *Moluris*, together with numerous others recently established by M. Solier in the Annales de la Société Entomologique de France.

The genus *Pimelia* is distinguished by having the body of an ovoid or oval form, with the thorax narrowed, especially at the base, convex, without posterior angles, and destitute of a porrected prosternum. One of the most remarkable species is the *Pimelia coronata* from Egypt, which has the margins of the elytra furnished with a series of spines, giving it somewhat the appearance of a coronet.

PIMENTA (Lindley). A single genus, formerly the *Myrtus pimenta* of Linnæus, and still belonging to the natural order *Myrtaceæ*. It is the plant which yields the common allspice, and is cultivated in the West Indies. The berries, when intended to be used as spice, should be gathered as soon as the flowers have faded, and not be allowed to ripen. They have a commingled flavour of cloves, cinnamon, and nutmegs, and hence the common name. In our stoves they grow freely in loam and heath mould, and are propagated by cuttings.

PIMPLA (Fabricius). A genus of hymenopterous insects, belonging to the family *Ichneumonidæ*, and distinguished generally by the great length of the ovipositor and its lateral filaments. There are many species, some of those found in tropical climates being the largest insects of the family.

PINE APPLE is the fruit of the *Ananassa sativa* of Dr. Brown (the old *Bromelia ananas* of Linnæus), or cultivated pine apple. The culture of this celebrated fruit is one of the most important feats of modern gardening, and no branch of the business is attended with more success. In former times, if a pine plant could be fruited in three years, the gardener considered himself lucky; now, the principal crop is fruited in less than two. We have not only improved the method of growing the plant, but increased the varieties, so that they may be had at

any season of the year. It is a well-ascertained fact that there are finer pine apples grown in England than in any other country in the world. In their native countries, although the flavour may be equal, the fruit are inferior in size, and much less juicy.

The plant perpetuates itself by seed as well as by viviparous progeny. Soon after the fruit is ripe, the old plant dies, but not till it has left a successor, on the apex of the fruit, called a crown, and several suckers from the lower part of the stem. These last are mostly preferred as succession-plants, and are rooted, placed in small pots, whence they are shifted into larger and larger, until the plants attain such a size as will enable them to show and ripen off a full-sized fruit. Throughout the time of their nonage they are kept in a strong moist heat, by which their parts are greatly amplified, and in twelve or fourteen months are fit to take their final station in the fruiting-house.

PINGUICULA (Linnæus). A genus of pretty herbaceous plants, natives of Europe and North America. The flowers are diandrous, and the plants belong to the natural order *Lentibulariæ*. They are inhabitants of bogs and marshes, and known by the name of butterwort in English lists.

PINNOTHERES (Latreille). A genus of small crabs found upon our coasts, belonging to the sub-order of *Brachyurous Decapods*, and group named quadrilateral crabs by Latreille. These little crabs are found during a portion of the year, especially in the month of November, in different bivalve shells, especially in those of the muscle. The shell of the females is sub-orbicular, very slender and soft, whilst that of the males is solid, globular, and somewhat pointed in front. The legs are of moderate length, and the claws straight; the abdomen of the female is very large, and covers the entire underside of the body. They are ordinarily called pea-crabs, and it is within the shells of the molluscous animals above-mentioned that they both grow and breed. The ancients were acquainted with these little crabs, for Aristotle tells us that "there breed in some shells white and very small crabs, the greatest numbers are found in that species of muscle which have the shell protuberant; next in that of the *Pinnæ*, whose crab is called *Pinnotheres*. They are also found in cockles and oysters. These little animals never grow in any sensible degree, and the fishermen imagine that they are formed at the same time with the animal they inhabit." He likewise supposed that their lives were so dependent upon each other, that if the muscle loses its little crab, both shortly afterwards perish. "The pinna," according to Pliny, "is never found without its companion, which is a little shrimp, in some places a small crab, which bears it company in order to partake of its food. The pinna, gaping wide and showing her naked body to tempt the little fishes, they soon make their approaches, and, when they find they have full licence, grow so bold as to enter in and fill it; this, being seen by the guardian shrimp, by a slight rap he gives the signal to the pinna, who, therefore, shuts her shell, and suffocates whatsoever it encloses, giving a share of booty to her companion." Oppian, still more absurdly, supposed that the *Pinnotheres*, finding the shells of the bivalve open, throws a small stone between them to prevent them from closing, and so enables it to devour the inhabitant; whilst Hasselquist as ridiculously tells us, that the crab goes out to cater for the pinna, and when it returns, cries out for the shell to be opened, which the grateful inhabitant immediately complies with. In more modern times, the people on the coasts where these crabs are found attribute to their presence the injurious qualities which some muscles possess. Say, however, has described an American species under the name of *Pinnotheres ostreum*, which is found in the common oyster of that country, and which is stated to be "excellent food; and those who eat oysters, seldom reject it when the fresh oyster is opened. In considerable numbers the crabs are often collected and served apart for the palates of the luxurious;" whence it is evident, that the opinion commonly entertained that the injurious consequences which arise occasionally from eating muscles must be owing to other causes. For some of these observations we are indebted to Mr. Thompson's valuable Memoir upon this genus, in the third volume of the Entomological Magazine, in which it is clearly proved that the connexion of the *Pinnotheres* is parasitic, being never found at large like some other aquatic animals which occasionally make their way into shell-fish, since, in sweeping on a bank of old muscles, "almost every shell will be found to contain one full-grown female, some two, and others three, independent of young ones; and males, which occasionally occur in common with the females, while not a single individual is to be seen." The type of the genus is the *Cancer pisum* of Linnæus. There are several other species described in the "Malacostraca Podopthalma Britannica," of Dr. Leach; but this author has given the young and the males as distinct species.

PINTADINA. The name given by Lamarck to one species of the genus *Avicula*, which Leach has named *Margarita*. It is the shell known as the mother-of-pearl oyster, and is described under the article AVICULA MARGARATIFERA, or pearl-bearing *Avicula*, and under the leading head CONCHOLOGY. Some mention is made of that highly-prized gem, the produce of a diseased state of the animal, and the source of an immense branch of commercial wealth and national luxury in all parts of the globe, from the very earliest period of history down to our present times. We may here offer an apology for not having fulfilled a pledge given that some account of the pearl fishery would have been furnished our readers, it having been considered unadvisable to introduce it in this division of the work.

PINUS (Linnæus). A well-known and useful genus of forest trees, belonging to the truly natural order *Coniferæ*. They are mostly natives of the mountainous parts of the northern hemisphere, and furnish the builder with the principal part of his materials. There are above forty different sorts of this genus in cultivation. Some of them are highly ornamental, and all of them are well calculated for forming sheltering screens, and for nursing trees of a less hardy nature. They are raised from seeds, and constitute a principal part of the business of British nurserymen.

PIOPHILA (Fallen; TYROPHAGA, Kirby). A genus of dipterous insects, belonging to the family of *Muscidæ*, and having for its type the cheese-fly, *Piophila casei*, an account of whose habits we have given in our second volume, p. 9. The body in this genus is small and polished; the head sub-globose, without any frontal projection, the antennæ small with a single bristle, and the legs moderately long and slender. In

our article above referred to, headed CHEESE HOPPER, or CHEESE MITE, we unintentionally confounded together two insects which are found in cheese, namely, the cheese-hopper or larva of the *Piophila casei*, and the cheese-mite *Acarus lactei*. We are indebted to an obliging correspondent for pointing out this mistake in the Entomological Magazine, and which we take the earliest opportunity of rectifying. The article in question is confined to the operation of the first-named insect and its transformations; with the exception of the following passage, relative to the larvæ which, feeding upon cheese, are said "to cause it to decay; the fine powder which we perceive, and which is so highly prized by the gourmand, being nothing else but the excrement of these grubs." This paragraph which, by an oversight, was introduced into our account of the larva of the *Piophila*, although the writer thereof had often watched the mites under a microscope, relates to them and not to the former. The anonymous writer thus proceeds, "when a cheese is infested with the hoppers there is no powder, but, on the contrary, a moisture*; now a cheese that is attacked by the mites is always powdery wherever they harbour. Any dairy-maid knows that if the cheese is not well pressed, to separate the whey entirely from the curd, it will be much more liable to the attacks of the hopper-fly than if it had been pressed as it ought to have been. They also call a cheese that is decayed by having the maggots in it, the 'wet rot,' in contradistinction to the 'dry rot,' which the mites generally, but not always, accompany. There is also a very great difference in the attacks of the two insects. The hoppers being always found in the interior of the cheese without any visible external aperture; the mites are as constant to the exterior, and never penetrate into the inside (unless there are cracks in the cheese), until the outer part where they are is entirely consumed." Entomological Magazine, vol. iii., p. 502. We are thus happy in being enabled to correct any errors into which we may unintentionally have fallen in the course of our work, deeming accuracy of far greater importance than wilful ignorance.

PIPERACEÆ. A small natural order, consisting of three genera and seventy-one species. The genera are *Saururus*, *Piper*, and *Piperomia*. In general the peppers are much more valuable in commerce than as ornaments in gardening. Their flowers are inconspicuous, and the habit and foliage afford very little variety. They are herbaceous or shrubby plants with knotted stems, and opposite or verticillate leaves. The petioles are sheathing at the base, but without stipules, and the lamina is simple, entire, and often fleshy. The inflorescence is spadix-like, the flowers bracteate, stamens definite, the anthers erect, one or two-celled, opening lengthwise, shedding smooth grains of pollen. The germen is superior and one-celled. The stigma one or more and sessile. The fruit is indehiscent, with a fleshy mesocarp, containing one or more roundish seeds.

The *Piper* and *Piperomias* are all tropical plants, abounding in the hottest parts of the East and West Indies. Their fruit are warm and even acrid spices, and the pungent aromatic principle so familiar in culinary pepper is common to the whole group. The black, the long, the cubeb, and the betel peppers, are the best known and most valuable. These, or some one of them, are cultivated in Java, Sumatra, Borneo, and in the Phillippine Isles, and grow in the greatest abundance in Malabar, constituting one of the principal articles of export. The two sorts of pepper known as the black and white are the produce of the same plant: the black is the fruit entire, the pericarp being allowed to dry on the seed: the best white consists of the ripe seeds which have fallen from the plant, and are picked up by poor people from under the vines. The largest quantity, however, is produced by steeping the black pepper in warm water, and rubbing off the pericarps: much of the pungency, however, is thus removed, but it becomes a more sightly condiment.

The betel-pepper leaves are chewed with slices of the areca nut, as tobacco is in Europe; and, from its intoxicating powers, as well as from it allaying hunger, it is one of the most common luxuries of the East.

PISCIDIA (Linnæus). A genus of West Indian trees, belonging to *Leguminosæ*, and commonly called red Jamaica dogwood. In our collections they are rambling growing plants, often requiring to be cut down.

PISMIRE. One of the ordinary names for the ant.

PISTACIA (Linnæus). A genus of deciduous trees, natives chiefly of the south of Europe. They belong to *Terebinthaceæ*. In countries where these trees abound, the nuts are used as food, and great quantities are exported to foreign countries. The flowers are dicœcious, and the male flowers are suspended over those of the female trees by the cultivators to insure a crop. The *P. lentiscus* affords the true mastic of commerce. In this country the *Pistacias* are treated as greenhouse plants, and are increased by cuttings, or by grafting to unite the two sexes.

PISUM (Linnæus). The *P. sativum* is the common pea of our gardens and fields; a leguminous genus needing no description. Field peas are usually sown in February or March; and, in order to have a succession of young pods for the table, peas are sown in every month from October to July.

PISUM. A genus of molluscs established by Megerle, now united to the genus *Cyclas*, of which it may be deemed a species.

PITCAIRNIA (Heritier). A genus of rigid spiny herbaceous perennials, bearing a spike of hexandrous flowers, and belonging to *Bromeliaceæ*. They are natives of tropical America, thrive and flower freely in light soil, and are increased by suckers.

PITCHER PLANT is the *Nepenthes distillatoria* of Linnæus, a curious herbaceous bog plant, a native of China. They are grown with great success in our damp stoves. The flowers are dicœcious, and the genus belongs to *Cytineæ*.

PITTOSPORACEÆ. A small natural order of beautiful shrubs and small trees comprising four genera, viz., *Bellardiera*, *Pittosporum*, *Bursaria*, and *Senacia*. Of these together there are twenty-two species already described. The leaves are simple and without stipules, with white or yellow flowers. The order is distinguished by the imbricate æstivation of the sepals and petals, which last, as well as the stamens, are five and seated below the germen, and by its minute embryo. The *Pittosporum tobira* is nearly hardy, and expands its sweet-scented flowers in favourable situations in the open borders.

* The impression still remains in the mind of the writer hereof, that he has seen the hoppers in cheese which exhibited no moisture.

PLACENTULA. A minute species of mollusc, considered and classed by Fichtel with his microscopic *Nautili*.

PLACOBRANCHUS. A genus of naked molluscs established by Hasselt from specimens discovered in Java. It appears by his description to differ essentially from other molluscous animals; but its description requires more frequent observation of the species to enable us to assign to it a proper position in malacology. As far as we are able to judge, it appears to belong properly to the *Cyclobranchiata*, and nearly allied to the genus *Doris*.

PLACUNA (Lamarck; Anomia sella, Linnæus). The animal appears to be entirely undescribed of this singular mollusc; but the shell is well known to amateurs, and once bore a high price. This genus immediately precedes the genus *Anomia* in Lamarck's system, with which it was blended by Linnæus, though in form it bears but little resemblance; unlike them also in habits, it is never affixed to other bodies, and the probable organisation of the animal must likewise be perfectly distinct. The name given to this shell by Linnæus is not quite so happy as many others which have led him from their resemblance to things to adapt generic names. If that alone should guide the naturalist, this might better have been named a saddle-cloth than a saddle. It is a most remarkable mollusc, unlike every thing else in malacology, and, viewed in an anatomical light, probably presents more to astonish us than any other testaceous mollusc, were we only to consider that a shell, often six inches in diameter, encloses an animal by which it is constructed, whose utmost solidity at any part does not exceed the thickness of a sixpence, while every indication of muscular power is as strongly developed as in the gigantic inhabitant of the *Tradacna*, or other species of shells of an inferior size, such as the common oyster, whose valves cannot be torn asunder without the application of an immense mechanical force. The principal characteristic features of this singular mollusc are as above stated; the extreme thinness of the animal's body, the great delicacy of the texture of the valves which admit the rays of light to pass through them, and the strength of the hinge which presents a *point d'appui*, are scarcely to be equalled by any other mollusc. The very peculiar form of this hinge completely distinguishes this genus from all others; on one valve it may be described as resembling the letter V, the lower parts not quite joined; there are corresponding cavities on the opposite valve, so deeply indentated, that they sometimes form an external projection, the substance of the shell is thin, semi-pellucid, foliaceous, and the margins fringed; its form is sometimes orbicular, and very flat, as in the *P. papyracea*, which, from its diaphanous properties, is used in Japan as a substitute for glass in their windows; the other species is generally of a squarer form, and singularly bent, as if partially folded or warped over a cylinder; the valves of both species are finely striated or wrinkled longitudinally, and the ligament attached to the powerfully-constructed hinge, the interior presents a muscular impression similar to and as large as that of the oyster. The *Placuna sella* presents a slight tinge of purple in the colour of its valves; but the *P. papyracea* is nearly white. There are three recent species known as inhabiting the Indian seas and the coasts and islands of Japan, which abundantly furnish the *P. papyracea*. In a fossil state they have been discovered, but they are rare. A modern naturalist asserts, that the muscular impression of this shell is *not* remarkable; but surely he cannot have examined many specimens; we only refer our readers, who are interested in reconciling what may be termed anomalies in nature, to such examples as may daily be seen in the British Museum, in which we assert, without the fear of contradiction by any one acquainted with nature's indications of animal strength as exhibited in malacology, more strength is indicated as belonging to this feeble fragile shell than is marked in testaceous molluscs, whose habitations would bid defiance to external injury; and from their size and substance require a mechanical force incalculably greater than appear requisite for the shells of this genus; and the conclusion naturally is, that they are furnished with a closing muscular apparatus sufficiently powerful to crush their own valves, and equal to that necessary for retaining closed, or shutting the valves of molluscs incomparably thicker.

PLAGIOSTOMA (Lamarck). As no recent example of this mollusc has been discovered, Lamarck assigns to it a supposititious place in the connecting chain of malacology, and he appears to consider it an intermediate link between the genera *Lima*, *Pecten*, *Spondylus*, and *Podopsis*. The shell is sub-equivalve, free, sub-auriculated, and the cardinal base straight and transverse, the apices are but little distant; the external edges of the hinge angular, straight on one side, oblique on the other, the hinge not exhibiting any teeth or serrations; there is a cardinal cavity between the apices, partly internal, opening outwards, and receiving the ligament. The animal is of course entirely unknown, and illustrates one of the numerous instances of animated beings who have totally disappeared from the face of nature, leaving the naturalists to draw analogous conclusions in support of their rank in the classification of recent objects of nature's formation. De France enumerates three species, but more have been discovered since his excellent work on Fossil Conchology.

PLANAXIS (Lamarck; Buccinum sulcatum, Born). These are marine shells, nearly allied to the genus *Phasianella*, but the animal is entirely unknown. A distinguishing character from that genus is manifest, the *Planaxis* having the base of the columella truncated as in the *Melanopsis*, and it would have been still stronger, if, as Lamarck conjectured to be the case, they had not possessed an operculum. Shells of this genus are very small in general, transversely grooved on the exterior, of an oval conical form, solid, the aperture ovate, columella flattened, truncated at the base, and separated on the right margin by a narrow sinus or channel; the interior surface of the right margin is grooved or rayed with a callosity running beneath the summit, appearing in that respect allied to the genera *Buccinum* and *Purpura*. Sowerby, in his Genera of Shells, observes that he has seen one specimen with a thin horny operculum (a circumstance unknown to Lamarck), and he considers them more nearly allied to the *Buccina* and *Purpuræ* than to the *Phasianellæ*, which possess a solid calcareous operculum, and also by their having a callosity running under the summit of their right lip. Only two species appear to be known, one from India and the other from South America.

PLANORBIS (Lamarck; Helix, Linnæus). Müller and Bruguiere were the first naturalists who separated this mollusc from the genus *Helix* of Lin-

næus, and the propriety of so doing is manifest from an investigation of the animal constructing this shell. If no other reason existed for the separation being made, it would have been desirable in order to distinguish the terrestrial from the aquatic species, which were indiscriminately blended. This genus inhabits fresh water; the form of the shell is discoid, that is, having its spiral evolutions on a horizontal plane, or, as it were, wound round a central point, gradually increasing in size, and leaving the upper and lower sides concave and nearly similar, the spire being only but slightly elevated; the aperture is oval, dilated, and far removed from the axis of the shell; the lip is never reflected, the substance is generally thin and diaphanous, the whorls nearly cylindrical, but sometimes flattened, angular, or carinated; they possess no operculum. Lamarck does not appear to have observed in more than one species of the *Planorbis spirorbis* the very peculiar and characteristic distinction of its being heterostrophe or left-handed, commonly called a reverse shell, which also occurs in many other examples examined by the writer. This genus may be divided into two species, such as are keeled or carinated, and those not so; the *Planorbis corneus* is a specimen of the latter, and the *P. carinatus* of the former. The species of this genus inhabit the lakes and ditches of Europe. Some are known in a fossil state.

PLANTAGINEÆ. A small natural order of herbs, containing only three genera and eighty species. The species are, for the most part, mere weeds, found on waste ground all over the world. The genera are *Plantago*, *Littorella*, and *Glaux*. The leaves are stellate, and occasionally ternate; the pubescence is jointed; the flowers are brownish, and arranged in dense spikes. Their leaves are rather bitter and astringent; their seeds mucilaginous and rather acrid; those of *P. arenaria* are imported from the south of France in great quantities for the purpose of forming an infusion in which muslins are washed. *P. lanceolata* is an agricultural plant, being sown among other grasses in laying down sheep pastures, and sold by seedsmen as rib-grass. *Hort. Brit.*

The plantains have a tendency to follow the migrations of man; and have among the natives of some of our own foreign settlements been named the "Englishman's foot," for wherever it is found there our countrymen have trod. The *Littorella* is the shore-weed of British botany, and the *Glaux maritima* is the black salt-wort of the same.

PLANTANTHERA (Richards). A genus of three species of plants belonging to *Orchidaceæ*. The *P. bifolia* of Richards is the same species called *Orchis bifolia*, or butterfly orchis, of Linnæus.

PLANULACEA, in modern malacology, is the second family of the first class *Cephalophora*, first order *Cryptodibranchiata*; it includes the genera *Renulina* and *Peneroplis*.

PLANULARIA is a genus established by De France to a fossil mollusc, now united to the genus *Peneroplis*.

PLATANUS (Linnæus). A genus of highly ornamental timber-trees, natives of the Levant and of North America. Their flowers are inconspicuous and monœcious, and belong to *Amentaceæ*. The species are known by the common name of plane-trees, and both the *P. orientalis* and *occidentalis* are elegant, and, when full grown, majestic plants. They are usually propagated by cuttings planted in a shady border in autumn.

PLATINUM. This mineral was entirely unknown to the ancients, and we believe that the first known specimen came to this country about the middle of the last century. This valuable metal is usually found in grains combined with gold, iron, lead, palladium, rhodium, iridium, and osmium, and the largest mass ever discovered weighed less than twenty-eight ounces. Its main place of deposit is a vast alluvial tract in New Granada, South America. The valuable property that platinum possesses of remaining unaltered in the air, or when exposed to the action of heat at a high temperature in the furnace, peculiarly fits it for a variety of purposes in the useful arts; but the great expense attendant on its manufacture has hitherto prevented its employment for domestic purposes, if at least we except its application in ornamenting porcelain.

PLATYLOBIUM (Smith). A genus of Australian evergreen shrubs, belonging to *Leguminosæ*. From the compressed form of their pods they are vulgarly called the flat pea. They are handsome greenhouse plants, thrive well in light loam and heath mould, and are easily increased by cuttings.

PLATYPUS (Herbst). A genus of xylophagous beetles, belonging to the family *Bostrichidæ*, and distinguished by having the antennæ short, terminated by a very large club, which is destitute of joints; the body is linear, the head truncate in front, the tibiæ broad and curiously striated, and the tarsi long and very slender; the penultimate joint not being bilobed. These are curious little wood-boring insects, of which but few species are known, the type is the *P. cylindrus* of Herbst, about a quarter of an inch long, which has occurred in the New Forest in Hampshire. There are eight or nine other exotic species.

PLATYRHINUS (Clairville; Macrocephalus, Olivier). A genus of coleopterous insects, belonging to the section *Tetramera*, and sub-section *Rhyncophora*, or weevils (see Curculionides), and sub-family *Anthribides;* the antennæ are clavate, the rostrum short and broad, the eyes entire, the body of an oblong form, and the two basal joints of the antennæ short. This genus comprises but a single British species *Curculio latirostris* of Bonsdorff, which is half an inch long, and is found in *Sphæria fraxinea*, growing on the trunks of various trees. The other genera, which belong to this sub-family (which was omitted in its place) are *Anthribus*, *Rhinomacer*, *Tropideres*, *Brachytarsus*, and *Phlœobius*, all of which are British, together with a great number of genera described by Schonherr in his work in course of publication upon the *Curculionidæ*.

PLECTRANTHUS (Heritier), A genus of annuals and undershrubs natives of various parts of the globe. Their flowers are for the most part blue and didynamous, of course belonging to *Labiatæ*. The shrubby sorts are easily kept and propagated, but are plants of no beauty.

PLEUROBRANCHIDIUM. A naked mollusc without any trace of shell, occupying its place as a connecting link between the families *Subaplysiacea* and *Aplysiacea* in modern malacology.

PLEUROBRANCHUS (Cuvier). The shells belonging to this genus are but little known, and the *P. poranii* is perhaps the only example described. The form is large, well shaped, the edges membranous, oval, and concave beneath, convex above, the sharp edges closely united, and the summit altogether subspiral posteriorly.

PLEUROCERUS (Cuvier). The animal of this genus of mollusc is incompletely known, it appears to have a probociform head, two lateral tentacula, subulated and pointed, the eyes externally placed at base. The shell is oval or pyramidal, the aperture oblong, the external lip thin, the internal one attached to the columella, which is smooth and twisted, without an umbilicus, it has a horny or membranous operculum.

PLEUROTOMA (Lamarck; Murex, Linnæus). Shells of this genus were classed with the *Murices* by Linnæus. Bruguiere in aftertimes confounded them with the genus *Fusus*. Lamarck, in the first instance, called such of them as had a short canal *Clavatulæ*, and the others *Pleurotomæ*; but the very variable length of canal in the intermediate species induced him to class the small under the present genus, being guided only by the notch on the upper part of the edge of the aperture. With regard to the former arrangements, they cannot properly be confounded with the *Murices*, as they never possess the varices so remarkable in that genus; and from the genus *Fusus* they may readily be distinguished by possessing a long thin notch on the right side of the aperture. These molluscs are either turreted or fusiform, varying in length, terminated at the base by a straight canal more or less lengthened; the right margin with a deep narrow notch or slit near its upper part, the spiral whorls variously sculptured as in the genus *Cerithium*, between which and the genus *Turbinella* they appear to form a natural link. They possess a small horny operculum, and many fossil species are known. They inhabit the eastern and tropical seas, and many of the species are abundant in Java.

PLEUROTUMARIUM. A fossil species of mollusc established by De France, it appears intermediate with the recent genera *Turbo* and *Delphinula*.

PLICATULA (Lamarck; Spondylus, Linnæus). The genus differs but little from the Linnæan arrangement. Lamarck has, however, separated it for the following reasons: the ligament is altogether internal as in the *Pecten;* it has the primary teeth of the *Spondylus*, but without the ears or prolonged beak which are so conspicuous in that genus. The *Plicatulæ* also possess the faculty of affixing themselves to one another or various marine bodies grouped together in clusters, as sometimes occurs in the genus *Spondylus;* the valves are both of them closely interlocked and strongly plaited within and without; the summits are unequal and without external facets. They mostly inhabit the American seas, and several fossil species are known.

PLOIARIA (Scopoli). A curious genus of hemipterous insects, belonging to the family *Cimicidæ*, and sub-family *Reduviides*, having the body very long and slender, as well as the legs and antennæ, the latter being elbowed at the extremity of the long basal joint, the anterior legs are, however, short and prehensile. The *Cimex vagabundus* of Linnæus is the type of this genus, which is found in the larva and pupa state in obscure and dirty situations. In the imago state it is found in outhouses and in trees; its motion is very slow and irregular, and it balances itself like a tipula without changing its place. Its fore legs are not employed in walking, but are folded three times beneath the head, the femur resting upon the trochanter, and the tibia upon the femur, the antennæ seeming to make up for the deficiency by being often brought into contact with the surface upon which the insect is walking. The fore legs are therefore employed as instruments for seizing the prey; the rostrum is very short and curved, and the fore legs being also short, are adapted for bringing the food to the mouth. The pupa very nearly resembles the perfect insect, but it is entirely covered with hairs scattered over the body and legs. The perfect insect is about one-fifth of an inch in length, of a whitish colour with brown spots.

PLOVER (*Charadrius*). A genus of *Echassiers*, or stilt birds, belonging to the pressirostral family, and resembling the lapwings in their haunts and their habits, but still distinct enough from them for being considered as a separate genus. The principal generic characters are as follow: the bill shorter than the head, slender, straight, compressed, and with the nasal grooves extending two-thirds of the length, which of course renders that portion of the upper mandible weak and in part flexible; the nostrils are near the base of the bill, and toward the sides pierced in, and partly covered by a membrane, which lines the grooves to a considerable extent; the tarsi are long in some of the species, and of mean length in others, and they are slender in all; the toes are three to the front, and none to the rear, united at the base by a small membrane; the first quill of the wings is shorter than the second, which is the longest in the wing.

Plovers occur in many parts of the world, indeed almost in all; and they may be considered as birds which range from place to place with the seasons, although they are not decidedly migratory. In the summer they are inland birds, dispersing in pairs for the purpose of breeding. They breed on the margins of marshes and streams, generally in wild places, but the eggs are deposited on the solid ground. In some of the species, however, the eggs are placed on the bare sand, and in others they are under cover of aquatic plants; but these differences appear to depend fully as much on the country as on the birds. After the broods are reared, the birds assemble in considerable flocks, and descend from the breeding places on the moors, first to the low grounds, and ultimately to the beach, in countries where the winter is severe. There are, however, great differences among them in these as well as in other respects. When they flock they are much esteemed as game, and the more so probably that it is very difficult to come within shot of them, as they always have sentinels when the flock is feeding, which give the alarm in a loud whistle upon the slightest appearance of danger. When the alarm is given, the whole are on the wing in an instant; and, as they fly rapidly and wheel and double adroitly with their pointed wings, they soon get out of sight. Their food consists of small ground animals, chiefly worms and mollusca; but it may reasonably be doubted whether they beat the ground with their feet, in order to bring out the worms, as is generally alleged of them. The fact is, that they are on the feeding grounds during that weather and those times of the day when the worms are out; and by the time that the worms have begun to sink deep in the ground in order to hybernate, as they do in cold and upland places, the plovers are lower down feeding upon mollusca.

The common English name plover is a corruption of the French *pluvier* or "rain bird," they being most

active when the weather is rainy or otherwise moist. Birds are instinctively good prognosticators of the weather, though of course without knowing any more of the matter than almanac-makers, and they generally utter their particular cries before the rain actually comes. In such countries as Britain, the rain very often comes about the hour of the night when the nocturnal atmosphere has made its greatest descent. The air is, however, softened, and as soon as this takes place such birds as the plovers are in motion and whistling away at the top of their bent. This circumstance led to the vulgar opinion, once very prevalent, that the plovers are the cause of the rain, which in most cases follows this unusual stir of them; whereas the fact is, that the coming rain is the cause of the greater activity among the birds. They are not the only birds which have in this way got the name of rain-birds, for the same has been said of the woodpeckers; and indeed all birds which feed upon small animals that conceal themselves in drought and come out in soft and moist atmospheres, are excited and become active before rain. Instead of bringing rain, the plovers are not, in any sense of the word, aquatic or water birds, for they never go into the water, though they do resort to the soft ground to feed; yet in their feeding they appear to give the preference to firm surfaces.

As British birds, there are three species of plover, generally understood to be resident in one part of the country or another all the year round; but they differ a good deal from each other in their habits.

The Common Plover (*C. pluvialis*). This bird is differently coloured at different ages, and this has not only led to its being called by many names, but to the old and the young being sometimes described as different species. As a British bird it is very common in all places which suit its habits, and it is very generally distributed over other countries. It has been most frequently seen in the winter plumage, and accordingly it is usually described by the colours of that. The upper parts are blackish, spotted with golden yellow; the sides of the head, the neck, and the breast, are ash-colour clouded with yellowish-brown; the quills of the wings are black, with the ends of the shafts white; and all the under part is white. The bill is blackish, and the feet grey. The length of the full-grown bird is about ten inches and a quarter, and it is a compact bird, and, when in good condition, heavy in proportion to its lineal dimensions. Its wings are not very long, but they are firm and capable of active flight, both on a forward course and upwards and downwards. In the breeding season, the breast (of the male bird at least) becomes of an intense black; and as the bird was first noticed in this plumage, in places far to the north, it was described as a different bird from that which flocks on the low fields in autumn and the beaches in winter.

The common plover always nestles on the dry places of the upland moors, never far from the mires and pools, but not close to their margins. The nest is merely a rude channel scratched in the earth; and as both the bird and the eggs are very like the ground and the heath and lichen in colour, one may pass quite close to the nest without observing it. They make their appearance, or rather make themselves heard, upon the breeding grounds in the latter part of March, or early in April, according to the place and the season; and it is to be understood that the weather in the place which they leave, not in that to which they come, determines their movement. In the more cold and northerly parts of Britain, where the upland forms a striking contrast to the plains by the sea and the beaches, they, as well as the lapwings, often take the hill too early. They do not of course come upon the moors while these are covered with snow or bound up in frost; but a slight return of the storm sometimes overtakes them, and though they do not tumble about on the wing, and battle with the wind and snow-flakes as the lapwings do, they are, perhaps, put to greater straits for food, as they do not dash about like the others. They appear to pine before they leave their places of winter habitation; for, although there are often many of them on the same moor, they do not appear in flocks there, even upon their arrival. It is only on rich pastures that they flock; and as they use the wing but little on the breeding-grounds, unless they are forced up by danger, each pair take up their ground, which is not invaded by any other pair. If the weather is severe they are seldom seen except early in the morning, running from the marshy pools to the cover of the withered grass and heath, in which they are soon lost to observation. If the weather is open the male very soon begins his music. It is a shrill but rather pleasant whistle, began at early dawn, and the ploughmen on the margins of the moor have their reveillie in the whistle of the plover, just as those farther down have it in the song of the lark. The place for the brood is one in which exposure becomes concealment. It is not in the cover of the grass or heath, but generally in an open and rather elevated place, where one would be the least likely to look for a nest, unless well acquainted with the habits of these birds. The eggs are usually four in number, of an olive-grey colour, blotched and streaked with a dusky tint. They are large for the size of the bird, and they are arranged as those of most of the running birds are, in quatrefoil, with the small ends towards the centre. During the night the female sits closely, and the male stands sentinel at a little distance, but does not give an alarm unless danger is very pressing. When the sun beats strongly and the ground gets warm, the female steals quietly and by a circuitous route from the nest to the feeding-ground, where she continues the whole day if the sun shines unclouded, the heat of the sun being sufficient for keeping up the requisite warmth in the eggs. But if rain comes, or even a very dark cloud passes over the sun, she hurries back to her charge in the same circuitous and stealthy manner as she left it. If the feeding-ground is at some distance from the nest, the female performs the greater part of her journey on the wing; and she displays no small finesse both in rising when she departs, and in alighting when she returns. On her departure she runs crouching for a considerable distance, and then rises and flies back over the nest, and wheels and counter-marches several times before she goes off. On her return she practises the same manœuvres reversed, flying over the nest to some distance, and running to it after she has alighted. The male, though seldom seen unless when danger threatens, is always on the watch, except early in the morning and late in the evening, which are his feeding-times. He watches the female and the eggs during the night, which is rather an easy task, as there are but few enemies abroad on the plovers' ground then. In the absence of the female during the day, his watch is a little more severe, as crows are very apt to come prowling over the moors in quest of

eggs or of nestling birds. It costs the bird no small share of artifice to get rid of the crow, because the crow does not seek the bird but the nest; and where crows, whether the hooded or the carrion, are numerous, they destroy many of the eggs. From quadrupeds there is little to fear; but if a dog happens to pass, stratagems are immediately resorted to. The bird takes the wing, and alights near the dog, but always in a different direction from that in which the nest is situated. If the dog gives chase, as is always done by a strange cur upon the moor, the bird rises and flies a little way, then alights, and runs with drooping wing as if crippled. The cur is always close upon the game, but never comes up with it; and if he persevere, the sport is continued till he is drawn to a distance from the nest, and at the same time quite exhausted. Then the bird whistles loudly to his mate, announcing that all is safe; and after wheeling round and round the enemy, as if in derision, dashes back to his watch-tower.

As is the case with those of all ground birds, the young, when they break the shell, are covered with down. At first they cannot run to find their own food as the young gallinidæ do; and one can easily see the reason; the food of the gallinidæ is found in the place where the nest is, while that of the plover is always at some distance. Both parents feed them when they are in this early and helpless stage; and after they are able to run, which they are long before they can fly, both parents watch them, and entice off the enemy by manœuvres similar to those already noticed. It is generally said that the shepherds' dogs on the hill occasion no alarm to the plover, or indeed to any of the birds that nestle there.

It is generally said that the plovers moult twice in the year, the chief moult in the autumn, and a less one in the spring; and they certainly do change their colours at those times. During the great moult they are both still and silent, and are understood to hide themselves singly in the snow; and, as the ground is then beginning to be moist, worms are much more easily found than during the drought of summer. When the new plumage is complete, the birds begin to flock and to move off to their winter-quarters; and as they do this by stages, and feed well by the way, they are very fat and excellent eating.

The Dotterel Plover (*C. morinellus*). Both the common name of this bird, and the specific one, imply that it is "a little fool," and, in those places where the birds are well known, "as stupid as a dotterel" is a character very often bestowed upon those who are not over-burdened with wisdom. The name does not apply to the bird in all its localities. When the birds flock they are an easy prey to the fowler; but when they are upon the breeding-grounds, they are not only not easily captured, but very rarely seen,—so rarely, indeed, that though analogy led to the conclusion that thousands of them must have been somewhere in the upland wilds of Britain every year, yet the birds or the eggs have been very rarely found upon the breeding-grounds, and that only of late years.

The upper parts of the dotterel are blackish-ash colour clouded with greenish, having a dull metallic gloss, and the margins and tips of the feathers reddish. The top of the head is dark grey; the streak over the eyes white; and the front and cheeks white dotted with black. The breast and flank are reddish white, with a broad band of black on the former, and the rest of the under parts are white. The quills have black tips. The bill is black, and the feet are greenish. As is the case with the common plover, the dotterel is subject to very considerable seasonal changes of colour. As in that bird, the description usually given is that of the winter plumage after the autumnal moult; because, although the birds are seen in vast flocks in this winter dress, it is rare to get a sight even of one in the nuptial plumage, which is that by which the bird ought to be described. We believe it was first seen in this nuptial, or summer plumage, in Siberia, and, as systematic naturalists are always far more anxious to find a species than to establish a truth, it was called the Siberian plover (*C. Siberica*). In this plumage it has the front and cheeks white without black spots, the occiput black, the hind neck and sides of the neck ash colour, and the middle of the belly black. The length is nearly nine inches, and the weight, especially when the birds flock in autumn and winter, is considerable as compared with the lineal dimensions, the weight being then about five ounces.

It is probable that the greater number, if not the whole of these birds, quit Britain for warmer climates during the winter; and they make their appearance upon the low and cultivated grounds of the south of England, and the central part of Scotland, nearly at the same time, in the early part of April. They continue coming for several weeks. Their halt is not upon the very richest grounds near the sea, but rather on the cold upland ones which are nearer the moors. At that season they are in packs rather than in flocks; and these packs keep augmenting for some time; after which they gradually melt away, though some linger till nearly the beginning of June. They do this in the south as well as the north, if the place where they linger is near an extensive and dreary moor, which would lead one to suppose that they breed in all parts of the country where they can have sufficient hiding, upon the heath-clad downs in the south of England, as well as the secondary ridges of the Grampians in Scotland; but, as we have said, their manners on the breeding-grounds are everywhere so hiding, that there is great difficulty in finding them out. One may pass a cold height, half hassock and half mire, where hundreds of them may be, without the slightest chance of seeing one. The eggs are very similar to those of the plover, and arranged in the same manner, only they are considerably smaller. The appearance of the young in their early stage is very little known.

That dotterels breed not only on the southern slopes of the Grampians, but pretty generally in the Scottish mountains, is proved by the fact of their having a Gaelic name. Nor is it a little remarkable that this name should embody the same charge of folly which is implied in the common English one. It has an addition, however, which points to the places in which the nests of the birds are most likely to be found. The name is *An tâmadan mointich*, which literally means "the fool of the peat-bog." Now, these peat-bogs always lie upon the first slopes, very generally where the water parts to run different ways in the hollow between two mountains. Very generally these bogs receive a considerable supply of water even in the most dry time of the year, and they are thus in a great measure proof against the visits of man or quadrupeds. The summer is warm upon them, however, in proportion to their elevation,

and thus they abound with those small animals which serve as food for the dotterels and their broods; and, from the peculiar nature of the places, the birds breed in safety as well as secrecy. The length of the incubation, and the economy of the breeding-time generally, are not known. They return to the low country in the month of September, and then they are in numerous flocks, which keep very closely together. Even then, however, they appear upon the bleak and bare places rather than the fertile ones; the lower moors, on the secondary ridges of hills, in Scotland, and the downs and other sheep-walks in England. At this time they are very fat, and excellent eating. In Scotland they are not much attended to as game; but the case is different in England, especially in Norfork, where they appear in great numbers, and afford sport for six weeks or two months. On these occasions they show very little fear, and do not move far from the enemy, though they keep up such a succession of rising and alighting, that it is not easy to come close up to them. One may come upon the flock on the ground close to each other; but, even if one comes near, the whole do not rise; the near ones rise, fly over the rest, and alight in front; and this may be continued to the edge of the common, or other pasture, the birds apparently taking the matter very easy, but contriving to keep at nearly the same distances. If followed to the verge, the whole rise, and traverse the common in another direction, but in the same provoking manner; and one may follow them thus for a whole day, always near, but never reaching.

They play the same sort of game with a dog, only they play it more rapidly. They let him almost into the flock, then they take the air at very low flight all round him, and he is quite at a loss to which side to turn. Thus they teaze him, till he is quite worn out, by always leaping and snapping at a bird which nearly touches his nose, but of which he is never able to get hold.

Fowling-pieces are far more successful, as it does not appear that their instinctive resources are capable of affording them any protection against these. They fly very close, so that the most bungling marksman may make more of the value of his powder, and, by the time that he loads, they will have alighted close at hand, and be ready for another shot. A large flock on a wide down may thus be followed for a whole day, and a great number of them obtained. On foot the sport is rather fatiguing; and the best way is for two to go in concert on ponies, with assistants to pick up the birds. The gunners take the flock right and left; and when the one fires, he turns them on the other, who gets an equally good shot. This may be continued for any length of time, if the flock is sufficiently abundant, and, even if the birds attempt to make off, they may be brought back again. In November they disappear even from the south of England, and they leave Scotland sooner; but where they go, until their reappearance in the spring, is not satisfactorily known, though probably not farther than the south of Europe. In summer, dotterels are very abundant in the wild places of Russia, where they nestle and rear their broods; and when the moult is over, and all are vigorous, a retreat for the winter is made to the south-east of Europe and the south-west of Asia. The manner of their migratory flight, and the time of the day or night at which it takes place, have not been observed.

The Ring Plover (*C. hiatinela*). This is another British species, by no means rare, but peculiar in its localities, and thus not generally seen. It is a bank bird, frequenting the flat shores of the sea, and the barren accumulations of debris in the estuaries of the larger rivers, which places it never quits, summer or winter. It runs along the sand and gravel with much rapidity; and is an ornamental bird upon places where, with the exception of a few running birds, few living creatures are apparent. It is indeed one of the few birds that resolutely inhabit the boundary between sea and land all the year round.

The ring-plover is a small bird compared with the common plover, or even with the dotterel. The length is about seven inches, and the stretch of the wings about sixteen. The male bird, when in the summer or breeding plumage, has the upper part brownish-ash; the lower cheeks are black, passing up to the base of the upper mandible; and between the black and the ash-colour, on the crown, there is a band of white passing over the forehead and eyes; and between this white and the ash-colour, again, there is a three-cornered patch of black, with an angle directed to the front and one toward each eye; the chin is white, and the white there goes back in a point under the black almost to the nape; all the under parts are pure white; but there is a broad gorget of black on the neck, immediately above the breast, passing into a narrow black collar on the hind neck; the greater wing-coverts have white tips; and the quills, which are dusky black, have a white spot upon each, the whole forming a bar across the wing when closed; the tail is dusky brown, with the exterior feathers and the tips of the rest white, and each feather is pointed or wedge-shaped at the tip. The female has the collar less bright and defined, more white on the wings, less on the forehead, and hardly any brownish tinge in the ash-colour of the upper parts.

This is almost the only land bird which remains upon our lonely beaches in the warm season. It is its plaintive whistle that we hear as we approach the margin of the sea on a sultry day; and if we happen heedlessly to place our foot on a few eggs, almost the colour of the sand, they are the eggs of the ring-plover. There is not the least vestige of a nest, or even a hole scratched in the sand. They are on the bare surface, and on sunny days the bird leaves them the whole day over; but she sits at night, and also during the day if it rains. When surprised upon her eggs, she cannot get to a distance by stealth as the common plover does; but she turns and doubles so very quickly and so many ways, that if her very first movement is seen it is not difficult to find the eggs. Her instinct appears to be to draw attention to herself; and, while she plays off her little arts for this purpose, she utters a feeble and wailing complaint. If you follow her, she will lead you to a considerable distance from the nest, and then take the wing and fly off in a different direction; but, if you watch her, you will find that she runs to the nest as soon as she alights, though still not in one straight line.

Ring-plovers pair in May, and the young are generally hatched at the season of greatest heat, when the sand near the high-water mark is almost alive with little animals. The young run fast the instant that they come out of the shell, but they are then covered with down, and some time elapses before they get their flying feathers and are able to

take to the wing. They are, however, able to find their own food. In the pairing time each pair is solitary, and till the young are feathered and the old have moulted each bird lives solitary; but after this they assemble in little flocks, and mingle with the stronger birds of the same order, which resort to the shores in autumn and winter. Climate appears to have no effect on the colours of these birds. They are common on all beachy shores, as far to the north as Greenland; and, wherever they are found, their colours at the same season are the same.

The Kentish Plover (*C. Cantianus*). The haunts and the habits of this species, in so far as the latter are known, bear some resemblance to those of the ring-plover, and on this account the two have been confounded. Their sizes, their forms, and their colours are, however, all so different that they are as decidedly distinct species as birds can be. The Kentish plover is nearly an inch shorter than the ring-plover, and the form of its body is much more slender and elegant. The tarsi of the Kentish are longer and stouter, and the wings are proportionally shorter. The colours are also different both in the naked parts and in the plumage. The ring-plover, under all its changes of plumage, whether with age or with season, has the tarsi, the toes, and the basal half of both mandibles yellow: in the Kentish plover these are always quite black. There is no gorget and collar of black on the Kentish plover, but merely a patch on each shoulder, ragged at the margins, and not meeting each other either before or behind. The black under the eye and the white over it are both broken, and the black patch on the forehead is small and irregular, and the top of the head is rust colour. The white on the under part is still more pure, and glossed with a racy lustre on the middle of the belly. The upper part too has a reddish tinge, and not a brownish one. The colours of this bird are what may be called simple; but still it is one of those instances in which the simplicity of nature outdoes all the elaborateness of art; for all the art of the chemist cannot prepare a pigment that will come nearly up to the intense white on the under part of this bird, and no gloss of art can imitate the racy bloom upon the belly. The ring-plover is a pretty bird certainly, and it is interesting from the times and the places of its occurrence; but, in point of beauty, it is nothing to the Kentish plover.

The grounds, the numbers, and the geographical distribution of the two birds are fully as different. The ring-plover is found chiefly upon the sand; the Kentish among gravel; the one is abundant and distributed into very cold latitudes; the Kentish plover inhabits peculiar places of the warmer shores of Europe, and only where there is a run of the tide. It is not abundant any where, and in England it is very rare and very local, being met with only on some of the coasts of Kent and Sussex, more readily on the shingly beaches about Sandwich than any where else. It is the *white-fronted* plover of Meyer, and the *shore* plover of Bechstein; but, as is the case with many other birds, the continental naturalists appear to describe it in its winter plumage, in which we believe it has never been seen in England. It may migrate in the winter, though we believe it is not very usual for birds that deposit their eggs nestless on the low and warm beaches to migrate in the winter, though many, which winter on these beaches, have a northward migration in the summer. The Kentish plover, like the ring, makes no nest, but places its eggs on a smooth dry place among the shingle. They are four in number, of smaller size than those of the ring-plover, paler cream colour in the ground, and marked with small spots and streaks of black. Little is known of the habits of these birds in the nesting time, and indeed the eggs are but seldom seen, on account of the rarity of the birds and the similarity of the eggs to many of the pebbles around them. It is probable, however, that the female follows the habit of the genus, in leaving her eggs to the heat of the sun upon clear days, and sitting in the night and during rain. The young run about as soon as they come out of the shell, and immediately find their own food, but some time elapses before they can fly. This bird agrees so perfectly with the ring-plover in the greater part of its habits that analogy would lead to the conclusion that it is a resident bird in winter, as well as in summer; and the reason of its not being observed in winter may be the absence of observers from the stormy places which it inhabits at that inclement season.

The species which we have enumerated comprise all the plovers, both general and local, that are to be met with in any part of the British islands. They form but a small fraction of the whole genus, of which, as we have said, there are species in every part of the world. The manners of the whole are so much alike, however, that very brief notices of a few of the others will suffice. Africa is a great plovers' country, from the dryness of the surface at one period of the year, and the heavy rains at another.

Crowned Plover (*C. coronatus*). This is a South African species, and among the largest birds in the whole genus. It measures a foot in length. The upper plumage of the body is greenish-brown; the top of the head black, surrounded by a circle of white; the chin is black, and so are the quills; and the greater coverts of the wings are white, and the tail-feathers whitish, crossed by bars of black; the front of the neck is grey, and the breast russet, waved with greenish and dotted with black; the bill and feet are reddish.

This species belongs to a sort of subgenus, the chief part African, which differ considerably from the characteristic plovers, whether we take the type of the common plover as shifting its abode with the seasons, or that of the ring-plover as remaining on the same ground all the year round. The members of this group, instead of having the scales on the tarsi more or less reticulated, as they are in the typical plovers, have them escutcheoned in a manner approaching those on the gallinaceous birds. Their colours are also much more broken than those of the typical plovers. They are found through the whole length of Africa, from the Cape of Good Hope to Egypt. This difference in the character of the feet, and also in the colour, indicates a difference of habit, a less aquatic one than that of the true plovers, though they never go into the water beyond the naked part of the legs; but the precise nature of this difference is not known, as the habits of these birds have not been studied with any thing like attention. We shall just name one or two of the others which have these characters.

Black-headed Plover (*C. melanocephalus*).—This species occurs in Egypt and also in the central parts of Africa. It measures eight inches in length. The upper part is blackish, and so is the eye-streak,

which is very broad, and the top of the head. A narrow streak above the eye, the front of the neck, and the breast, are very pale russet. The coverts of the wings are whitish ash, and the quills mottled black and white. The tail-feathers are bluish, with the tips of the external ones black and white. All the under part from the breast is white. The bill is blackish, and the feet blnish. In the breeding season the male acquires a black gorget, but loses it when that season is over.

Spur-winged Plover (*C. spinosus*). This species is African, and about eleven inches in length. As the specific name imports, the turn of the wing is armed with a horny spur. The upper plumage is reddish brown. The head greenish black, and furnished with long thread-like feathers. The throat, breast, quills, and tips of the tail-feathers are black. The sides of the neck, the larger coverts of the wings, and the belly, are yellowish white. The spur is whitish, and the bill and feet black. The neck of the female is whitish.

Hooded Plover (*C. pileatus*). This is also an African species, measuring about ten inches in length. The upper parts are reddish grey, the head dark, and a band down each side of the neck; the chin also has a black band passing round the throat; the nape is white, the quills and tips of the tail-feathers are blackish; all the under parts are white, sometimes streaked with dusky on the foreneck and breast; the bill, and a naked membrane in front of the eye-brow, are yellow; the feet are red.

Those of this peculiar type are not exclusively confined to Africa; there are some in South America, one of which is the

Cayenne Plover (*C. Cayanus*). Although this one is named the Cayenne plover, it is more of a Brazilian bird, Brazil being much more a ploverian country than Cayenne. It is a bird about nine inches long; the upper part is blackish, mottled with grey and white on the mantle. There is a broad band of black in front of the eyes, and a breast-plate of the same; a large patch of grey, margined with white, covers the occiput; the tail-feathers are white with black tips; there are red spurs to the wing; the bill is black, and the feet orange; it will be perceived that, except in size and colour, this bird bears a strong resemblance to the spur-winged plover of Africa. Specimens of this group also occur in Asia, one of which is the

Wattled Plover (*C. bilobatus*), which is a native of India, and measures about ten inches in length. The upper plumage is yellowish grey; the top of the head black; there is a white spot behind the eye; a white band across the coverts of the wings, the quills black, the lateral tail-feathers white, and a black bar across the others; the bill and feet are yellow, and there is a painted wattle or membrane of the same colour pendent from each angle of the gape.

There are other plovers of Africa which have not the characters of the group which we have been noticing, and they are generally of a smaller size. Among them we may mention the

Double-collared Plover (*C. bitorquatus*). It is about seven inches in length, the same size as our collared plover, but rather a more showy bird. The upper parts are brown, glossed with metallic reflections; a white band passes over the forehead, the eyes, and the nape; the neck is grey, with a black collar, then a white, and below that another black one, extending partly on the breast; the outer tail-feathers and all the under parts are white.

There are various species of plovers in Australia, which are generally of rather small dimensions, and appear in their habits to follow the ring-plover rather than the common plover.

Red-capped Plover (*C. pyrocephalus*). This is seven inches long. The upper parts are brownish grey; the top of the head bright brownish red, with a band of white on the forehead; the lower coverts are brown with white shafts, and the middle ones are mottled with grey and white; there is a half collar of red on the neck, and a gorget of black on the breast, and the space between these, and also all the under parts, are white; the bill is black and the feet reddish.

The islands of the Eastern Archipelago, and near the remote isles of the Pacific, have their plovers, but they do not appear to differ from the other plovers of warm countries in any essential point.

America, north, south, and central, contains a great number of plovers; those of the north bearing a very considerable resemblance to the ones with which we are acquainted in Europe. The common plover of Europe, which is indeed a plover of many parts of the world, is by no means rare in North America; but as its appearance and manners are nearly the same every where, to repeat either would only be occupying space without any corresponding advantage. It seems, however, that this species is considerably more migratory in America than it is in Europe, just as it is more migratory in continental Europe than in the British Islands. But this might be expected, because all birds are more migratory in North America than they are in the corresponding latitudes of Europe. The mountains there are not well adapted for being the summer retreat of birds, especially stilt birds, which, though they are never in the water, always like to be near it, and therefore the summer migration, which is an upland migration with us, and may be north, south, east, or west, according to circumstances, is a latitudinal migration in America, always to the north; and the greater number of the stilt birds which make their appearance in the United States during the winter, pass the summer northward of the St. Lawrence and the great lakes, where the marshy country, and the dry and warm season, are remarkably well adapted to their habits. Those plovers, which may be said to be properly American birds, are not quite so migratory, though they also shift their ground a little with the seasons. We shall notice a few of them.

Wilson's Plover (*C. Wilsonius*). According to Wilson, by whom it was first observed, "This bird very much resembles the ring-plover, except in the length and colour of the bill, its size, and in wanting the yellow eyelids. The males and females of this species differ in their markings, but the ring-plovers nearly agree. We conversed with some sportsmen near Cape May, who asserted that they were acquainted with these birds, and that they sometimes made their appearance in flocks of considerable numbers, others had no knowledge of them. That the species is rare we were well convinced, as we have diligently explored the shore of a considerable part of Cape May, in the vicinity of Great Egg Harbour, many times at different seasons, and had never seen them before. How long they remain on our coast, and where they winter, we are unable to say. From the circumstance

of the oviduct of the female being enlarged, and containing an egg half grown, apparently within a week of being ready for exclusion, we conclude that they breed there. Their favourite places of resort appear to be the dry sand-flats on the sea shore. They utter an agreeable pipe note. This species is seven inches and three-quarters in length, and fifteen and a half in extent; the bill is black, stout, and an inch long, the upper mandible projecting considerably over the lower; front, white, passing on each side to the mandible; the eye is bounded by a band of black of equal breadth; lories, black; eyelids, white; eye, long, large, and dark; from the middle of the eye backwards the stripe of white becomes duller, and extends for half an inch; the crown, hind head, and auriculars, are drab olive; the chin, throat, and sides of the neck, for an inch, pure white, passing quite round the neck, and narrowing to a point behind; the upper breast below this is marked with a broad band of jet black; the rest of the lower parts, pure white; upper parts pale olive drab; along the edges of the auriculars and hind head, the plumage, where it joins the white, is stained with raw terra sienna; all the plumage is darkest in the centre; the tertials are fully longer than the primaries, the latter brownish black, the shafts and edges of some of the middle ones white; secondaries and greater coverts, slightly tipped with white; the legs are of a pale flesh-colour; toes bordered with a narrow edge; claws and ends of the toes, black; the tail is even, a very little longer than the wings, and of a blackish olive colour, with the exception of the two exterior feathers, which are whitish, but generally the two middle ones only are seen. The female differs in having no black on the forehead, lories, or breast, those parts being pale olive."

The Kildeer Plover (*C. vociferus*), is a very common species in North America, and makes itself known by its cry, which resembles the sound of the name popularly given to it. In the depth of winter, when the ground is covered with snow, it resorts to the sea-shore, where, indeed, it is found at all seasons of the year. No sooner, however, have the rivers broken up, than its shrill pipe is again heard, sometimes roaming to considerable distances from its favourite localities, at others skimming the surface of the sea coast, or exploring the watery flats and meadows on foot. The newly-ploughed fields, bare flats which contain shallow pools, dry sandy fields near the sea shore, are its favourite haunts on the advance of spring; and about the beginning of May it chooses to breed in some of these latter situations. It is not over particular in the construction of its nest. It is a mere hollow, lined with any materials as are most conveniently come at, such as bits of sticks, straw, pebbles, or earth. Indeed, in some instances, it has been found to dispense with a nest altogether, and to bring forth its progeny on the bare ground. The eggs are generally four in number. They are of a yellowish clay or vivid cream colour, thickly dotted over with spots of black. Their size is uncommonly large in proportion to the size of the bird, measuring fully an inch and a half in length, and rather more than an inch in breadth. They taper to a narrow point at one extremity. During the breeding season they exhibit much anxiety and alarm for the safety of their progeny. At this season they may be seen now floating about, high in air, now approaching the surface of the earth, then skimming the surface of the ground, then limping about on one foot as if they were lame, the while uttering the most clamorous, piteous, and incessant cries of *Kildeer, Kildeer*. The instant a person approaches, his ears are assailed with a continuous strain of this harassing noise, and, if his object seems to be to search out the nest, the birds flutter about near to his person, continuing this annoyance till he is generally obliged to abandon his search. On these occasions they betray much cunning in never alighting near the particular spot where the nest is placed. In the spring and fall of the year, these cries are often heard in the night, more especially in moonlight nights; and, from the circumstance of their flying abroad in the dark, it is probable that they see better at these times than most of their tribe. Worms are understood to be their principal food; and, as there is a species of these which rise to the surface of the ground during the night, it is extremely likely that this is their principal inducement to be abroad at this season.

The Kildeer is much more common in the southern states in winter than in summer. In South Carolina they are very numerous in the months of February and March, in the rice-fields, and not unfrequently around the planter's yards, where the negroes frequently amuse themselves in catching them with a line, having a crooked pin baited with a worm attached to the end of it. Their flight resembles that of the tern, but it is more powerful; and they often soar aloft to a great elevation in the air. They have a semi-aquatic habit, and are very fond of walking in shallow pools of water, and also of bathing themselves in the summer months. They are strong and vigorous in the wings, and can run with astonishing rapidity. In this exercise, as well as in walking or standing, they carry the body in a stiff horizontal position, which gives them the appearance of a well-drilled recruit standing at attention. Their flesh is not generally considered as very delicious food; but in autumn, when the birds become fat, it is not at all contemptible.

In the drought of summer these birds frequent the channels of brooks and small streams, where they feed upon small aquatic insects. They resort to the sea-shore at the beginning of autumn in small companies, seldom more than ten or a dozen being observed in one flock. They then become more silent, and also more difficult to be approached.

Its size is ten inches long, and about twenty inches in the stretch of the wings. The bill is black; the frontlet, chin, and the ring round the eye, are white; the front of the crown and the auriculars, from the bill backwards, are blackish olive; the eyelids are bright scarlet; the eye is very large and of a deep black; from the middle of the eye backwards, there is a stripe of white; there is a broad band of black round the lower part of the neck, and under that there is a band of white, followed by another rounding band or crescent of a black colour; the rest of the lower parts are pure white; the crown and hind head are light olive-brown; and the back, scapulars, and wing-coverts, are of the same colours, skirted with brownish-yellow; the primary quills are black, streaked across the middle with white; the rump and tail-coverts orange; the tail is of a tapering form, and of a dull orange colour, crossed near the end with a broad bar of black, and tipped with orange; the two middle feathers nearly an inch longer than the adjoining ones; the legs and feet are of a pale

light clay colour. The tertials, as is usual in this tribe, are very long, reaching nearly to the tips of the primaries. The exterior toe is joined by a membrane to the middle one, as far as the first joint.

Black-bellied Plover (*C. apricurius*). This species is, in some of its characters, intermediate between the plovers and the lapwings, but still its habits are more those of a plover. It is rather a large bird. It is twelve inches long, and twenty-four in the stretch of the wings. The bill is an inch and a quarter in length, of a black colour, thick, and deeply grooved on the upper mandible; the head and globe of the eye are uncommonly large, the latter is of a deep bluish black colour; the front is white; the top of the head and the hind head are black, spotted with golden yellow; the back and scapulars are dusky, sprinkled with similar golden orange spots, mixed with other spots of white; the breast, belly, and vent, are black, and the sides of the former are whitish; the wing-quills are black, and the middle of the shafts white; the greater wing-coverts are black, tipped with white; the lining of the wings are black; the tail is alternately barred with blackish and pure white; the tail-coverts are pure white; and the legs and feet are of dull lead colour. The outer toe is joined to the middle one by a broad membrane; the hind toe is uncommonly small.

These birds require a considerable length of time to acquire their colours, and consequently they are found in various states of plumage. At first the breast and belly are white, but this colour gradually appears mottled with black, until latterly the bird assumes an entirely black colour. The spots of orange or golden on the crown, hind head, and back are white at first. In every stage of the plumage the species is distinguished by the large size of the head and the thickness of the bill.

It is most frequently met with in the mountains of Pennsylvania late in April, frequents the countries towards the mountains, and seems uncommonly fond of the newly-ploughed fields, where it constructs its nest of the most simple materials slightly woven together. The eggs are four in number, of a bright olive colour, sprinkled with black, and are uncommonly large for the size of the bird. They have often two broods in the same season. They are very clamorous during the breeding season, and exceedingly shy and watchful. Winged insects, worms, grubs, and different kinds of berries, of which latter, the species called the dew-berry, they are particularly fond. They resort to the sea-coast, taking their young with them, where they are joined by vast multitudes just returned from their breeding places in the north. They remain about the sea-shore until the beginning of November, when they take their departure for the south.

There are a good many more species of plovers in various parts of the world, and it is probable that there are not a few hitherto undiscovered. It is not necessary, however, to notice any more, as the species of which we have given the outline reach all the varieties of character that are to be met with in the genus.

PLUM is the *Prunus domestica* of Linnæus, a domesticated fruit-tree, of which there are many varieties. They belong to the natural order *Rosaceæ*, and in no other instance has the effects of cultivation been more conspicuously exemplified than in the improvement of the wild sloe of our woods and hedges. In the wild state the fruit are small and austere; in their cultivated condition they appear as the luscious green gage, and as the ample magnum bonum, with numberless varieties more or less approaching these in quality and size. The different sorts are propagated by grafting or budding on the common plum stock raised from seeds, or the Brussels plum stock.

PLUMBAGINEÆ. A small natural order comprising three genera, viz., *Statice*. *Armeria*, and *Plumbago*, and of these genera there are eighty-two species. They are low shrubs or herbaceous plants with showy red or blue flowers. All the *Statices* and *Armerias* are well worth cultivation, as they enrich every floral collection in which they have a place. The different species of *Plumbago* are remarkable for the acridity of their juices. The thrift (*Armeria*), and the sea lavender (*Statice*), are like the plumbagines very ornamental plants, but they differ greatly from them in their properties. They are bitter, tonic, and astringent. *Statice Carolinaria* is said to be one of the most powerful astringents known. The root is the part employed, and is much used by some medical men in America. *Plumbago Capensis* is a handsome free-flowering greenhouse plant, and thrives in any rich soil; the *Statices* are mostly hardy plants, and succeed in the open ground.

PLUMIERA (Linnæus). A genus of evergreen trees and shrubs, chiefly natives of South America. The flowers are pentandrous, and the genus belongs to *Apocyneæ*. The species are fine ornamental stove plants, thriving in any light porous soil. They require to be kept dry when not growing freely, which causes them to flower abundantly.

PNEUMODERMA. A naked molluscous animal, described by Péron in Freycinet's expedition to Australia; only one species is known, and it is classed between the genera *Clio* and *Phylliroe*.

PNEUMORA (Thunberg). A genus of orthopterous insects, belonging to the section *Saltatoria*, and family *Locustidæ*, having the legs much shorter than the body and slender, the thorax small and bipartite, the abdomen very large, and bladder-like; whence the name of the genus, which signifies air. The species are few in number, of moderately large size, and confined to Southern Africa, where they are found on different plants in September and October.

POA (Linnæus). A genus of useful agricultural plants, and of which our finest pastures are formed. They are chiefly natives of the northern hemisphere, and with other grasses clothe the hills as well as the valleys of every temperate clime. Thirteen species are found in Britain.

PODALYRIA (Lambert). A genus of handsome conservatory or greenhouse plants, natives of the Cape of Good Hope, belonging to *Leguminosæ*. Although named after Podalirius, one of the mythological sons of Æsculapius, none of the species are medicinal. They are propagated by cuttings.

PODANTHES (Haworth). A genus of undershrubs, natives of the Cape of Good Hope, bearing pentandrous flowers, and belonging to the natural order *Asclepiadeæ*. This genus is nearly allied to *Stapelia*, and required to be kept in dry porous soil, and cautiously watered,

PODOCARPUS (Heritier). A genus of evergreen trees, mostly natives of south-eastern Asia. The flowers are monœcious, and the genus belongs to *Coniferæ*. Several species of this genus have been

introduced into our greenhouse collections, where they thrive in a mixture of loam and moor-earth, and may be increased by cuttings. The Chinese species are pretty hardy, and promise to be acclimated so as to stand in our shrubberies.

PODOPHYLLACEÆ. A small natural order of plants, consisting of two genera, viz., *Podophyllum* and *Jeffersonia*, of each a single species. They are erect plants, growing in damp shady places, with stamens twice as many as the petals; the ovary single, the stigma thick and sub-peltate, and the seeds indefinite. The genera are North American plants. Their roots are said to be cathartic, their herbage narcotic and poisonous, and their fruit eatable, but far from pleasant. *Podophyllum peltatum* is the wild lemon or may-apple of the colonists, and its root, whether in decoction or powder, is a valuable aperient, being one of the most safe, easy, and certain known. The plants are increased by division.

PODURIDÆ (Leach). A family of apterous insects, belonging to the order *Thysanura*, Leach; the head is distinct from the thorax, bearing two filiform antennæ composed of four simple joints, or with the last of these joints articulated, the parts of the mouth small, mandibulated, the legs six in number, and the abdomen terminated beneath by a forked appendage, applied, when at rest, along the underside of the body, and serving for leaping. These insects are of small size, they are very active in their movements, and are generally found in damp situations under stones, decayed leaves, &c., or beneath the bark of trees. Other species are found upon the surface of standing water, where they are, nevertheless, enabled to execute their leaps. They are sometimes found upon the snow, and occasionally they assemble together in considerable numbers, looking like a small heap of gunpowder when seen at a little distance; when alarmed, however, the entire mass skips off, and soon entirely disappears. It is probable that they feed upon decaying vegetable matter.

These insects are oviparous, and undergo no metamorphoses, quitting the egg under the shape which they retain through life, they grow rapidly, and change their skins. De Geer observed some of them in Holland in a living state, at the time of the greatest cold, their eggs being near them, the latter were of a yellow colour, which became dark red when they were nearly ready to hatch. The young ones, when first hatched, carry their tails stretched out behind. The aquatic species were also observed by him to be able to survive their removal from the water but a very short time; whence it is most probable that the aquatic species are different from those found upon land. About twenty species have been described as belonging to the genus *Podura*, including the *Podura plumbea*, Linnæus, of a leaden colour, found under stones, but never met with in society; *Podura aquatica*, Linnæus, found in quantities upon standing waters; *P. nivalis*, found upon snow and in woods.

The genus *Smynthurus* comprises those species which are of a globular form, and have the terminal joint of the antennæ annulated. The type is the *Smynthurus fuscus*, Latreille, found in moist woods.

Mr. Templeton has published a valuable Monograph upon the Irish species of this family in the second number of the Transactions of the Entomological Society.

PŒCILUS (Bonelli), A handsome genus of coleopterous insects, belonging to the section *Pentamera*, family *Carabidæ*, and sub-family *Harpalides*; the body is of an oblong and depressed form, the wings sometimes short, the thorax narrow at the base, the labrum short, truncated mandibles; with small teeth at the base, third and fourth joints of maxillary palpi of equal length. These are very active insects, which make their appearance in the early sunshiny days of spring and summer, when they may be seen running with great quickness about footpaths. The type is the *Carabus cupreus*, Linnæus, a very abundant species, of a fine coppery-green colour; there are several other British species.

POINCIANA (Linnæus). A genus of beautiful East and West Indian shrubs, or small trees, belonging to *Leguminosæ*. It is called by the colonists Barbadoes flower-fence, and is a highly ornamental plant as well in foliage as in flower. They require the strong heat of a stove to flower well, and may be raised from cuttings or from imported seeds.

POISON OAK is the *Rhus toxicodendron* of Linnæus, a hardy trailing plant, long ago introduced into our gardens.

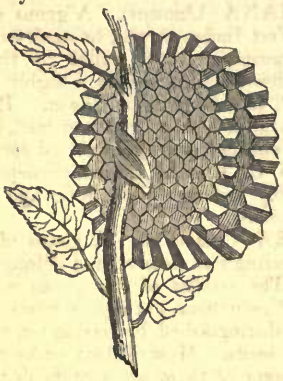
POIVREA (Commelin). A genus of herbs and climbers, bearing fine flowers, and belonging to *Combretaceæ*. The species of this genus was formerly considered *Combretums*, but it now forms a section of that genus, distinguished by having ten stamens and five angular seeds. Most of them strike root by cuttings; but some of them are so difficult to root, that they can only be propagated by root grafting.

POLANISIA (Raffles). A genus of pretty annual plants, mostly natives of India. Their flowers are dodecandrous, and the genus is ranged among the *Capparidaceæ*.

POLISTES (Latreille). An extensive genus of exotic hymenopterous insects, belonging to the family of the social wasps (*Vespidæ*), and distinguished from the typical wasps by the more slender form of the body, the basal segment of the abdomen being smaller and narrower than the second, the wings are longitudinally folded, the eyes internally emarginate or kidney-shaped, and the portion of the internal margin of the terminal part of the mandibles is shorter than the basal part, with the clypeus toothed in the middle.

The habits of these wasps are in many respects similar to those of the genus *Vespa*, or true wasps. Like them they reside together in vast societies, composed of males, females, and neuters, in nests of variable size, containing hexagonal cells. Some of the exotic species construct these nests of a very strong material resembling pasteboard, which they also defend by a common envelope. Others, comprising the European species, form their nests of a more papyraceous substance; and *P. gallica*, which is common in France, builds its nests on the branches of shrubs, which somewhat resemble a small bouquet or rose, and consist of not more than twenty or thirty cells, which are arranged in a single tier. In some of the species, however, the cells are of a surprising number, and arranged in successive layers supported by pillars. It is in the spring that the foundation of these nests are commenced by the female, which was impregnated in the preceding autumn. The eggs at first deposited are destined only to produce neuters, which assist her in her labours; but towards the summer she deposits eggs which will bring forth males and females. At this period several of the cells are found to be filled with pure honey.

It is a peculiarity in the nests of the European *Polistes* that the cells are not arranged horizontally, but vertically, which is probably owing to the circumstance, that, as there is no outward covering to the nest, the rain would lodge in the cells if they were placed in an upright position, whereas, when arranged vertically, the rain falls off without resting. The following is a figure of the nest of *Polistes Gallica*, a species somewhat smaller than the common wasp, and of the same colours, and which is interesting on account of its being the species attacked by the *Xenos Rossii* of Kirby.



Some of the species having the second joint of the abdomen very large, the preceding forming a clavate peduncle, have been separated into the genus *Epipone*. The *Vespa tatua* and *nidulans* of Fabricius belong to this genus, the latter of which with its nest and parasite, belonging to the genus *Chalcis*, is figured by Reaumur in the sixth volume of his Memoirs. The nests of these species are very large, and are suspended in trees, the exterior of the nest being composed of the most beautiful paper-like material, over which from its fine polish the rain glides without doing the least damage. The study of the exotic species of these genera requires much attention, and has hitherto been greatly neglected.

POLLICIPEDE (Leach). A genus of molluscs, constituted by the late Dr. Leach, but now considered only a species of the genus *Pentalepas*.

POLYERGUS (Latreille). A genus of ants. See FORMICIDÆ.

POLYGALA (Tournefort). A genus of handsome evergreen shrubs, all from the south of Africa, of perennial herbs, natives of Europe, and a good many annuals from North America. The flowers are diadelphous, and the genus belongs to the order to which it gives a title, viz.

POLYGALACEÆ. A natural order of plants, consisting of six genera and sixty-four species. The genera are *Polygala*, *Muraltia*, *Mundia*, *Securidaca*, *Krameria*, and *Monina*. Most of this order are interesting to the lover of plants, as well for the neatness of their foliage as for their handsome flowers. The *Polygaleæ* are remarkable for the union of their stamens into a single body, their one-celled anthers opening with a pore and their irregular petals, one of which is often keel-shaped, and beautifully bearded. The leaves have generally a bitter astringent taste, and the European species are stomachic and stimulant, and are supposed to possess an influence over the lacteal secretion of cattle fed upon them; hence they have received the name of milkwort. Several of them are useful medicines; while one, the *P. venenata*, a native of Java, is remarkable for the poisonous qualities attributed to its leaves, which, if only touched, produce violent sneezing and oppressive faintness. *Monina polystachya*, is the yal-hoe of Peru, where it is used as a cure for dysentery. *Krameria* deviates more than any other genus in this very natural group from the normal structure of its associates; its sepals are generally four, rarely five; the stamens four or three, and single, or but slightly connate by their filaments. *K. triandra* is the rhatany, which is a valuable astringent tonic. The whole are propagated by cuttings or seeds.

POLYGONACEÆ. A natural order comprising fourteen genera and above one hundred and eighty-eight species. The knot-wort, the rhubarb, the sorrel and the dock, which, with other associated genera, form this type, are herbaceous, rarely shrubby plants or trees, with knotted stems and branches, simple alternate leaves, revolute in vernation, dilated sheathing petioles, and acreate stipules. The flowers are in general united, sometimes separated, and either solitary or disposed in fasicles or racemes. The perianth is free, regular, persistent, without sepals, often coloured with a three to six parted limb. The stamens are definite, exserted from a torus, lining the bottom of the calyx; the filaments are free, the anthers two-celled, opening lengthwise; the germen is superior, one-celled, and contains a solitary ovule; the styles are from two to three, and the stigmas simple or feathery. The fruit is dry and indehiscent, bladder or nut-like, and often covered by the persistent calyx.

Along with many of the most common weeds which cover waste ground in every latitude, there will be found in this type several important officinal and dietetic plants, the chief of which are the rhubarbs, the sorrel, and the buck-wheat.

The genera in this order are *Coccoloba*, *Polygonum*, *Oxyria*, *Brunnichia*, *Tragopyrum*, *Atraphaxis*, *Rumex*, *Emex*, *Podopterus*, *Triplaris*. *Rheum*, *Calligonum*, *Eriogonum*, and *Kœnigia*.

POLYLEPAS (Cuvier). A genus of molluscs, belonging to the family *Lepidacea*, one species of which constitutes Dr. Leach's genus *Scalpellum*.

POLYOMMATUS (Latreille). A genus of butterflies, comprising the pretty little blue species so common in our fields, and belonging to the family LYCÆNIDÆ (which see). This is a very extensive genus, distinguished by having the posterior wings destitute of a tail or produced anal angle. The British species are termed blues, from the elegant shades of that colour with which the upper side of the wings are ornamented, whilst the beautiful eye-like spots on the under side of the wings have given rise to the generic name, which is derived from the Greek, and signifies "many eyed." The larvæ feed upon various kinds of grasses. These pretty little butterflies are amongst the objects which do not fail to attract the attention of the most incurious in a summer day's stroll. "We have few more jealous and pugnacious insects," says Mr. Knapp, "than the little elegant blue argus butterfly (*P. alexis*, Stephens), noted and admired by all. When fully animated, it will not suffer any of its tribe to cross its path, or approach the flower on which it sits, with impunity; even the large admirable (*Vanessa atalanta*) at these times it will assail and drive away. There is another small butterfly, the copper (*Lycæna phlæas*, Fabricius), however, as handsome, and perhaps still

more quarrelsome, frequenting, too, the same station and flowers; and a constant warfare exists between them. We shall see these diminutive creatures, whenever they come near each other, dart into action, and continue buffeting one another about till one retires from the contest, when the victor returns in triumph to the station he had left. Should the enemy again advance, the combat is renewed; but, should a cloud obscure the sun, or a breeze chill the air, their ardour becomes abated, and contention ceases. The pugnacious disposition of the argus butterfly soon deprives it of much of its beauty; and, unless captured soon after its birth, we find the margins of its wings torn and jagged, the elegant blue plumage rubbed from the wings, and the creature become dark and shabby."—*Journ. of a Nat.*, p. 277.

There are about fifteen British species, including the azure blue (*P. argiolus*), relative to which a long controversy has been maintained in natural history, on the question, whether it is a double or single-brooded species; the small blue (*P. alsus*); and the mazarine blue (*P. acis*), which seem to belong to a distinct subgenus established by Dr. Horsfield in the Lepidoptera Javanica under the name of *Pithecops*. The others, including the large blue (*P. Arion*), figured in our plate of British butterflies; the chalk-hill blue (*P. Corydon*); the Adonis (*P. Adonis*); the common blue (*P. Alexis*); and others, are true *Polyommati*.

POLYPUS. Under this head we shall introduce some interesting matter descriptive of a class of animated nature which, take it altogether, may be considered as the most wonderful of created beings, proving, beyond all argument to the contrary, the opinion every enlightened naturalist must subscribe to, that no matter how inferior in the scale of nature animals may be, they, nevertheless, have functions to perform as important as those of the mightiest structure; and another convincing proof to the reflective mind, that, in proportion to the tenacity of life enjoyed by these animals, and their reproductive powers, in the same ratio their usefulness must be appreciated, though it cannot always be fathomed by finite wisdom. We propose, with this opportunity, to introduce some account of the *Polypi* "peopling the vast empire of the deep," those wonder-working stone-masons, whose incessant industry raises mountains from ocean's profound abyss, forming what are commonly termed coral rocks and reefs, so remarkable in the south seas and other parts of the world. We shall, in the first place, separate the fresh-water *Polypi* from those which we intend calling the coralliferous *Polypi*, that is, the animals constructing barriers that defy the tempest's devastating shocks in the midst of ocean's empire, forming immense islands destined to fall under the controul of man, and to afford him an opportunity of exercising his superior intellect, in bending all things created to his necessity or convenience under the divine will of his inscrutable Maker. We will commence with the fresh-water *Polypi*. Most of the observations are the result of an able naturalist's long study—many we can personally confirm—and the others we fully rely upon, though they are so marvellous as to excite scepticism in persons altogether unused to investigate nature's mysterious operations.

Polypi, whether marine or fluviatile, are gelatinous animals, consisting of a long tubular body, fixed at the base, and surrounded at the mouth by arms or tentacula. They are many of them inhabitants of the fresh waters, and are among the most wonderful productions of nature. The particulars of their life, their modes of propagation and powers of reproduction, after being cut to pieces, are truly astonishing, and baffle the efforts of reason to account for. Nor was it till after repeated experiments by eminent naturalists that the scepticism of the philosophic world was overcome. The green polypus, a species that will fully illustrate the nature of the whole tribe, is found in clear water, and may be seen in great numbers in small ditches and trenches of fields generally in the months of April and May. It attaches its body to the under parts of leaves, and to the vegetables growing beneath the water. The long tubular body has its head furnished with eight, and sometimes ten, long feelers or tentacula, surrounding the mouth. It possesses the faculty of contracting its body very suddenly when disturbed, appearing like a round green spot; but the danger past, it resumes its usual position.

It is of a very predaceous nature, and feeds on the various species of small worms or aquatic insects that unguardedly approach it, when they are instantly seized by the polypus, conveyed by its arms into the mouth, and gradually swallowed as a snake gorges a frog. It is capable of swallowing worms thrice its own size, from the dilatibility of its body. Two of these animals have been seen attacking the same worm by opposite extremities, each gradually swallowing its respective portion, till, their two heads coming in contact, the larger one has gorged not only the worm, but the polypus at the opposite end; and, what is more wonderful, the animal thus engulfed, after remaining a considerable time so confined, has been ejected unhurt with the long-contested prize, which he then remained the undisturbed possessor of. The remains of animals upon which they feed are evacuated by the mouth, that being the only aperture to their body. The multiplication of the species is by a process nearly resembling vegetation. The young are seen emerging from the parent's sides, one or two at a time, and sometimes more; and these young are frequently again prolific before they drop off. Thus it is no uncommon circumstance to see two or three generations at one time on the parent polypus.

The most marvellous, but, nevertheless, true circumstance respecting these extraordinary animals, is their tenacity of life and power of reproduction.

It appears almost impossible to destroy their existence. Mr. Trembley, of Geneva, records numerous experiments made by him. He relates, that, when they are cut into small pieces, each portion produces its own head and tentacula, springing into life again, and multiplied almost to an endless extent, by such dissection upon each of them, it became a perfect animal. Even when turned inside out it suffers no material injury, shortly after taking its usual food, and resuming all its other functions.

The above brief view of the fluviatile, or fresh water polypus, will give an idea of their wonderful formation. But this subject might be enlarged upon to the extent of volumes, were we to embrace it in its fullest extent, and even then but a very limited knowledge would be obtained of these marvellous beings.

We will now proceed to give some description of the marine *Polypi*, or at least such of them as are the fabricators of *Corals, Madrepores, Gorgoniæ*, &c. Un-

der these names we open another enchanting volume of nature's lovely works. It is one replete with high-wrought interest, and presents more matter for mental reflection than almost any other part of creation, marvellous as they all are. The writer of this article has, for some years past, been accumulating information on the subject of coral formations; but it is proper to state that the field of actual observation is open to but few, and yet fewer have benefited from it as naturalists when within their reach.

Our countryman Ellis published a valuable work on corals and the corallines. It is nearly the only one of any consequence on that subject; but it wants simplicity, and a natural association in its arrangement as a system; and subsequent discoveries in that branch of nature have rendered it extremely incomplete. The plates, however, are most accurately designed, and beautiful fac-similes of the various species described. Solander, in a work on *Zoophytes*, as also other naturalists and travellers, have contributed much interesting matter relative to the history of coral formations; but, in our opinion, it is to the labours of an eminent French naturalist, Lamaroux, that we are indebted for the best and most natural scientific arrangement of this little-understood subject. He has grappled the difficulties with a vigorous mind, and thrown a charm around it never before presented. From one of his now rare works we therefore propose making a few extracts, and only regret that we cannot transfuse into our language all the spirit and simple eloquence which distinguishes the original. We must therefore content ourselves with attempting a correct, rather than an elegant translation. The title of Lamaroux's work, to which we first allude, is "Histoire des Polypiers Coralligènes Flexibles." A history of *Polypi* takes a wider range than this part of the subject requires, in which only such as form *coral* are to be considered. They have been called *Zoophytes* by great authorities, but it is manifestly inaccurate, as the signification of animal plant cannot apply, since the organisation of corals and corallines is purely animal, and possesses no vegetable property beyond a coincidence of external configuration, which would equally apply to many portions of animal structure which present a similar resemblance. To call them "stone plants" would be no better; and to say they are animated stones would still more be cavilled at. It will presently be explained that corals, commonly so called, are formed by certain *Polypi*, who work out the term of their existence on, and never quit during life, the coral, leaving, after death, no more, as it were, than their skeleton, or rather that of the whole colony of *Polypi*. Coral thus being the dwelling, as well as the formation, of these creatures, we propose adopting the term *Polypidom* to express the view we take of the subject. We shall therefore translate the title of Lamaroux's work "A Treatise or History of the Flexible Polypidoms," leaving it to the better taste of others to adopt anything more expressive. The term *Polypidom* would equally well apply to the coral and *Madreporic* formations, which are distinguished by their *stony* nature from the flexible *Polypidoms*, whose axis is *horny*; and the architects these may properly be called coralliferous *Polypi*, contradistinction to the other species.

amaroux truly observes, that, notwithstanding the sive information of naturalists, philosophers, and travellers, much yet remains unknown of those *Polypidoms* which people the vast empire of the deep. A very small portion of their *Polypi* have been observed, and entire orders exist whose animals have not, to the present time, been discovered. No light has been thrown on their organisation, their growth, or their precise term of existence; all yet remains in mysterious obscurity respecting the physiology of this singular class of organisation; but that they are wholly *animal* remains no longer a doubt; and the term *Zoophyte*, for the reasons we have assigned, can no longer apply to them.

Polypidoms present one decided never-failing character, that of being the habitation, and forming the most solid part of many thousand living animals, united, and incapable of voluntary separation from each other. These creatures, or *Polypi*, have but one character in common, that of being constantly attached to an animated mass, sharing in, and contributing to, its existence; and, notwithstanding this voluntary attachment to the colony, each individual possessing animal functions of its own, distinct from its neighbour. All the *Polypi* constituting a *Polypidom* participate in its existence, and the sustenance derived by one of these little wonder-working creatures extends its beneficial influence to the most distant point of the colony it forms a part of. It is not easy to understand or account for this; but matter-of-fact observation proves that it must be so; and we are bound to receive concurring evidence in the absence of positive and particular proof to the contrary. And here Lamaroux says—"Some species of *Polypidoms* are found constantly sloping on the southern aspects of rocks, but never on those to the east, west, or north; on the contrary, others only develope themselves on those aspects in general; whatever their situation, their branches appear constantly directed, in the progress of their construction, towards the main sea."

The larger *Polypidoms* are but rarely met with in situations exposed to the shock of violent currents, or full influx of the waves. It is in the caverns of rocks, in submarine grottoes, in the shelter of large and solid masses, and most particularly in those gulfs where the waters are not agitated, that these extraordinary creatures fix their dwelling. Many of them appear not only formed to resist the powerful action of the boisterous surge, but to thrive and delight in it, their bending branches yielding to the movements of the waters, and balancing the animals that form them in the restless medium. Others, again, construct rocky and immoveable habitations, giving them the form of tunnels, and placing themselves in the interior; while some, by their reunion or aggregation, form an extensive stratum, narrow in proportion to its length, but prolonged without interruption, and forming an immoveable dike or wall, for many terrestrial degrees. This usually crosses the great currents of the ocean, whilst its solidity and greatness continually are augmenting, as it were, to overcome the difficulty of its task. Sometimes these rocks of Madrepore are curved in a circular form; the *Polypi*, inhabiting them in their interiors, elevate by slow degrees their marble dwellings to the surface of the waters; thus, ever sheltered in their labours, they load, by patient perseverance, the bottom of the deep; but in the higher part of this impenetrable wall openings are left that communicate with the external waters, that the *Polypi* within may be con-

tinually supplied with aliment, and the principal materials for the construction of their submarine habitations.

The fearless navigator, confidently sailing in a sea that former adventurers had indicated as free from rocks, dashes his prow on an unexpected ridge, whose sides are so perpendicular that no sounding can be found at the ship's stern; but, while combating with the fury of the tempest, he happily meets one of these openings which chance, or rather the animal's instinct, has left unclosed; by this he is saved. He enters a harbour of slightly undulating waters, sheltered from the contending storms which, outside the barrier, seem bent on its annihilation, but cannot shake it, and spend their force in air.

The *Polypidoms* do not always rise to the surface of the waters; some extend themselves horizontally on the base of the sea, or pursue its curvatures, spreading ocean's floor with an enamelled carpet of varied brilliant hues; at other times this carpet has only one shade, nearly equalling the Tyrian purple of antiquity. Many of these beings resemble a shrub that winter has despoiled of its verdure, but which spring has renovated with fresh flowers, their branches covered from its base to the extremities with petaled animals, whose beauty vies with the most delicate and richly-coloured blossoms.

The *Polypidoms* are found near the surface of the water as well as at the greatest depths of the ocean. Some exist in parts where the light of the sun cannot penetrate, and there multiply to infinity, notwithstanding the enormous pressure and extreme cold which they must experience at a depth of two or three thousand fathoms. There are strong grounds to presume that their growth is slow in proportion as they are immersed in the water, and that, at five hundred fathoms from the surface of the sea, it would require a century before coral attained the same growth as when only a few yards of fluid covered it.

Polypidoms, like plants, vary with the climate they inhabit. In the colder latitudes the *Cellularia* and *Sertularia* only are to be found, with a few closely-woven *Sponges* and a small number of *Alcyonia*. In the neighbourhood of the volcanic isles of the polar regions, or on those shores exposed to the marine flow and ebb, which, after having been warmed by a tropical sun, has bathed the eastern coast of America, and then directed its course to the western shores of Europe, *Corallina*, *Gorgonia*, and *Isidia*, are met with. The two first multiply a little from sixty to fifty degrees of northern latitude; their numbers then increase to the forty-fourth or forty-fifth degree; and *Gorgonias*, with rampant stems: *Spongias*, with loose tissue, brittle or elastic; and *Millepores*, with foliated and fragile expansions, are found. A little farther the coral reddens the depths of the ocean with its brilliant branches; and this is soon followed by the *Polypœan madrepores*.

It is not, however, before the thirty-fourth degree of northern latitude that these animals commence the development of that grandeur and immensity that presents itself at every step to the extent of a parallel southern latitude. Here they disappear, after having exhibited the same series of phenomena observed in the northern hemisphere.

It is then within the tropics, or in a zone of more than sixty degrees' expansion, that these beings, these animalculæ, scarcely visible to the naked eye, and whose operations uninterruptedly proceed, eternally exercise their empire in a medium of never-changing temperature.

From the depths of the ocean they elevate those immense reefs that may ultimately ensure a communication between the inhabitants of the temperate zones. The naturalist visiting these madreporous islands, once covered with the ocean, is astonished at their extent and perfect preservation, so perfect, indeed, that the sea appears to have abandoned them recently; and the same species of *Polypidom* that crowns the greatest heights, and forms the whole island, frequently extends from its shores to an endless distance; so that, when the tide recedes, perhaps an interminable league presents the same *Polypidom* to observation that composes the heads of their mountains. The air, light, and rains, have contributed to destroy the animals of these *madrepores*. Their skeletons alone remain to attest the ancient sojourn of the ocean in these elevated sites, and the slow but incessant diminution of the waters on the planet we inhabit. The greater number of *Polypidoms* are found to originate in the heart of the ocean, and in its numerous divisions, with the exception of the *Naissæ* and the *Ephydatias*, which inhabit fresh water, whether current or stagnant.

Some of the *Polypidoms* appear to prefer the immediate influence of the atmospheric changes. They are seen on rocks, and on the plants which the tide leaves uncovered, sometimes in such profusion that they all appear concealed under a membrano-calcareous covering. These species, however, at least on our own shores, are neither numerous, nor attain to any considerable size.

They almost all suffer from the action of the air. At the period of the great equinoctial tides the sea retires from those rocks it covered many preceding months. When the water first leaves them the *Polypi* are full of life, but suffer and languish as they lose their moisture, nor fail to perish altogether, should the sea remain too long without again covering them. Those whose structure enables them to retire within the recesses of their cells are better enabled to hold out for a longer period, being sustained by the moisture they preserve; but the uncovered *Polypi*, and those whose whole mass is animated like the *Alcyonia*, experience a more rapid alteration, proportioned to the higher temperature and the dryness of the air. Taken in this state of sufferance, and replaced in sea-water, these little animals slowly resume their activity. There are some which do not expand their tentaculæ till the second or third day; whilst those which, immediately after their exposure to the air, have been carefully restored to their natural element in a tranquil spot where the water was not agitated, have soon expanded from their cells, or the mass to which they were attached. It may here be necessary to remark, that naturalists have frequently erred in describing the contracted polypus for one expanded; and so extremely different is their appearance, that such errors may well be excused in those who have fallen into them.

Of the duration of life in these creatures, like all other organised beings, both in the animal and vegetable kingdoms, they have three epochs of existence, their growth, their maturity, and their decline. Some commence and terminate their existence in the short space of a day, perhaps an hour only, while others

live through centuries, setting the tooth of time at defiance. Some of the *Polypidoms* have only this ephemeral life; the existence of others seems eternal and coeval with the world's formation; this observation does not, however, apply to the *Polypi*, as they, separately considered, do not appear to possess a long life, but, on the contrary, many circumstances induce us to believe it of a very limited duration.

In the *Flustra*, *Cellularia*, and *Sertularia*, annual species are found, and others are subordinate to the marine plants that support them. In almost all *Polypidoms* the lower parts are wholly devoid of animalculæ, and in the greater number they are only seen at the extremities. Some there are entirely covered with animated *Polypi* through the summer and autumn, but they then decline, and finally perish with the cold of winter. No sooner, however, has the sun resumed his revivifying influence, than new animals are developed, and fresh branches are produced upon the old ones. The lower portion appears inert, and deprived of all kind of life; the *Flustra*, *Sertularia*, and *Gorgonia*, afford many examples of this. Arrived at the last stage of existence, the *Polypidom* languishes; it has no longer the power to resist the destructive influence of time, or the attack of those natural enemies which the energies of life till then repulsed. Some of these feed on its fleshy envelope; others penetrate to the interior of the axis, and live on its substance, however solid it may be, or, by perforating it in various directions, destroy its support, sending it a wreck to the mercy of the waters, till at last the fragments perish, and are cast upon the shore in a form scarcely recognisable, being reduced to grains of calcareous sand, again destined to become incorporated and rendered subservient to man's use in some other shape.

In the vegetable world plants are found in all latitudes, in all climates, in every soil, whether on the roof of the peasant's cottage, or on the marble dome of a palace: the number of such is, however, inconsiderable; but the majority of vegetables that adorn the surface of the globe require a particular soil and climate. This, however, is not the case with *Polypidoms;* few of them prefer one substance to another as a point of attachment; the greater proportion of these creatures, requiring only one fixed point of rest, attach themselves indifferently to any hard or solid body the sea presents; they are seen on primitive, secondary, and other rocks, sometimes on stems of marine plants, on blocks of lava, fragments of vases, or other antiquities, and even on human skulls. Sometimes these *Polypidoms* wholly envelop fragments of wood that float on the surface of the water; at other times they surround and bury the wrecks of old vessels abandoned in ports and other places; and there are some whose base dividing into numerous fibres, like the root of a tree, penetrate deeply into sandy or muddy shores to find a point of fixation which the surface cannot afford them. In general their base is solid or extended in the corticiferous *Polypidoms*, fibrous in the calciferous, and non-existing, or nearly so, in the carnoid and celluliferous classes; thus, as this part only serves the *Polypidom* as an anchor, we may consider it as a means employed by nature to prevent those beings, deprived of locomotive power, from becoming the sport of the waves. In this respect only, independent of their external configuration, do they resemble vegetable productions. The forms of *Polypidoms* are too various to admit of a general description, as the following outline will exhibit.

The celluliferous appear aggregations of isolated cells, placed on the surface of marine bodies, or else cells so united as to form by their adhesion to each other a thin crust on the surface of the thalassiophites or testaceous mollusca, and frequently appear in leafy diversified expansions; sometimes these cells are placed on stems like leaves on their branches; in others they appear in the form of very long branching or simple tubes, separated from each other in their upper part, and united in their lower, to form stems, as well as a firm foot or root, by which they adhere to some solid immovable base.

In the calciferous there also exist great disparities; some of them ramify like shrubs, whilst others divide in numberless dichotoma, or resemble a painter's brush; some take the form of an umbrella or an open fan; some are simple, others branched; some articulated, others compressed; some flat, and others cylindrical.

The corticiferous display an equal variety; there are spongia that spread in thin patches on the rocks and marine plants; others form themselves into globular masses, or are hollowed in the form of tunnels; many rise in tubes like organ-pipes, and some divide in the form of thick leaves. What an infinite variety of form exists between the *Gorgonia* with its simple unbranched stem, and others whose anastomosed branches resemble the reticulations of net-work, or as in the flabellated andyomena, in which they are so regularly and elegantly designed, that they resemble delicately worked lace.

The isidia has an alternately stony and cartilaginous stem, bearing some resemblance to the vertebra of an animal of more perfect organisation; others in appearance may be compared to shrubs despoiled of their leaves, but covered with flowers, whose snowy whiteness is heightened by being contrasted with the deep and brilliant red of the branches.

In the carnoid *Polypidoms* differences almost as numerous exist, but they are much less known than those described in the preceding orders.

Having thus briefly given a general idea of the form of *Polypidoms*, a more general description will scarcely be expected; for, if this be impracticable in one division, it must remain so with regard to all other of these animal architects.

With respect to the size of *Polypidoms*, we find some so minute, that it requires the aid of glasses to discover them, whilst others are as elevated as the mountains, their heads raised to midway air, their base fixed in the sea's foundation to a depth unfathomable; such are the madreporous islands so numerous in the south-eastern ocean, where they are hourly augmenting by the incessant and inconceivable labours of countless myriads of *Polypi*. Some geologists have imagined that these isles were only the summits of submarine mountains that had been covered, or, as it were, encased by *Polypidoms;* but submarine mountains, the almost perpetual source of subterranean fires, are found in all latitudes, and greatly vary in their extent and in their forms. The madreporean islands, on the contrary, exist only within the tropics, and present forms constantly analogous to each other, nor are they ever overturned by earthquakes or volcanic eruptions. These are described in the following extracts by veracious travellers who have traversed those seas.

"The whole group of the thousand islands, and indeed the greater part of those whose surfaces are flat in the neighbourhood of the equator, owe their origin to the silent, unseen, never-ceasing labours of *Polypi;* their calcareous habitations are constructed in an infinite variety of forms, yet with that order and regularity, each after its own kind, that is so discernible to the minute inquirer in every part of creation. It is true the eye may easily be convinced of the fact; but it is difficult for the human mind to conceive the possibility of animals, so apparently insignificant, being endowed with the power, much less of being furnished in their own bodies with the materials of building up the immense fabrics which, in almost every part of the Eastern and Pacific Oceans lying between the tropics, are met with in the shape of detached rocks, or reefs of great extent, just even with the surface of islands already clothed with plants, whose roots are fixed at the bottom of the sea several hundred feet in depth, where light and heat so very essential to animal life, if not excluded, are sparingly received and feebly felt.

"Thousands of such rocks, reefs, and islands, are known to exist in the Eastern Ocean, within and even beyond the limits of the tropics. The eastern coast of New Holland is almost wholly girt with reefs and islands of coral rocks rising perpendicularly from the bottom of the abyss. Captain Kent, of the Buffalo, speaking of a coral rock many miles in extent, on the south-west coast of New Caledonia, observes, that it is level with the water's edge, and towards the sea as steep as the wall of a house; that he sounded frequently within twice the ship's length with a line 150 fathoms (900 feet), without being able to reach the bottom.

That delightful writer and intelligent traveller, Captain Basil Hall, in his voyage to the Loo Choo Islands, has also made some interesting remarks on the examination of a coral reef; he observes that during the different stages of one tide the changes it undergoes is truly surprising. When the tide has left it for some time it becomes dry, and appears to be a compact rock, exceedingly hard and ragged; but as the tide rises, and the waves begin to wash over it, the coral worms protrude themselves from holes which before were invisible. These animals, he says, are of a great variety of shapes and size, and in such prodigious numbers, that in a short time the whole surface of the rock appears to be alive and in motion. The most common worm is in the form of a star, with arms from four to six inches long, which are moved about in all directions, probably to catch food. Others are so sluggish that they may be mistaken for pieces of rock, and are generally of a dark colour, from four to five inches long and two or three round. When the coral is broken about high-water mark it is a solid hard stone; but if any part of it be detached at a spot where the tide reaches every day, it is found to be full of worms of different lengths and colours, some being as fine as a thread and several feet long, of a bright yellow, and some of a blue colour; others resemble snails, and some are not unlike lobsters in shape, but soft, and not above two inches long.

The growth of coral appears to cease when the worm is no longer exposed to the washing of the sea. Thus a reef rises in the form of a cauliflower, till its top has gained the level of the highest tides, above which the animal has no power to advance, and the reef, of course, no longer extends itself upwards; the other parts, in succession, reach the surface, and there stop, forming in time a level field, with steep sides all round. The reef, however, continually increases, and, being prevented from growing higher, extends itself laterally in all directions; but, the growth being as rapid at the upper edge as it is lower down, the steepness of the face of the rock is still preserved. These are the circumstances which render coral reefs so dangerous to navigation; for, in the first place, they are seldom seen above the water; and, in the next, their sides are so perpendicular that a ship's bow may strike against the rock before any change of soundings has given warning of the danger.

To the remarks of these travellers we will add those of another, an accurate observer of nature, whose frequent visits to the coast of New Holland fully confirm these accounts. His diffidence has hitherto prevented the public from enjoying the animated description he gives of the wonderful phenomena coral formations exhibit. We have, nevertheless, his permission to extract an observation from his manuscripts, which does not appear to have been made by any other naturalist or traveller with whom we are acquainted, or whose publications have appeared. It is the magic effect produced by the almost instant growth of vegetable matter on these rocks; for, no sooner have the *Polypi* become checked in the upward progress of their eternal labour, by having reached the level of the sea, and are forced to work their restless course beneath its surface, than the upper world, jealous, as it were, of territory thus forced upon it, immediately claims it, and peoples it anew. It is rapidly clothed with verdure; an artificial soil is quickly deposited by the exuviæ of marine animals and plants. The excrement of birds, who flock in countless myriads to feast upon the sea's *rejectamenta*, greatly assists to increase the stratum of soil, leaving with it the seeds of plants and trees, that, springing into life, quickly attain maturity in such congenial ground, and, in their turn, contribute largely to their parent soil, as the succeeding changes of season, with unerring truth, divest them of their leafy garb. By these causes repeated strata of earthy matter are deposited; a verdant island rises, smiling in the face of desolation, and bids defiance to the angry storm, forming possibly a future asylum to man, or the subject of a state's contention.

Another fact, less easily accounted for, but proving the infinite goodness of God, is, that on these islands fresh water is almost always to be found in the hollow basins below the level of the sea, and in the cavities formed in the earthy cavities on the face of the island, and generally in the most open situations. May not this be caused (without any very extravagant stretch of hypothesis) by the immense pressure of the surrounding medium forcing the water through the rocky interstices, and filling these basins by a species of infiltration, during which much of its saline particles are purged, and it is ultimately purified by the heat of the solar rays, which crystallise the remaining salt, and precipitate it to the bottom of these gigantic evaporating basins, immediately supplying vegetation and animal life with their most necessary and salutary aliment, water, in addition to that which the bounteous streams of heaven seasonably supply?

Montgomery, in his poem "The Pelican Island,"

so elegantly and so truly exemplifies these mighty fabrics, that such of our readers as have not read that portion will thank us for this opportunity of doing so.

"Compared with this amazing edifice,
Raised by the weakest creatures in existence,
What are the works of intellectual man?
Towers, temples, palaces, and sepulchres;
Ideal images in sculptured forms;
Thoughts hewn in columns, or in domes expanded,
Fancies through every maze of beauty shown;
Pride, gratitude, affection, turned to marble
In honour of the living or the dead;
What are they? fine-wrought miniatures of art,
Too exquisite to bear the weight of dew
Which every morn lets fall in pearls upon them,
Till all their pomp sinks down in mouldering relics;
Yet in their ruin lovelier than their prime;
Dust in the balance, atoms in the gale,
Compared with these achievements in the deep,
Were all the monuments of olden time,
In days when there were giants on the earth.
Babel's stupendous folly, though it aimed
To scale heaven's battlements, was but a toy,
The plaything of the world in infancy:—
The ramparts, towers, and gates of Babylon,
Built for eternity—though, where they stood,
Ruin itself stands still for lack of work,
And desolation keeps unbroken Sabbath;—
Great Babylon, in its full moon of empire,
Even when its 'head of gold' was smitten off,
And from a monarch changed into a brute;—
Great Babylon was like a wreath of sand
Left by one tide, and cancelled by the next:—
Egypt's dread wonders, still defying Time,
Where cities have been crumbled into sand,
Scattered by winds beyond the Libyan desert,
Or melted down into the mud of Nile,
And cast in tillage o'er the corn-sown fields,
Where Memphis flourished, and the Pharaohs reigned;
Egypt's grey piles of hieroglyphic grandeur,
That have survived the language which they speak,
Preserving its dead emblems to the eye,
Yet hiding from the mind what these reveal;—
Her pyramids would be mere pinnacles,
Her giant statues, wrought from rocks of granite,
But puny ornaments for such a pile
As this stupendous mound of catacombs,
Filled with dry mummies of the builder worms."

We will now proceed with an account of the coral formations, from which we have somewhat deviated, we trust, however, not unprofitably to our readers, as every additional illustration of these interesting facts will be duly appreciated.

Lamaroux observes—If we compare this polypean mass, that rises from the immeasurable depth of the ocean to a level with its surface, shooting into the air under the form of mountains, to the *Melobesia*, to the *Cellepora*, which has only the appearance of a white spot, merely a minute deposit of calcareous particles, how striking is the difference! what an infinity of intermediate stages of formation must exist between the two extremes! Generally speaking, the cellular *Polypidoms*, as well as the calciferous and carnoid, seldom exceed a yard in height, and usually are much smaller. The corticiferous are sometimes many yards in height. It is then in the madreporic *Polypidoms*, those that are wholly stony, that we must seek for giants in this department of the animal kingdom; whilst their architects are so small as frequently to elude the naked eye, and can only be distinguished by a magnifying power; in some groups of *Polypi* they even escape the best optical instruments, and leave us only analogy and reason to demonstrate their being and existence. It has, however, on the authorities we have quoted, been shown that *Polypi* exist of a very considerable size; none of them, however, exist on our own coasts, or in the north of Europe, though it is not improbable that the equinoctial seas may enclose many species as yet undescribed.

If, notwithstanding the energetic influence of air and light on all created beings, and particularly those of submarine existence, we may judge, from the hues that still remain to them in the cabinets of naturalists, their colours must be varied and brilliant in the extreme on their natural sites, in the fathomless profundity of the sea.

The atmospheric fluids rapidly affect the colour of *Polypidoms*; it is by no means uncommon to see a *Sertularia*, of a brilliant yellow when first discovered in the sea, fade and become a tarnished brown three hours after it has left it: sometimes the change is much more rapid. Sponges, of a lively lilac when covered with the water, become nearly white when exposed a few minutes to the contact of air and light. There are, however, *Polypidoms* preserved many years in museums whose colours appear more permanent; their stems are of a bright and deep hue, or their rind of a brilliant colour; we can readily suppose this envelope to have been infinitely brighter while the *Polypi* were in life. It is not, however, impossible that, like many of the marine *Floridas*, some of these animal productions may assume *more* varied hues and brilliant tone of colouring, from the combined effect of light, humidity, and their first stage of decomposition.

It is always to be remembered that these considerations of *Polypidoms* are not applicable to the *Polypi*, whose dwelling they form; these latter are sometimes of the clearest transparency, at others this pellucid appearance is clouded and whitish; they frequently partake of the colour of the animated mass to which they belong, only differing in shades according to the various parts of organisation. In many of the *Gorgoniæ*, and in some of the *Alcyoniæ*, the colour of the *Polypi* is entirely different from that of the *Polypidom*, and forms an elegant contrast. In general their brilliancy and transparency become tarnished and opaque as soon as they are deprived of life, or exposed to atmospheric influence.

The unreflecting mind may ask what is the utility of these creatures; too small to afford material nourishment to others, yet capable of rendering venomous those which partake of the little they can supply? When devoured by fishes, they have caused maladies so serious and so general that travellers in those regions will not touch fish, knowing it, by fatal experience, to be unwholesome and of a baneful quality. Molluscous animals taken from the madreporic rocks have been found to possess an insufferable stench; this may be accounted for by the *Polypi* being in a state of decomposition, and their fetidness is then sufficiently powerful to cause vertigos and even suspended animation, as has been experienced by Lamaroux while preparing specimens of the *Antipathes myriopylla*, which a friend had sent him from Nice.

Sometimes the *Polypi* wholly envelope, in a calcareous coating, marine plants; and, by obstructing the pores necessary for their aliment, cause them to perish in a living tomb. Other innumerable instances might be adduced, such as causing shipwreck, the choking up of harbours, &c.

But He, who formed the universe, created nothing in vain! His works all harmonise to blessings, unbounded by the mightiest or most minute of His creation. Each day displays to the properly constituted mind new proofs of His wisdom in new developments of His plans, and gives fresh force to the conviction that our ignorance alone must obscure our view when we cannot comprehend His aim of eternal good.

On land the vegetable tribes absorb the carbonic acid our inhalements have created, and return us the life-giving oxygen. In the bosom of the deep the *Polypi* absorb the calcareous salts brought from the various countries whose coasts it has visited, which salts, by a continued accumulation, might otherwise prove as destructive to its inhabitants as the carbonic acid proves to those on land; but the *Polypi* collect, decompose, and render them insoluble to the surrounding element which their labours have thus purified; they unite them into a mass of such extent that in the progress of time the domain of man becomes enlarged, and vegetation blooms and blesses with its fruits on the structures that have ceased to serve them.

Let those, who thoughtlessly ask of what use are these creatures, learn the fact, could no other be adduced, that to the assistance of lime we owe the elegance and solidity of our buildings, particularly the latter. The calcareous stone or carbonate of lime, that Proteus of the mineral world, is wholly wanting in the equatorial regions; may we not therefore be permitted to consider these madreporous *Polypidoms* as destined by Infinite Wisdom to supply its absence? At Djeddah in Arabia, and on many other parts of the coasts of the Red Sea, the houses are constructed entirely with blocks of beautiful madrepore. In the Indian isles, as well as in those of the Indian ocean, and in many other parts, the madrepores are used for the manufacture of lime. At Martinique also they dredge them for that purpose from the bottom of the sea.

What could we substitute for sponge in domestic uses? where find a substance equal to this polypean production in the property of imbibing water without any diminution of elasticity or alteration of its nature? The sponges we have in use are found in the equinoctial seas of both worlds, and in the warmest parts of the temperate zones; they are a considerable object of commerce, many of the Mediterranean isles have no other product to export.

In France, and throughout Europe, the *Corallina officinalis* is used as a powerful anthelminthic; it is known under the name of *Coralline* of Corsica, and brought from the different parts of the Mediterranean; it is very abundant on the western coasts of France, as also on the shores of England. Sir Humphry Davy has remarked that it has a fattening tendency, as well as others of its family.

The inhabitants of Iceland, celebrated for its frosts and its volcanos, make use of a flustra, in the form of snuff, to excite sneezing, either on account of its agreeable smell, resembling violet, or as a preservative against the scurvy, so dangerous in its ravages in those regions.

On that well-known *Polypidom*, the Red Coral (*Isis nobilis*), true stony coral of authors, we must make a few short remarks. It is so well known as a material from which numberless elegancies of life are formed, that a particular description of it were needless. In all ages and in all countries mankind have acknowledged its beauty. Warriors have employed it in the ornamenting of their weapons; men and women in the decoration of their persons and houses; the physicians of the middle ages looked upon it as a universal remedy; and the priests of ancient religious sects esteemed it as an object acceptable to the gods.

Coral then may be a name retained to distinguish the above species *par excellence* from the other *Polypidoms* of a stony texture. Its natural figure is tree-like; it is inarticulated, the axis stony, stiff, and susceptible of the highest polish; the rind is fleshy, becoming chalky and very friable by desiccation, and always adhering to the axis; this is equal to marble in solidity, which, being formed of concentric layers, they become perceptible by calcination; its surface is more or less striated; the striæ parallel and uncqual in depth.

A reticulated body, formed of small membranes, with numberless vessels and glands filled with a milky juice, appears to unite the rind with the centre. This reticulated body is found in all corticiferous *Polypidoms;* the rind is of a less deep colour, of a soft substance, and formed of small membranes and slender filaments; it is pierced by tubes or vessels, and covered with tubercles, which are thinly scattered and have a large base, the summit of which is terminated by an opening divided into eight parts. In the interior is found a cavity which contains a white and almost transparent polypus, its mouth surrounded by eight conical tentacula slightly compressed, and ciliated on their borders.

This coral is found in different parts of the Mediterranean and Red Seas, it grows in all directions, and each trunk forms a perpendicular to the level from whence it springs; it attaches itself to all rocks, whatever may be their nature; it is also found on unfixed bodies, such as fragments of lava, stone vases, broken glass, and specimens have been exhibited in museums adhering to a variety of bodies.

When coral is once detached and at the mercy of the waves, it soon loses its polypiferous rind; to enable the constructors of this brilliant edifice to labour for its increase, it is indispensable that it should be fixed; their work does not, however, advance with a rapidity equal to that of the madreporic *Polypi* in the Indian sea, or the immense Eastern Ocean, whose labours, in the short space of a few years, close the entrance of marine ports, and raise those gigantic reefs we have already been describing, on which many vessels, sailing in those distant regions, have struck and perished.

Coral is found at different depths in the bosom of the waters, but, notwithstanding the density of the medium in which it exists, all aspects are not suitable to its increase. On the coasts of France it covers those rocks that face the south; it is rarely met with on those having an eastern or western aspect, and never in a northern one. It is never found at less than three or four yards below the surface of the sea, nor ever at a greater depth than 350 yards.

In the straits of Messina coral prefers an eastern aspect, on the south it is seldom found, and still less on the rocks of the north or west. They there fish it from a depth of 100 to 200 yards. In those straits, immortalised by Homer and Virgil, the solar rays strike more perpendicularly than on the coast of France, their heat penetrates to a greater distance, and the coral is found even deeper than 300 yards; but then its quality no longer compensates for the risks and numerous difficulties attending the procuring of it.

On the north coast of Africa it is not sought beyond thirty or forty yards in depth, and at a distance of three or four leagues from shore; they abandon it when it reaches 250 or 300 yards.

The coral is generally of a more beautiful colour

in shallow waters which easily admit the light, than where the immense column of water, by absorbing all the luminous rays, deprives it of the energetic influence exerted over all animated beings by that beneficent medium unceasingly emanating from the sun.

Coral on the coasts of France, being perhaps better chosen than in other countries, has the reputation of possessing the liveliest colours and the greatest brilliancy; that of Italy, however, rivals it in beauty; on the Barbary coasts it attains greater thickness, but the colour is inferior.

Fifteen different varieties are distinguished in the course of commerce; these, from their colour and degrees of beauty, obtain the several names of *froth of blood, flower of blood, first, second, third blood,* and so on.

At Trapani in Sicily, where the principal coral fishery of the island is carried on, it is managed by a very ingenious and simple contrivance. To the centre of a large wooden cross is fixed a stone sufficiently ponderous to carry the cross to the bottom of the water. Pieces of small strong net are tied to each limb of this cross, which is poised horizontally by a rope, and then let down into the sea. As soon as it is felt to touch the bottom, the rope is made fast to the boat, which is then rowed about over the beds of coral, and the great stone breaking the branches of the rocks, they become entangled in the net-work, are thus secured, and wrested from their birth-right.

Corallina is a plant-formed *Polypdiom*, articulated, branched, and trichotomous, axis or interior wholly composed of horny fibres; rind cretaceous and cellular, the cells being invisible to the naked eye. Former authors had united under the name of *Corallines* all the flexible *Polypidoms*, such as the *Sertularia*, *Tubularia*, &c. Later writers on the subject deem it advisable to reserve this denomination for one order in this class of creation, a close observation of the various characters distinguishing the order has induced a separation of them into genera, and to assign particularly to one genus the appellation of *Corallina*.

The *Corallines* of Europe have their polypæan cells so very small and so subject to obliteration, that it is not extraordinary they still remain undiscovered; in the equatorial seas the cells are much larger, and frequently visible to the naked eye. Lamaroux observes that rambling over the Calvados (a range of rocks on the coast of Normandy), he frequently found a very large *Corallina*, a variety of the *C. officinalis;* it was covered with simple transparent filaments, which had a movement peculiar to themselves, they disappeared with the slightest agitation of the water, or when the *Polypidom* was exposed to the air; in the latter case he was never able with the strongest magnifier to discover the slightest remains of these filaments, the point they had been attached to, or the cells they might have issued from, supposing them to have been *Polypi*. This, however, remains doubtful, as it was only in the spring season he ever observed them, and then only a few particular individuals. In winter he never could discover them at all.

In the *Jania* and *Corallina* are frequently observed small globular bodies, more or less voluminous, and varying in their substance; the tubercles that are found on the *Amphiroa, Halimeda, Udotea*, and *Melobosia*, appear analagous. Ellis imagined them air-vessels to support them in the water; but these vesicles are rarely empty, they have even been found quite solid or filled with small grains of an unknown nature. They are more probably ovaria, enclosing the germs of future *Polypidoms*, and indeed all the flexible species appear thus to multiply.

The *Polypidoms*, to which the generic name of *Corallina* is reserved, have always articulated stems, more or less compressed, more or less branched, and constantly trichotomous. Their colours, when fresh, generally incline to red or purple; exposed a very short time to the atmospheric action, light and humidity, they display a variety of prismatic hues, each more brilliant than the other, from the lightest and most brilliant rose-colour to a dull brown, greenish, or only with a tinge of red; infinite gradations are observable, but they all become bleached in the air.

Polypidoms of this genus are found in all latitudes, at every depth, and on all the coasts of the principal divisions of the world. They are, however, larger in the equatorial seas, more brilliant in their hues, and more elegant in their form. Fixed usually on rocks, or other hard and almost immoveable substances, they resist the influence of the waves, and are very rarely detached from their bases or cast on shore. Only one or two species of *Corallina* are parasites on the *Thalassiophytes*, whilst nearly the whole of the *Janias* are found upon these vegetables.

Corallines vary but little in their height; they sometimes exceed, but seldom, four inches, and are in general less.

The *Corallina officinalis* was formerly used as an anthelminthic or worm-destroying medicine, but at the beginning of the eighteenth century it seemed nearly to have fallen into disuse in France; at a later period it was again brought into vogue from the reputation of the *Fucus helvinthocorton*, vulgarly called moss of Corsica, whose properties seem to be of the same nature, and a chemical analysis of the *Corallina officinalis* does not very essentially differ.

In the Philosophical Transactions, Mr. Hatchet gives the following account of his chemical experiments on what he terms *Zoophytes*. He says *Madrepores* and *Millepores* (like several of the shells) are formed of a gelatinous and membranaceous substance hardened by carbonate of lime, the difference consisting only in the mode in which these materials are combined; that in the *Tubipora, Flustra*, and *Corallina*, some phosphate of lime is mixed with the carbonate; that in the *Isis*, the basis is a regularly organised, membranaceous, cartilaginous, and horny substance, hardened by carbonate of lime, one species only, the *Isis ochracea*, yielding also a small proportion of phosphate of lime. That the hardening substance of the *Isis nobilis*—red coral, is likewise carbonate of lime with a small portion of phosphate; but that the matter forming the membranaceous basis consists of two parts, the interior being gelatinous and the external a complete membrane, so formed as to cover the stem in the manner of a sheath or tube. The other *Gorgoniæ* consist of a horny stem coated by a membrane, which is hardened by carbonate of lime. Sponges are of a nature similar to the horny stems of the *Gorgoniæ*, and only differ from these and from each other by the quality of the texture. And, lastly, that the *Alcyonia* are likewise composed of a soft flexible membranaceous substance very similar to the cortical part of some of the *Gorgoniæ*, and in like manner somewhat hardened by carbonate slightly mixed with phosphate of lime.

From this mass of evidence we collect in general, that the varieties of bone, shell, coral, and the numerous species of *Polypidoms* with which the last are allied, only differ in composition by the nature and quantity of the hardening or ossifying principle, and by the state of the substance with which this principle is mixed or connected; the gluten or jelly which cements the particles of phosphate or carbonate of lime and the membrane, cartilage or horny substance which serves as a basis, appearing to be only modifications of the same substance, which progressively graduates from a viscid liquid or gluten into a gelatinous substance; this again by inspissation, and by the more or less perfect degrees of organic arrangement, forms the varieties of membrane, cartilage, and horn, forming the peculiar differences of the several species.

In the matchless Museum of the Royal College of Surgeons of London, several elegant preparations of *Madrepore* and calcareous *Polypidoms* may be seen, in which it is manifest that when the carbonate of lime has been absorbed by a chemical operation, the animal matter remains, still exhibiting its original form; but, being divested of its hardening matter, is a mere gelatinous substance.

Lamaroux has constituted four classes of flexible *Polypidoms*, the

First Class is that of the celluliferous, whose *Polypi* are found in shelly or non-irritable cells. It is divided into three orders, beginning with that whose cells are apparently isolated, and comprehends the *Flustra*, *Cellularia*, &c. The second order includes all those with coalescent or united cells, formerly styled *Sertularia;* the *Tubularia* forms the third order, their cells being tubular and horny, simple or branching, with one or many openings. The

Second Class, whose *Polypidoms* are styled calciferous, are of a chalky substance mixed with that of animal, and continuing apparent in every stage; this class also contains three orders, the first of which has, like the *Tubularia*, the *Polypi* at the extremities of the stems and branches, but, being less horny and more calcareous, forms an intermediate link between the last order of the first class and the second order of the present class, whose *Polypidoms* are very cretaceous or chalky, but whose *Polypi* are not apparent; they are articulated, which distinguishes them from the third order of this class, in which they are *not* articulated.

In concluding this article we are enabled to add, that an able naturalist is about to publish, at no very distant period, a systematic arrangement of these wonder-working creatures. It is a subject on which more may be said, and less is hitherto known, than any other; but the necessary information and observation is so difficult of access, that few persons have ventured to explore its mazes; but the immense impetus now given to the study of nature by the united labours of eminent men, in every part of the world, will render her paths more easy to tread, and enable the student to unlock the storehouse of her treasure.

POLYTHALAMACEA, is the third order of the first class, *Cephalophora*, of the French naturalists; it includes the genera, *Orthocerata*, *Belemnites*, *Conularia*, *Conolites*, *Orthoceras*, and *Baculites;* these constitute the first family, under the name of *Orthocerata*. The second family, *Lituacea*, includes the genera *Icthiosarcolithes*, *Lituola*, *Spirula*, *Hamatites*, and *Ammonceratita*. The third family, *Cristacea*, comprise the genera *Crepidulina*, *Oreas*, and *Linthuris*. The fourth family, *Ammonacea*, includes the genera *Discorbites*, *Scaphites*, *Ammonites*, and *Simplegas*. The fifth family, *Nautilacea*, consists of the genera *Orbulites*, *Nautilus*, *Polystomella*, and *Lenticulina*. The sixth family, *Turbinacea*, includes the genera *Cibicides* and *Rotalites*; and the seventh family, *Turriculacea*, possesses only one genus, *Turrilites*.

Under the different generic names a more full description is given of each of these molluscs, and it will be seen that the greater number of them are only known in a fossil state; the most common recent species, such as the *Spirula* and *Nautilus*, will give an idea of the whole order, and why it has been called *many-chambered*. The general characters of these shells are, the body of the animal being contained more or less in the last-formed division, the shell is straight, or more or less rolled upon the same plane, divided by chambers or septæ, and these perforated with one or more syphons or holes. The entire order is established upon the imperfect knowledge possessed of the animals of the *Nautilus* and *Spirula*, to which analogous reasoning approximates the other genera. The arrangement of the genera constituting this order has been guided by the curvature of the spiral cone, the first straight, the others being gradually rolled upon the same plane until no trace of it appears externally, as in the *Nautilus*.

POMADERRIS (Labillardière). A genus of evergreen shrubs from New Holland, having pentandrous flowers, and belonging to *Rhamnaceæ*. They are in greenhouse collections, and are treated like other plants from the same quarter of the world.

POMATHORINUS, a genus of *tenuirostral*, or slender-billed birds, bearing some resemblance to the sugar-eaters, but still sufficiently distinguished from them to be reckoned a separate genus. The characters are: the bill long, slender, straight at the base, but slightly bent towards the top, very much compressed in the distal part, but without any notch, and the culmen of the upper mandible with a distinct ridge. The nostrils pierced obliquely near the base of the bill, and partly covered by an oblong membrane. The wings of moderate length and rounded; the tail long and also rounded. The feet with three toes to the front and one to the rear, the middle front is the longest, but the hind one the stoutest of the whole. The claws on all the toes much compressed, crooked, and sharp at the points. All the known species, of which there are several, are forest birds, natives of the Eastern islands and Australia; but little or nothing is known of their manners or their feeding. The species first discovered were classed with the bee-eaters, by the describers of the time; but they do not even belong to the same family, as the bee-eaters have the feet syndactylic, and these birds have not.

P. temporalis was discovered in New Holland by Brown, during Flinders' voyage, in the early part of the present century; but it most likely exists in other parts of the east. Its length is about ten inches and a quarter; its tail pretty long, and its wings short. The upper plumage is yellowish-ash, passing into dull yellow on the under part. The front, under the head, throat, and breast, are white, a thin line over the eye and the tail-feathers are black, but the latter have the tips white. The bill is black at the base, and whitish at the top.

P. superciliosus is another Australian species, for

the knowledge of which we are indebted to the same illustrious naturalist. It has a considerable general resemblance to the former, but it is considerably smaller. Its length is seven inches and three quarters. The upper part is brownish yellow; the dark streak over the eye extends to the nape; the throat, breast, and anterior part of the belly are white; and the bill and feet are black.

P. montana. This species has been observed in the wooded parts of the mountains of Java, at the height of seven thousand feet above the level of the sea; and it is probable that it also exists in the elevated parts of the adjacent islands, and in New Guinea. Its total length is seven inches and a half; its general colour maroon; its head blackish with a white eye-streak; and its throat and breast pure white.

P. Isidorii is a native of New Guinea, and though it has the same generic characters, it differs considerably in appearance from any of the others. Its general colour is maroon, very rich on the wings and tail, paler on the throat and breast, duller on the belly, and mottled a little with grey on the head and back. The total length is about eight inches; the bill is an inch in length, of a yellow colour, very much compressed toward the tip, and with the margin of the upper mandible overlapping the edges of the under one. The tarsi are very stout for the size of the bird; they are covered with large scales in front, and of a reddish brown colour. The toes are stout, of the same colour as the tarsi, and furnished with compressed and crooked yellow claws. The tail consists of ten feathers, is wedge-shaped at the extremity, and nearly four inches long; so that when the length of the bill and tail are subtracted, there remains little more than three inches for the body and head of the bird. The wings are short, and all the quills nearly of equal length, the first being the shortest in the wing.

This bird is easily obtained in the woods of New Guinea, from which specimens were first brought by the French. It is a bird of very peculiar structure, from the length of the bill and tail, the shortness of the wings, and the fact of their being nearly squared over. In these respects there is hardly any other bird that can be compared with it; and, although nothing is known of its habits, there must be a peculiarity of habit answering to its peculiarity of structure. It must be quite incapable of long-continued flight, and thus it cannot move from island to island unless where these are separated from each other by narrow channels. The strength of the tarsi and toes, and the larger scales on the former, might lead to the supposition that it is a ground bird, but the form of the claws are against that. The genus altogether is one of the many peculiar ones of the eastern islands, to which we have nothing corresponding in any other region.

POMEGRANATE is the *Punica granatum* of Willdenow, a fruit-bearing shrub indigenous to the south of Europe, and which in the natural system constitutes an order by itself. The pomegranate, so called from its fruit being likened to an apple full of grain, has received its generic name either from the scarlet colour of its flowers, or in reference to its Punic habitat, the plant being originally found on the northern shores of Africa. It has been long an inhabitant of our gardens, but valued for its fine flowers rather than for its fruit, which never ripen thoroughly in this country. They are usually planted against south walls, and are easily propagated.

POMPILIDÆ (Leach). A family of aculeated hymenopterous insects, belonging to the sub-section *Fossores*, and having the hind legs long, the antennæ filiform or setaceous, and often curled up spirally at the tips in the females; the abdomen is ovoid or oval, and attached to the thorax by a narrow and very short peduncle; the lower jaws and lip are straight, and of a moderate length; the collar is transversely quadrate or longitudinal; the hind margin being nearly straight, and extending as far as the base of the fore wings. The family is of considerable extent, and comprises species varying considerably both in their size and colours; they do not appear to be confined to particular districts of the globe, but prefer warm and sandy situations, in which the females construct their nests by burrowing in the earth; they generally provision their nests with spiders, but occasionally with other insects which they have wounded with their stings, and which serve for the food of their progeny, which are produced from eggs deposited separately in the provisioned cells; some species also make their nests in burrows which they find already formed in wood. They are extremely active in their movements; and whilst the females are in search of their prey, they may be observed constantly running along the ground, shaking their wings, or taking short flights. The males are generally smaller than the females; the latter are provided with an extremely powerful sting, and the wounds which they make with it are very painful.

We have, on various occasions, noticed the great solicitude exhibited by female insects in the construction and provisioning of the nests, formed, not for their own residence, but for their future young. The following observations, extracted from the note book of the writer hereof, present another instance of the same kind. "September 17. Observed a very small specimen of *Pompilus fuscus*, at the foot of a perpendicular sand-bank, at Coombe, dragging a seemingly dead ant (*Formica Herculeana*), much larger than itself, to its burrow; on reaching the foot of the bank it quitted the ant, and, as I thought, flew away, but it was only to reconnoitre and discover the nearest way to its nest, situate half up the bank. It then returned to the ant, and seizing it in its jaws began, tail foremost, to drag it up the bank, the uneven surface of which, however, caused it several times to overbalance itself, and fall down again to the foot of the bank. This, however, seemed not to intimidate it, for it as often commenced the re-ascent, endeavouring at the same time to avoid the uneven parts which had caused its downfal. I watched it thus occupied for a length of time, and have little doubt that it ultimately succeeded in reaching the nest, although my attention was attracted away by other objects."

The family comprises the genera Pepsis, *Ceropales*, *Pompilus*, Salius, Planiceps, and *Aporus*. Those printed in italics being British. The genus *Pompilus*, Fabricius, comprises those species which have the maxillary palpi longer than the labial, the upper lip concealed beneath the clypeus and the wings, with four sub-marginal cells. There are twenty-six British species, including the type *Sphex viaticus* (Linnæus), a handsome insect, varied with red and black, which is very common on Hampstead Heath and elsewhere.

PONTEDERACEÆ. A small natural order in-

cluding only three genera, and of which there are ten species. They are aquatic plants, natives of the East Indies, tropical Africa, and North and South America; they are ornamental, and may be easily cultivated in an aquarium; their properties are unknown, and they have not hitherto been applied to any useful purpose. The genera here united are *Pontederia*, *Heteranthera*, and *Leptanthus*. The species of the two latter may be cultivated in the open air.

PONTIA (Fabricius). An extensive genus of butterflies, belonging to the family *Papilionidæ*, and distinguished by having the lower wings formed into a gutter for the reception of the abdomen; the palpi nearly cylindrical, slightly compressed, with the last joints of nearly equal length, and the club of the antennæ ovoid. The caterpillars are naked and destitute of the fleshy retractile appendage observed on the neck of the caterpillars of the genus *Papilio*. The genus comprises the white butterflies, so common in our gardens and fields, the larvæ of some of the species feeding upon and occasionally entirely destroying our cabbages, brocoli, cauliflower, &c. They are, however, subject to the attacks of various parasitic insects, especially the *Microgaster glomeratus*. "Small birds" also, observes Mr. Haworth, "destroy incredible numbers of them as food, and should be encouraged. I once observed a titmouse (*Parus major*) take five or six large ones to its nest in a very few minutes. In enclosed gardens sea-gulls, with their wings cut, are of infinite service. I had one eight years, which was at last killed by accident, that lived entirely all the while upon the insects, slugs, and worms he found in the garden. Poultry of any sort will soon clear a small piece of ground, but, unless they are of the web-footed kind, they do much damage by scratching the earth."

The most common species of this genus are the large white butterfly (*P. brassicæ*, Linn.), the small white (*P. rapæ*), and the green veined white, *P. napi*. Mr. Stephens, however, added several others, which have been regarded by some writers as varieties only of the common kinds.

POPULUS (Linnæus). A genus of very conspicuous forest trees, natives of Europe and North America, bearing diœcious flowers, and ranging with the *Amentaceæ*. Four species are natives of Britain, viz., the abele, the hoary, the aspen, and the black poplars. The Lombardy is a favourite in ornamental plantations; the black Italian produces the best timber; they are all propagated by cuttings of either their young shoots or roots.

PORTLANDIA (Linnæus). A genus of highly ornamental trees, natives of Jamaica. They belong to the fifth class and first order of sexual botany, and to the natural order *Rubiaceæ*. This plant, to grow it well, requires a strong stove heat, and is well worth every care to bring it to a flowering state, as when in flower it is a magnificent object.

PORTUGAL LAUREL is the *Cerasus Lusitanica* of Linnæus, a common shrubbery plant, and propagated by seeds, which ripen in abundance upon old trees.

PORTULACEÆ. A natural order containing ten genera and fifty-five species already described. The *Purslane* and its allies are succulent herbs or shrubs with fleshy, entire, alternate leaves, and usually destitute of stipules. The inflorescence is axillary or terminal, solitary, or in spikes or panicles; the calyx is free or only slightly adhering to the base of the germen; the petals are exserted from the calyx or torus, in number five, more or less; the stamens are definite, exserted with the petals from the calyx or torus; the filaments are discrete, the anthers versatile and two-celled; the germen is superior, one to three-celled, and many-seeded; the style single, and the stigmas several-cleft. The *Purslane* is the only plant of any use, the generality being only weeds.

POTAMOGETON (Linnæus). A genus of aquatic perennials, all indigenous to Britain, where they are known as pond-weed. The genus belongs to the natural order *Alismaceæ*. None are in cultivation.

POTENTILLA (Linnæus). An extensive genus of herbaceous perennials, found everywhere over the whole mountainous surface of Europe. The flowers are rather pretty, and for the most part yellow or white, and from their character are ranged in *Rosaceæ*. They may be called ornamental weeds; though there are a few exotic species which deserve a place in the flower garden.

PRASOPHYLLUM (Dr. Brown). A rather numerous genus of tuberous-rooted herbs, natives of New Holland, belonging to *Orchideæ*. According to Sweet, they should be planted out in a frame in a mixture of light loam, sand, and peat earth, and only protected from frost.

PRAWN. A small crustaceous animal belonging to the long-tailed (*Macrourous*), ten-legged (*Decapodous*) division, and to the family *Palæmonidæ*, being, in fact, the typical species of that family, and known by the technical name of *Palæmon serratus*. It is highly prized as a delicate shell-fish. See PALÆMONIDÆ.

PREMNA (Linnæus). A genus of tropical trees bearing didynamous flowers, and belonging to *Verbenaceæ*.

PRIMULACEÆ. A much admired natural order of mostly humble plants, comprising within its limits seventeen genera and one hundred and forty-three species. They inhabit the mountains and meadows of all parts of the world, but especially in the northern hemisphere. "Nothing can surpass the beauty of the little delicate Alpine *Primulas*, *Androsaces*, *Aretias*, and *Soldanellas*, with their modest blossoms sometimes rivalling the whiteness of the surrounding snow, and sometimes emulating the intense blue of the empyrean." They are as much valued for their early advent as for their intrinsic beauty; for no sooner is the snow melted, and the earth loosened by the vernal airs, than these harbingers of spring put forth their welcome blossoms. Besides the above named genera there is the *Cyclamen*, the elegant *Dodecatheon*, (considered worthy of being dedicated to twelve divinities), the *Cortusas*, *Tricutalis*, *Coris*, *Huttonia*, *Lysimachia*, *Lubinia*, *Anagallis*, *Micranthemum*, *Centunculus*, *Samolus*, and *Campylanthus*. The prominent botanical character of the order is the fruit, one-celled, with a central placenta, and the stamens opposite the petals. The properties of these plants are insignificant, nature having thus as it were secured some of her prettiest flowers from rapine, and spared us kindly the pain of destroying these most delicate specimens of her handiwork. The tubers of the *Cyclamen* abound in south-eastern Europe, and are eagerly devoured by swine; hence the plant is called sowbread. A kind of wine is made from the flowers of the cowslip, said to be useful in fevers. All the genera are increased by division or seeds.

PRINOS (Linnæus). A genus of North American evergreen shrubs, commonly called winterberry. The flowers are hexandrous, and the genus belongs to *Rhamnaceæ*. The species grow in any light peaty soil, and are increased by layers.

PRIONIDÆ (Leach). A family of coleopterous insects, belonging to the section *Tetramera*, and subsection *Longicornes*, distinguished by having the upper lip obsolete, the body generally of large size and depressed. The jaws often very large, especially in the males; the antennæ of moderate length, the thorax often denticulated at the sides. The family is of considerable extent, and comprises some of the most gigantic insects of the order to which it belongs; thus, *Prionus gigas* is six inches and a half in length, and *P. cervicornis* five inches and a half including the mandibles. They frequent the great forests of tropical climes in which the trees are old and of a large size, as it is in the wood of the latter that the larvæ reside. These larvæ do not materially differ from those of other beetles having similar habits; the head is small and the body thick, fleshy, and depressed, with the legs very minute. Those larvæ are supposed by some authors to be the *Cossus* of the Romans; and it is certain that they are greedily devoured by the negroes in the West Indies. When they have attained their full growth they spin a cocoon of silk with chips of wood, within which they undergo their transformations. They take care to place this cocoon near the surface of the tree, so that the insect, when arrived at the imago state, may the more easily find its way to the open air. The females are provided with a corneous tubular borer, which they introduce into crevices in the bark in order to deposit their eggs. During the day they remain quiescent in the woods, but come forth in the twilight and fly round the trees. The family comprises the genera *Spondylus* and *Prionus*, which latter has recently been divided by M. Serville into a very great number of sub-genera. We possess in England but a single species *Prionus coriarius*, which is about an inch and a half in length, and of a dark brown colour. See CERAMBYCIDÆ.

PRISMATOCARPUS (Heritier). A genus of annuals and two or three perennials, natives of Europe and South Africa. The flowers are pentandrous, and the plants belong to *Campanulaceæ*. The genus was long ranked as *Campanulas*, until separated by Heritier. The African species are treated as greenhouse plants, and the annual sorts as tender annuals; that is, raised from seed in a hotbed, and afterwards planted in the open borders.

PRIVET is the *Ligustrum vulgare* of Linnæus, a European shrub, much used in forming ornamental shrubberies. It belongs to *Oleinæ*.

PROCTOTRUPIDÆ (OXYURI, Latreille). A family of hymenopterous insects of considerable extent, belonging to the sub-section *Pupivora*, having the wings almost destitute of nervures, the antennæ composed of from ten to fifteen joints, the abdomen terminated by a tubular ovipositor, and either external, forming a terminal point, or internal and exsertile. The maxillary palpi are generally long and slender. These insects are of minute size, and generally of a black colour, with pale or red legs. They are found in grass and amongst leaves, and generally are very active. From the *Chalcididæ* they differ in having the antennæ straight, and the nervures of the anterior wings often more conspicuous, whilst the structure of the abdomen and the ovipositor distinguishes them from the *Cynipidæ* and *Ichneumonidæ*. This family has been recently investigated by Dr. Nees von Esenbeck, as well as by several English authors, by whom many species have been described, and numerous genera established. They are parasitic upon other insects. Some of the species exhibit various remarkable peculiarities. Thus the *Platygaster Boscii* is furnished with a long curved horn, which arises at the base of the abdomen, and extends over the thorax as far as the head. The species of *Galesus* are remarkable for having the mandibles elongated into a kind of beak, and the female *Gonatopi* are provided with a curious pair of recurved pincers, attached to the fore tarsi, quite unlike any thing to be observed in any other insect. The wings of the *Diapriæ* are entirely destitute of nerves, and the *Mymars* (including some of the most minute creatures belonging to the order, and visible only when creeping upon the window between the eye and the light) are provided with a brush of very long hairs upon the margins of the wings; whilst the genus *Proctotrupes* is distinguished by the exserted and conical ovipositor; the antennæ thirteen jointed, and straight.

PROMEROPS (*Epiemachus*). A genus of birds belonging to the slender-billed family of *Passeres* in the arrangement of Cuvier. They have sometimes been confounded with the bee-eaters (*Merops*); but the structure of their feet, the form of their bills, and their modes of feeding, are quite different. The bee-eaters are syndactylic, or have the outer front toe and the middle one of equal length, and united together as far as the last joint, which makes that part of the foot in a great measure the same as one large toe with a cleft point. *Promerops*, on the other hand, are anisdactylic, having the middle and outer toes of different lengths, and united only at their bases. In this respect they resemble the nut-hatches, creepers, humming-birds, and hoopoes, to the last of which they have the closest resemblance. Their mode of feeding is different, however, for they live in a great measure upon the nectar of flowers, for the procuring of which their bills and tongues are well adapted.

The characters may be stated as follows:—The bill much longer than the head, slender, and with the gape opening as far backward as the eyes; the mandibles very much compressed, sharp in the edges for the whole of their length, the upper one very slightly notched toward the point, exceeding the under one in length, and with the crest on the culmen, which advances between the plumes and the forehead; the nostrils, at the base of the bill, opening forward, and in part covered by a feathered membrane; the tarsus of the same length as the middle toe; the outer toe longer than the inner one, and united to the middle one at its base, and the hind toe furnished with a very strong claw; the wings are of moderate length, and rounded, the first quill being very short, the next three gradually longer and longer, and the fifth one the longest in the wing. The natural history of these birds is not a little confused, as they have been differently viewed by different writers, and variously mixed up with other genera, with which it does not appear that they have much real connexion either in their geographical distribution or their habits. The most characteristic of them are understood to be natives of Southern Africa and Australia, of the isles which lie between them, and of some of the isles

eastward of New Holland; and the American species, which have sometimes been added to the genus, all belong to others, either to the sugar-eaters, or to some other genus nearly resembling them. In this uncertainty, we can do little more than mention the names of a few of the best-established species, remarking, that the whole are tree or plant birds, that their tongues are cleft at the extremity, and otherwise adapted for collecting those sweet juices from the nectaries of flowers upon which the birds may, in a great measure, be said to feed.

Splendid Promerops (*E. splendens*). This is a very beautiful bird, a native of Australia, and between nine and ten inches in length. The upper parts, and the head, neck, and breast, are velvet black, with reflections of green and purple; the feathers on the sides are large, rounded at their extremities, and each marked with a spot of very rich golden green; the feathers on the flanks are yellowish white, produced, and having thread-like niches; and some of them have the shafts drawn out in long filaments; the middle coverts resemble the back, and the external ones are black, with red borders; all the under parts are white; the bill and feet are black. These birds inhabit the Australian forests, and are understood to suck the sweet juices of flowers, but their habits are very little known.

Magnificent Promerops (*E. magnificus*). This is also a native of Australia, a larger bird than the species last mentioned, and still more brilliant in its colours. The upper part is black, with purple reflections, and the coverts of the wings pass into golden purple at the tip and margins; the quills, which are the same colour as the back, are very broad, and squared over at the ends; the middle tail-feathers are greenish-purple, and the lateral ones black; there is a sort of gorget of blue scaly feathers on the throat and fore neck, a collar of bronze-green below it; and the breast is glazed with silvery reflections; the under parts and flanks are iridescent violet, the feathers on the latter being long, and with loose backs, something resembling those of the birds of paradise; the bill and feet are black. The entire length is about twelve inches.

Pointed-tailed Promerops (*E. caudacutus*) is a native of the island of Madagascar, and about eleven inches in length; the upper part is black, with dull green reflections; the primary quills are black, the secondaries mottled with white and yellow in the central parts; and the tail-feathers, which are painted at the tips, are iridescent black; the lower parts are blackish brown; and the bill and feet are black, with a white streak on the ridge of the former.

Hissing Promerops (*E. sibilans*). This is a South African species, smaller than any of those already mentioned. The upper part is brown, clouded with olive; and the lower part white, passing into brown on the flanks, a collar of white surrounds the neck; the lateral tail-feathers are white, striated with brown and black; the bill is brown, and the feet yellow; the bird gets its name on account of the low hissing noise which it makes while flying, but otherwise its manners are very little known.

Azure Promerops (*E. cyaneus*). This is also a South African species, and one of the largest of the whole, measuring not less than fourteen inches in length. The upper parts are azure blue, with green reflections; the quills and tail-feathers are silver grey on the under part, with azure margins; the under parts of the body are sky-blue, marked with green; the bill is blackish; and the feet bluish grey. This species is the Indian hoopoe of some authors, but they are wrong in both respects, as it is neither a hoopoe nor an Indian bird.

Red-billed Promerops (*E. erythrorynchus*). This is also African, and measures twelve inches in length, but the female bird is a little less than the male. The upper parts are bright shining green, with reflections of blue and bronze; the quills and lateral tail-feathers are spotted with white; the under parts are of a variable colour, green in some lights and violet in others; and the bill and feet are red.

Namaqua Promerops (*E. cyanomelas*). This species, as its name imports, is found in the Namaqua country, a rich district of Southern Africa, near the conflux of the Great Orange river with the Atlantic. The forests of that country are particularly rich in birds, as well as in antelopes and other animals; but they cannot be explored without much difficulty and some danger. The present species of promerops is about ten inches long in the male bird. In that sex the upper parts are black, with metallic reflections; the under parts black, with brown; the tips of the outer tail-feathers are white; and the bill and feet black, The female is considerably smaller; she has the bill less arched, the reflections on the upper part fainter, and the under part much more inclining to brown.

These are the principal species which have hitherto been discovered of this very peculiar genus. It will be seen that all of them belong to the southern hemisphere, to Southern Africa, New Holland, and the adjacent islands. Some species have been described as being natives of the West India islands, and of various parts of tropical America, but those which have been so described are all birds of different genera, and, generally speaking, belong to the *Conirostral* family, and not to the slender-billed birds; and of course this difference in the structure of so essential an organ as the bill indicates a corresponding difference in the habits.

PROTEACEÆ, a natural order of highly ornamental evergreen shrubs or trees, chiefly natives of the Cape of Good Hope and New Holland. The order contains thirty-two genera, of which there are three hundred and seventy-five species already described. The leaves are simple, narrow, entire or serrated. The flowers generally grow in clusters, and are green, yellow, or red, sometimes surrounded by coloured bractæ, with dark hairy margins. The flowers are tetrandrous, with distinct anthers. The stigma undivided, and mostly oblique The fruit is various, sometimes a single nut, or congregated in a kind of cone. The proteas of the Cape, and the Banksias, dryandras, and telopea of New Holland, are the finest plants of the order. They are propagated by cuttings and seeds.

PROTELES, a genus of carnivorous mammalia walking on the toes, and intermediate in structure and appearance between the hyænas and the gennets, but not strictly admitting of being classified with either. There is only one known species, a native of Southern Africa, which is a country containing many singular animals; and in that country it is popularly styled a hyæna, though it is not one in reality. Lalande was the first to discover it; and Cuvier pointed out its characters, styling it provisionally the hyæna civet, and the hyæna gennet. In

some respects however, it has stronger resemblances to the dog family, especially the foxes, than it has to the hyænas or the civets, though it stands very like the hyæna on its legs, the fore ones being considerably longer than the hind. At first sight it is not very unlike the young of the common hyæna; but its head is differently shaped, and its toes are different in number. Its head is slender and handsomely formed; and its muzzle, instead of being blunt, is elongated, like that of the civet, or still more like that of the fox. The teeth resemble a little those of the hyænas, but they are not quite so carnivorous. The ears are long, and thickly covered with short hair, resembling those of the striped hyæna; the nostrils are on the point of the muzzle, which is black, and very slightly covered with hair; the mustachios are long and bushy; the hair of the mane, which extends all the way from the head to the tail, and the tail itself, are covered with rough and shaggy hair, which is hard to the touch, and the individual hairs are annulated by alternate portions of black and white; the rest of the body is covered with woolly hair, interspersed with a few long and stiff hairs; the ground colour is white, washed with reddish grey, and covered by irregular lines of black on the sides; the legs are the same colour as the body, with cross bands of black, except the tarsi, which are black altogether. This is rather a handsome animal; but it is comparatively rare in Southern Africa, and little known even to the native inhabitants. In its habits it is strictly nocturnal; and hence it is rarely seen unless when its earth is found and it is dug out. It appears to be to a certain extent social; for as many as three have been dug out of the same earth; but whether they join in hunting their prey has not been ascertained; they are about the size of a shepherd's dog, and are disposed to fight, and erect their manes when they are annoyed. It does not appear, however, that they are vicious in their dispositions, or make any serious inroads upon the farm yards of the settlers. Their limited numbers, and their retiring habits, tend, however, to render their history very imperfect.

PROTEUS, a genus of batrachian reptiles, closely allied to the tritons and salamanders, and, as a living animal, a singular inhabitant of singular places. Only one species is known, and that one is very local, being confined to the eastern Alps, and to some very singular places among them. The lakes in the neighbourhood of Sittich, in Lower Carniola, are the places where it was first found by the Baron de Zais, a zealous observer of nature, and by him it was communicated to Laurenti and Seapali, who wrote the first scientific accounts of it. Some of the lakes in which it was observed, are of singular character; for part of the year they show an expanse of surface-water like other lakes; but at one season the whole of the water withdraws into a hole in the bottom, and the bed of the lake becomes a meadow for a time. Subsequent research has found the proteus in other waters than these lakes; but still they are all connected with the rocks, or are what may be called "grotto-waters;" and no living specimen has been met with, excepting in some part of the Eastern Alps, between Vienna and the Adriatic. In the early ages of the world it appears to have been much more numerous than it is now, though still in the same part of the world. Remains or impressions have been found in the schistous strata at Eningen, of larger size than the living animal, but so much resembling it as to show that if they are not the same identical species, they are certainly the same genus.

Schrœber, of the Vienna museum, was the first who made proper dissections, and gave a detailed account of the anatomy of these singular creatures, since which time they have taken their proper place in the system, between the aquatic salamanders and the sirens.

The known species was named *Proteus anguinus*, by Laurenti, though some others improperly classed it among the sirens. It is an animal more than a foot in length, and about the thickness of one's finger, with the tail compressed vertically, and four rudimental feet, with three toes on the fore feet, and two on the hind ones. Its feet are very badly developed, so that it walks slowly and badly; but it swims easily and rapidly after the manner of tritons. It is furnished with internal lungs and also with gills on each side, which latter are of a coral red colour, and appear to be used in breathing much more frequently than the lungs. The proteus is thus a truly amphibious animal, capable of breathing either dry air, or air through the medium of water. Its gills are in the form of three little tufts upon each side, and it does not appear to lose them at any period of its life, so that the name proteus, which means a changer, is very inaccurately applied to it. Its eyes are so exceedingly small, and so much covered by the integuments, which form a sort of pit around them, that they are hardly visible. The ears are also covered with flesh, and both these senses appear to be in a very low state of development. It very often happens, however, that when an animal has the localised senses so imperfect that we are apt to pity its helpless condition, the general sense of the body is so much increased, as completely to supply the defect of all the other senses. This seems to be particularly the case with this animal, for it is exceedingly impatient of light; and if exposed to a strong light for any length of time it dies. Its general colour is whitish, with a rosy tint in the living animal, but the bloom of this tint goes off after death. The original opinion, that it was the larva of some sort of salamander has been totally exploded; first, because there is no salamander in the places which this animal inhabits; and, secondly, because the skeleton of the proteus, and its general organisation, are totally different from those of the salamander in every stage of their existence. The proteus has a sort of larynx and windpipe, and utters a feeble voice intermediate between hissing and whistling.

The skeleton bears some resemblance to that of the salamanders; but the vertebræ in the spinal column are more numerous, and the rudimental ribs are fewer. The bones of the head more resemble those of the siren. There is no crest on the cranium, which is very much depressed. The bones of the nose are merely rudimental; but the processes of the intermaxillary bones are long, and each of them is furnished with a row of teeth to the number of eight or ten. The vomers are also furnished with teeth more numerous than the inter-maxillaries, and extending far back into the mouth. The proper maxillary or jaw bones, and also the bones of the palate, are entirely wanting. The under part of the cranium is flat, formed by a single spheroid bone, but there are no walls or partitions of bone to the nostrils, which open into the mouth. The neck and body consist of thirty vertebræ, and the tail of twenty-five. With

the exception of the terminal one, these bones are very perfectly ossified; but their articulations to each other very much resemble those of fishes—that is to say, each of the two ends which are opposed to each other has a hollow cavity, and the two cavities are filled with cartilage. The ribs are seven on each side, and merely rudimental. There is no sternum, but there is a cartilaginous envelope to the heart, which in some sort answers the purpose of a sternum. The bones of the extremities are exceedingly imperfect, the blade-bone being the only part of the shoulder which is not cartilage, the bones of the pelvis being still less perfect, and those of the feet cartilaginous at their extremities. It appears that the animal has the power of sending a current of water from the mouth to the gills; for there are openings in the hinder part of the mouth which have their exit between the tufts of the gill. The liver consists of three lobes; the gall-bladder is very ample. The heart, which is situated between the fore feet, and whose cartilaginous envelope appears to assist in keeping them asunder, has but a single ventricle and auricle. The lungs are exceedingly simple, consisting of a few small and short tubes, a little dilated at their extremities. The stomach is thick and leathery; but the intestinal canal is slender. Small shelled mollusca appear to form part of the food of the proteus, as they have been found in the stomach; but the habits of the animal are so exceedingly obscure, that very little is known respecting them; and those which have been kept for a short time in confinement, have refused every kind of food. Of their mode of production nothing is known; and, indeed, the traces of organs for this purpose are very obscure.

Altogether this is one of the most singular animals in Europe; and its impatience of the light, and disposition to lurk in the sand, under stones, or in the darkness of subterranean waters, is greater than that of any other known animal. It also seems to be exceedingly sensitive and delicate, as no supply of water, no shading, and no treatment which has been hitherto resorted to, have succeeded in keeping it alive for any length of time.

Another species, almost equally obscure, and found in some parts of the United States, especially in New Jersey, has been referred to this genus, but apparently without propriety. It is a smaller animal, round in the body, with a groove down the back, having the tail flattened like an oar, and four little toes upon each of the feet. The accounts of it are, however, very vague.

PRUNELLA (Linnæus). A genus of perennial herbs, natives of the northern parts of America and Europe. They have mostly didynamous purple flowers, and belong to *Labiatæ*. A few of them are admitted into the flower garden, but the majority are only useless weeds.

PRUNUS (Linnæus). A genus of deciduous shrubs and trees, mostly natives of Britain and other parts of Europe. They belong to the class *Icosandria* of Linnæus, and to the natural order *Rosaceæ*. The species are the wild sloes of our hedges, and the cultivated plums of our gardens.

PSELAPHIDÆ (Leach). A family of coleopterous insects, nearly allied to the rose beetles (*Brachelytra*), but having the tarsi only three-jointed. These curious little insects have attracted much attention from the singularity of their characters. The abdomen is short and oval or rounded, and partially covered by a pair of short truncated elytra; the antennæ are thickened at the tips, sometimes only six-jointed, but more generally with eleven joints, some of which are curiously formed in one of the sexes; in some of the species the palpi are in general very long, and resemble an additional pair of antennæ; the tarsal joints are entire and slender, and often terminated by a single claw. These little insects are found in moss or amongst grass, at the roots, whilst others frequent ants' nests. The genera are *Pselaphus*, *Batrisus*, *Chennium*, *Dionyx*, *Bythinus*, *Arcopagus*, *Ctenistes*, *Bryaxis*, *Tychus*, *Euplectes*, *Claviger*, and *Articerus*, the most remarkable of which have been noticed in their alphabetical situation.

The genus *Pselaphus*, in its restricted state, comprises only those species which have the maxillary palpi elbowed and as long as the antennæ, which latter are eleven-jointed; the tarsi are terminated by a single hook. There are several British species, the type being the *Pselaphus Heisei* of Herbst.

The monographs of Leach (Zoolog. Miscell, vol. 3), Reichenbach, and Aubé, must be consulted for the characters of the genera and species of this family.

PSIDIUM (Linnæus). A genus of tropical forest trees, bearing icosandrous flowers, and belonging to the natural order *Myrtaceæ*. The fruit are the guavas of the colonists, some of which are equal in quality to our summer pears. The different sorts grow freely in our stoves and bear fruit, but they are not held in estimation so much as to be cultivated entirely for their fruit, as some other tropical fruits are. They are propagated by layers or cuttings.

PSOCIDÆ (Leach). A family of neuropterous insects, belonging to the section *Filicornes*, having the head not anteriorly produced into a rostrum; the first segment of the thorax very short; the second large and exposed; the wings deflexed at the sides, slightly reticulated, the posterior pair being the smallest; the tarsi are composed of two or three joints; the antennæ are setaceous and ten-jointed; the maxillary palpi exposed; the labial palpi indistinct. The family derives its name from the Greek, and signifies to pull to pieces, and is given to it in consequence of the habits of the larvæ, which, as well as the perfect insects, are found in old books, neglected collections of natural history, on old palings, under stones, &c. They are very active, running and flying quickly, and leaping out of the reach of danger. The larvæ resemble the perfect insects, both in habits and appearance; they are, however, unfurnished with wings, and unable to continue their kind; in the pupa state the wing covers are rudimental; the species are rather numerous, and of very small size. The type is the *Psocus quadripunctatus* (Fabricius), belonging to the typical genus *Psocus;* the other genus, *Atropos*, is described in its place.

PSORALEA (Linnæus). A genus of evergreen shrubs and herbs, mostly natives of Africa; they belong to *Leguminosæ*. They are all more or less ornamental, and one, the *P. esculenta*, having tuberous roots, is cultivated on the banks of the Missouri. It is the *Pomme de Prairie* of the Canadians, and affords, during winter, a nutritious farinaceous food. Several of the species are medicinal. They are easy of cultivation, and propagated by cuttings.

PSYCHE (Schrank). A very curious genus of lepidopterous insects, belonging to the family *Arctiidæ* (Stephens), having the body slender; the antennæ of the male bipectinated, of the females simple: the former sex is provided with ample wings, of which the

atter is entirely destitute, being moreover of very small size compared with the males. The wings of the males are semi-transparent, being clothed with hair rather than scales, a peculiarity characteristic of the *Trichoptera*, with which order these insects are still more nearly allied by the habits of the larvæ, which reside in cases formed of bits of twigs, leaves, &c. woven with silk. The following observations, communicated by Mr. Ingpen to Mr. Stephens, will be read with interest, involving as they do a curious point in physiological entomology :—

"In June last I procured a considerable supply of both larvæ and pupæ of *Psyche fusca*, found at Hornsey Wood, upon the hazel, sallow, &c., some only half the size of the others, from the largest of which I obtained four males and two females in the beginning of July; the larvæ in the smaller cases being still (Nov. 24) alive, from which I conceive that they remain at least two seasons, if not more, before they attain perfection, which opinion is strengthened by the fact of my taking the young larvæ*, on 17th July, 1827, under three-fourths of a line in length, including the case, which are now but four lines long, and which I fed at first on the leaves of the sallow, the cuticle of which they devoured, and with the downy portion they formed their cases; during the winter they remained fixed to the upper part of the inverted glass in which they were placed (having made the sides easy of ascent by covering them with a fine silken web), and in March they began to stir, when I supplied them with the buds of whitethorn and afterwards with sallow; they gradually increased the size of their cases, and added to them fine saw-dust and pieces of leaves, and after a few weeks they again became immoveably fixed, and from each of them the chalcideous parasites mentioned in the note were produced, and their extremely slow growth not only indicates their anomalous longevity, but satisfactorily shows why they are so obnoxious to the attacks of the parasites. The females never leave their cases," hence, Mr. Stephens adds, "how the union of the sexes takes place it is difficult to imagine, as the female does not leave her birth place, and the extraordinary smallness of the latter sex is very remarkable."

The genus, as restricted by English authors, comprises only a single species *Psyche fusca* (Haworth), the male of which is three-quarters of an inch in expanse, whilst the female is only one-sixth of an inch long; the wings on the male are entirely pale brown. The French entomologists, however, introduce into the genus the numerous small species, composing the genus *Fumea* of Haworth, which differ only in the rounded form of the wings and the straight pectination of the antennæ.

PSYCHODA (Meigen). A genus of minute dipterous insects, belonging to the family *Tipulidæ* and subfamily *Culiciformes*, having the wings broad, lanceolate and deflexed at the sides when at rest, the legs placed at equal distances, and the antennæ composed of a series of globular joints. These little flies have the body, wings, and antennæ clothed with long hairs which, with the position of the wings when at rest and their large size, give to them the appearance of very small moths. They are found in damp places, and some of the species may often be seen on the windows of our apartments. There are about a dozen species, the type being the *P. phalænoides* of Latreille.

PSYLLIDÆ (Latreille). A family of homopterous insects, belonging to the division *Aphidiens*, Latreille, having the antennæ composed of ten or eleven joints, the last being terminated by two setæ; the legs are formed for leaping; tarsi two-jointed. These are small active insects, found upon various vegetables upon which they form gall-like excrescences, by wounding the tender parts of the plants with their rostrum, for obtaining a supply of food. The larvæ have the body flat, the head large, and abdomen obtuse behind. The perfect insects are very active, and the females deposit their eggs in the midst of a mass of a white downy secretion. The family comprises three genera, *Psylla*, having the antennæ filiform, comprising numerous species (the type being the *Chermes buxi*, Linnæus) and *Livia*, having the antennæ short and very thick, and *Livilla*, Curtis's Brit. Ent. pl. 625.

PTEROCARPUS (Linnæus). A genus of tropical trees, belonging to Linnæus's class *Monadelphia*, and to the natural order *Leguminosæ*. The species are treated as stove plants, and are easily increased by cuttings. *P. draco* is one of the trees which exude, when cut, a reddish sap, called dragon's blood. This resin was formerly exported in great quantities from Carthagena; but, from diminished consumption of the drug, its collection has ceased; the produce of *Calamus draco* being now used as a substitute.

PTEROCERAS (Lamarck; Strombus, Linnæus). These molluscs have been separated from the Linnæan *Strombi*, in consequence of their not having the canal at their base shortened, or truncated, as is the case in the *Strombi;* it is, on the contrary, elongated in the form of a tail attenuated to its extremity, and generally closed in adult examples, the right margin dilated by age into an expanded *digitated* wing, attached to and covering the whole of the spire; the lower part interrupted by an interval or wide gap. This is not contiguous to the body of the shell (as in the *Rostellaria*), but distant and similar to that of the *Strombus*, which is only distinguished from this genus by the short canal and the want of digitations; we are therefore disposed to agree with the classification of Linnæus, particularly as a knowledge of the animal does not point out sufficient reason for separating it from the *Strombus;* which it closely resembles in all its organisation. Lamarck uses the term *digitations* generally for that portion of the shell which, in some species of this genus, may be more properly called claws, whence the trivial name of scorpion, or spider shell. In young molluscs of this genus these are not produced. The name given by Lamarck to this genus is derived from two Greek words, meaning a horn and a wing. Nearly all the species are inhabitants of the Indian ocean, and many of them exhibit the most beautiful colours on their lower or internal surface. Very few species are known in a fossil state. In Swainson's Exotic Conchology these molluscs are more faithfully and more exquisitely figured than in any other work extant.

PTEROMYS—Winged Mouse, or, more strictly speaking, Winged Squirrel. A very remarkable genus of rodent animals, formed, in some parts of their bodies, like the *petaurista*, or flying marsupial animals of Australia; but unlike them, and resembling the squirrels properly so called, in the structure of their teeth and in their general habits. They are furnished with large clavicles for their size, which gives a

* "Which larvæ, although taken so young, produced a great abundance of chalcideous parasites, in June last, the eggs of which must either have been deposited in the young larvæ upon leaving the eggs or in the latter, if not introduced upon the leaves upon which they were nourished."

powerful cross motion to the fore legs, so that these can be thrown outwards nearly at right angles to the axis of the body. The hind legs also are capable of very wide motion. In their system of teeth, their organs of sense, their mode of reproduction, and, generally speaking, in all the essential parts of their organisation and habits, they are true squirrels: and the description of them thus far may be referred to the article SQUIRREL. There is even, in some of the other squirrels, a slight approximation to what forms the distinguishing character of the present genus: the bodies of these are flat, they can spread their feet wide, and the skin of their sides stretches a little near the fore legs and flanks to break their fall. In the present genus the skin is regularly extended from the fore legs to the hind ones, covered with thick and soft fur, and forming a most efficient parachute. There is also a particular bone attached to the foot for supporting this membrane; so that, though this peculiar formation cannot be said to originate any of the motions of the animals, it enables them to leap much farther from branch to branch than if they had no extensile skin on the sides. This alone entitles them to be considered as a distinct group, and as such they are a very well marked one.

We need not say that these animals do not fly, or that the word flying is inaccurately applied to them; for there is no instance of a vertebrated animal performing real flight by the motion of any other bones than those of its anterior extremities. These animals can no more take a second leap, or gain a fresh impulse from the air as a fulcrum, than the heaviest of the mammalia; they can merely leap to a great distance, and it is this which is their habit in enabling them to pass from tree to tree, over considerable openings in the forest, without descending to the ground. We need not add that they are forest animals, because the apparatus with which they are furnished would be an incumbrance to an animal in any other locality. They are not found in the wooded countries of all parts of the world, but they range considerably in latitude, being found in polar countries, and also in tropical ones. They are met with in the woods of Canada and the United States, though not in the tropical or southern parts of America. Some of them occur in Lapland, and along the northern forests of the eastern continent, as far as the eastern part of Siberia. They are met with again in India, and in Java and some other of the eastern islands; but in Australia their place is occupied by those marsupial animals with laterally extended skin to which we have alluded.

Some naturalists have divided them into two sections or subgenera, according as they have the tail round, or broad and flat like that of the squirrel. The name *Pteromys* has been restricted to those with the round tails, from that being the form of the tail in a mouse; and those with the flat tails have been called *Sciuropterus*, or flying squirrels. The two divisions are pretty distinct from each other, both in this character of the tail, and in the nature of the places where they inhabit. Those with the round tails are larger and more handsome animals than those with the flat; and they are met with only in the warmer parts of America, and in the Asiatic islands; the flat-tailed ones are smaller, less handsome, and chiefly, if not exclusively, found in cold countries.

PTEROMYS. The tails in these are round, and the hairs do not stand out distinctly from each other. There are several species; but the nature of their haunts, and the rapidity with which they make their way among the thick branches of the trees, leaping fearlessly and smoothly where they cannot run, renders the study of their habits very difficult, and the consequence is that but little is known concerning them.

P. petaurista. This is the sailing squirrel, and also the great flying squirrel of the oriental isles. In the native language of the Malays it is termed *Jaguar*. The upper part of its body is brown, mottled with white; the under part greyish white, and the under side of the tail more or less brown, though above it is black for nearly the whole of its length; the thighs are red, and the feet brown; the borders of the mouth and around the eyes are blackish, the mustachios are black, and the cheeks and top of the head are mottled brown and white. The flying membranes form salient angles at the wrists, and there is a small rudiment of a membrane at each side of the base of the tail, united to the insides of the thighs, preventing the escape of the air in that way when the animal leaps. This is rather a large animal for the family to which it belongs, the head and body being about a foot and a half long, and the tail nearly one foot nine inches. It is understood that the habits of this animal are nocturnal, but very little is known of them. It occurs in the Molueca islands, the Philippine, and various other groups in the Eastern seas.

P. nitidus—the bright flying squirrel. This species inhabits the same part of the world as the former, though perhaps a little more to the westward, being more numerous in Java than in the isles further to the east. Its form and size are very similar to those of the preceding species, only it is, generally speaking, an inch or two shorter. Its colours are different, which makes its chief distinction, for its manners are just as little known as the other. The upper part is dark brown, and the under bright red. The tail is the same red as the under part at its base, but gets deeper toward the extremities. It is probable that this one is subject to some varieties of colour, because specimens have been met with agreeing with it in all their other characters, but having the belly white. There are some other species in the oriental islands, but they appear to belong to the flat-tailed section.

SCIUROPTERUS. The animals of this section have the teeth exactly like the common squirrels, while those of the former section have them different. In that section the teeth are simple teeth, without showing any layers of cortical matter, alternating with enamel in the crowns; and of course they indicate a difference in feeding, though it is not known in what the difference consists. The present section, which have cheek teeth like the squirrels, must of course be understood to feed upon the same substances and in the same manner as squirrels do.

S. sajitta. This species is found in Java and the adjoining islands, and differs from those of the former section in size, as well as in the structure of the teeth and in the form of the tail. It is only five or six inches long in the head and body, and nearly the same in the tail. Its prevailing colours are brown on the upper part, and white on the under. The lateral membrane forms a sharp saliant angle behind the rest, the same as in the animals of the former genus.

S. genibarbis, called Kechubu in Java, is about the

same size as the preceding, and the chief difference between them consists in the colour, the upper part being grey, the under part whitish, and there are long stiff hairs on the cheeks and sides of the head, which appear to serve as organs of touch in the living animal.

S. Sibericus, the common flying squirrel, is a native of the forests in the colder parts of Europe and Asia. Its residence is in the pine forests, and it is not rare in Sweden, Finland, the wooded tracts to the east of the Baltic, and so on eastward through Russia and Siberia. Its colours are ashey grey on the upper part and white on the under; its tail is broad, and only about half the length of the body; and the lateral membrane, instead of forming a sharp angle behind the rest, forms a simple lobe. It jumps with great alacrity, and very seldom misses its hold or falls to the ground; it is a lively little animal, and far from being the least interesting inhabitant of those dreary forests in which it resides. It has sometimes been confounded with the North American species, but they are perfectly distinct. In Cuvier's arrangement it is very properly taken as the typical animal of the sub-division. The name given to it by the Russians, who capture it in great numbers as a fur animal, is *polatuca*, which name was Frenchified by Buffon, and applied to the American species.

S. volucella. This is the American one, found abundantly in the wooded parts of the United States, where the animals associate in little companies, and give much liveliness when they are put in motion. They live upon fruits, seeds, and the buds of plants. It is a very small animal, not above five inches long in the body, or two and a half in the tail. Its colours are reddish grey above and white below. It is a lively little animal when in motion, but its chief time for activity is during the night. When kept in a cage it generally sleeps at the bottom during the day, but skips and frisks about with restless activity after night begins to set in. It does not appear that America contains any more than this one species.

PTERONIA (Linnæus). A genus of evergreen shrubs, found at the Cape of Good Hope. The flowers are syngenesious, and belong to *Compositæ*. They are easily managed greenhouse plants.

PTEROPHORIDÆ (Pterophorites, Latreille; Alucitidæ, Leach). A family of small nocturnal lepidopterous insects, distinguished from all other lepidopterous insects, by having the four wings, or two at least, slit longitudinally from the extremity to the base, and resembling branches or fingers, and deeply fringed, so as to have the appearance of feathers, whence these insects have obtained the names of plume moths. Their caterpillars are sixteen-legged; they feed upon leaves of various plants, and do not construct cases, like some of the *Tineidæ*. The body of the perfect insect is long and narrow, and their legs very long, so that many of the species (composing the genus *Pterophorus*) have so much the appearance of *Tipulæ*, that De Geer called them *Phalenes-tipulæ*. The genera are *Agdistes*, *Pterophorus*, and *Orneodes* (or *Alucita*). In the first, consisting of a single species, the wings are entire, but the whole appearance of the insect of which it is composed is so similar to that of the true *Pterophori*, that it must evidently be placed in the family. In *Pterophorus* (*Alucita pentadactyla*, Linnæus, &c.) the upper wings are divided into two branches, and the posterior into three; whilst in *Orneodes* (*Alucita hexadactyla*, Linnæus), the wings are divided into six feathers.

PTEROPODA is the second family of the third order *Cyclobranchiata* of modern malacologists. It includes the genera *Atalanta*, *Spiratella*, and *the never-to-be-determined inhabitant of the* Argonauta. See that article. The name of this genus is derived from an aliform appendage on each side of the animal's body, assisting its natation after the fashion of oars. The shells themselves are always symmetrical, extremely thin, semi-transparent, and longitudinally rolled from the apex forward, the evolutions being on the same plane.

PTEROSTYLIS (Dr. Brown). A genus of New Holland *Orchideæ*, introduced into our collections within these last twenty-five years. They succeed best in a frame, and in peat earthy soil, requiring only to be protected from frost.

PTEROTRACHEA (Lamarck). A naked mollusc, inhabiting the seas of hot climates. This genus at present only contains marine carnivorous molluscs, described by Semur, and it is not by any means sufficiently well defined to follow his arrangement without a further knowledge of them.

PTINIDÆ (Leach). A family of coleopterous insects, belonging to the section *Pentamera* and sub-section *Serricornes*, having the antennæ nine or eleven-jointed, sometimes pectinated or serrated, or in some species terminated by three large joints, not forming a solid club. The mandibles are short and triangular, the head short and rounded, or nearly globose, and hidden from above by the thorax, which is high and hood-like; the body is generally ovoid-cylindrical, convex above, and of a solid consistence.

The genera of which this family is composed are—

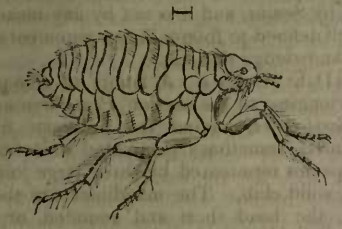
1. Antennæ uniform and simple. *Ptinus*, *Gibbium*, and *Mezium*.
2. Antennæ uniform, pectinated, or strongly serrated. *Ptilinus*, *Xyletinus*, and *Ochina*.
3. Antennæ terminated by three large joints. *Dorcatoma*, *Anobium*, and *Dryophilus*.

These insects reside in old wooden erections or furniture, upon which the larvæ feed, boring through them in circular holes. These larvæ very nearly resemble those of the *Scarabæidæ*, the body being fleshy and curved; they construct a cocoon with the fragments of wood which they have been gnawing, and therein undergo their transformations. The perfect insects counterfeit death, when alarmed, by lowering the head, withdrawing the legs and antennæ, and falling to the earth. Their ordinary movements are slow, and they seldom make use of their wings. The best known genus is that of *Anobium*, which comprises the insects commonly named the Death-Watch (which see).

The genus *Ptinus* is distinguished from the other genera with simple antennæ, by the ovoid-cylindrical form of the body, and the insertion of the antennæ between the eyes. There are eight or nine British species, all of which are of small size.

PULEX (Linnæus). A genus (or rather Pulicidæ, a family) of apterous insects, forming the order *Aphanaptera* of Kirby (*Siphonaptera*, Latreille), consisting of the various species of fleas. It is certainly a circumstance of some singularity that the three troublesome genera, *Pediculus*, *Cimex*, and *Pulex*, consisting of the lice, bug, and flea, should, both in a natural-history point of view, and with reference to their peculiar organisations, and consequent classifi-

cation, have proved perfect stumbling-blocks to philosophical entomologists. The peculiarities connected with the first of these groups we have sufficiently noticed in page sixty-three of the present volume; whilst the apterous condition of the second, in an extensive group of animals which are almost invariably winged, or at least wing-cased, is not without interest; and we have now to direct our attention to the flea. We take it for granted that some, perhaps many of our readers, will smile at our folly, as they will perhaps term it, in investigating the structure, history, and classificational station of the flea; but, as it happens that a knowledge of the structure, history, and classificational station of every animal is required to enable us to perfect our views of natural history; and as it also happens, as above remarked, that the flea is one of those anomalous creatures which, in all these points of view, have much perplexed entomologists, our enquiries may not, perhaps, after all, be so absurd as they might at first appear.



The Flea (*Pulex irritans*).

The body of these insects is of small size, of a hard shining integument, clothed with sharp bristles, arranged in tranverse series upon the back and on the legs. It is very much compressed and apterous; rudiments of wings and wing-cases exist in the shape of two flattened plates on each side of the body above the posterior legs; the head is small; the mouth in the form of a rostellum, consisting of the six ordinary parts of an elongated form, and provided at the base with a pair of articulated organs, which have been regarded as antennæ, but which are in fact the maxillary palpi; the true antennæ are of minute size, and inserted in a cavity on the side of the head which is ordinarily closed by a moveable valve; the basal joint of the fore legs is horizontal, and extends beneath the head, so that the fore legs appear to arise from the head; the legs are strong, and formed for leaping to a very great distance; the tarsi are five-jointed, and terminated by two large hooks.

We are indebted to Messrs. Kirby, Curtis, and Duges, for valuable dissections of the various essential organs of the flea, which, previously thereto, had not been satisfactorily ascertained; consequently, as palpi were regarded as antennæ, antennæ overlooked, &c., it is no wonder that views concerning these insects and their relations should have been imperfect.

Of the history of these insects, in their perfect state, we need not say much. Every one has probably, at one time or other, suffered from their bites, and felt, at the same time, the impossibility of securing the little tormentor, which "comme l'amour, rit en sûreté de la blessure qu'elle a faite et de la colère qu'elle occasionne." But the flea does not always escape, nor is it always regarded with disgust. "Dear Miss," said a lively old lady to a friend of mine (who had the misfortune to be confined to her bed by a broken limb, and was complaining that the fleas tormented her), "dont you like fleas? Well, I think they are the prettiest little merry things in the world. I never saw a dull flea in all my life*." M. Bertolotto, the flea exhibitor, must be a man of infinite patience to train his regiment of fleas as he has done, producing an exhibition in which a first-rate man of war, of 120 guns, with rigging, sails, anchor, and every thing requisite in a three-decker, not omitting a numerous crew, placed on a car of gold with four wheels, are drawn by a single flea. A four-wheeled carriage, on springs, with four persons inside, the coachman on the box, and a footman behind, is drawn by a single flea. A gold chain of two hundred links, with a golden ball at the extremity, is drawn by another flea. Fleas, with golden saddles, bridles, &c., carry figures of proportionable size, representing Buonaparte and one of his aids-de-camp. Another flea draws up and lets down a bucket from a well; and two others fight a duel. There is, moreover, a representation of the siege of Antwerp, in which the fort is attacked by fleas with fire-arms and cannon, the explosion being heard by the visiters, and General Chassé and Marshal Gerard appearing on horseback, or, more properly, on fleaback, which is succeeded by a grand ballet, in which four of the performers (fleas), dressed in male and female attire, dance a quadrille to the music of a band of fleas playing on different instruments, of which the tones are audible to the company, and which is again succeeded by a representation of his Majesty's stag-hunt, the stag and his pursuers being personified by fleas.

Many of the readers of popular works on natural history will know that some of the feats performed by M. Bertolotto's fleas are not new, and that similar kinds of exhibitions have from time to time been made with the flea; but it is not every reader who is aware that the flea undergoes a series of transformations as great as those of the butterfly or the bee. On opening the body of a female flea ten or a dozen oblong eggs, of a rounded form and white colour, are discovered, which are deposited by the female in obscure places, such as cracks in the floor, or amongst the hairs of rugs, where dogs are accustomed to lie. From these eggs are hatched long worm-like grubs, which twist about in all directions, and which, having attained their full growth, form for themselves silken cocoons, when they become incomplete inactive pupæ, having the rudiments of all the limbs of the future insect visible. These larvæ are supposed to feed upon drops of congealed blood, which may be found lying with the eggs. Such, at least, is the opinion of M. De France, who has published a Memoir upon this subject in the first volume of the "Annales des Sciences Naturelles;" but this part of the history of the flea is certainly not clearly ascertained. This author collected some eggs on the 23rd of August; on the 9th September they began to form their cocoons; and in sixteen more days they appeared in their perfect state. Thus we see there is no ground for the old notion, which Mouffet entertained, that the flea is produced from the dust, especially when moistened with urine, the smallest ones springing from putrid matter; or that recorded by Scaliger, that they are produced from the moistened

* Introduction to Entomology, vol. I, p. 102.

humour of dogs. It is certain, however, that the name given to the insect by the Romans, *Pulex*, is stated by Isidorus to have been derived from *pulvis*, dust, "quasi pulveris filius." It is to Leuwenhoeck and Rosel that we are indebted for a complete refutation of these fancies, these authors having first succeeded in rearing the insect through all its stages.

Having arrived at their final state, they commence their attacks upon us, or upon our animals, as well as upon pigeons, fowls, swallows, &c. They are very tormenting to dogs, cats, &c. The customary idea of sending dogs into the water to get rid of their tormentors is quite erroneous, as it has been ascertained, by M. De France, that fleas which had been kept under water for twenty-two hours had survived. Various plans have been suggested for destroying them, but there is nothing like water, soap, and the housewife's broom.

It is admitted on all hands that these insects, on account of their peculiar structure and transformations, constitute a distinct order amongst the metamorphotic insects. Fabricius, indeed, regarded them as belonging to his order *Rhyngota*, containing the suctorial *Hemiptera*; and it was long thought that they were very nearly allied to the bug in the formation of the mouth. In their transformations, however, they are much nearer to the *Diptera*. De Geer formed them into an order which he called *Suctoria*. Latreille named the order *Siphonaptera*, Kirby *Aphanaptera*, and Lamarck restricted the name *Aptera* for their reception. By Latreille they are placed between the *Pediculi* (order *Anoptera*) and the *Coleoptera*. The diversity in these views, and the celebrated men by whom they have been entertained, will be sufficient to show the interest which attaches to this group of insects.

We have already given, in the article CHIGRE, an account of an insect of this family of a very obnoxious nature, namely, the *Pulex* (*Sarcophaga*) *penetrans*. Since our article was published, we have seen a translation of Messrs Pohl and Kollar's account of the same insect, published in the Magazine of Natural History, and accompanied by various figures; but it still appears that there are many important questions in the history of that insect which remain to be investigated.

Of the other species of the family, *P. irritans*, or common bed-flea, and the *P. canis*, or dog-flea, are best known. Some of the other species are remarkable for having the antennæ protruded from the lateral aperture of the head, and standing erect like a rabbit's ears. Mr. Curtis has formed these species into a genus named *Ceratophyllus*.

PULMOBRANCHIATA. The first order of the second class *Paracephalophora* of modern malacologists. Molluscs of this order have their organs of respiration retiform or aërial, lining the upper part of the cavity obliquely situated from left to right on the origin of the animal's back, and communicating with the ambient fluid by a small round orifice pierced on the right side of the reflected edge of the mantle. All the molluscs of this order are more or less capable of respiring atmospheric air; the greater number of them are terrestrial; some exist on the banks of fresh water, and sometimes on the border of the sea, none of them ever bury themselves in the mud, being incapable of existing long without a supply of air, except such as hybernate during the winter season, viz., snails and their congeners, they are all phytophagous or vegetable feeders, and abound in all climates and portions of the globe. The first family *Lymnacea*, includes the genera *Lymnæa*, *Physa*, and *Planorbis*; the second family *Auriculacea*, a portion of the Linnæan genus *Voluta*, and the genera *Pedipes*, *Auricula*, and *Pyramidella*; the third family consists of the genera *Helix*, *Succinea*, *Bulinus*, *Achatina*, *Clausilia*, *Puppa*, *Caracalla*, *Helicella*, *Helicolimax*, *Testacella*, *Parmacella*, *Limacella*, *Limax*, and *Onchidium*. The species of this order are extremely numerous, many of them exhibiting the most brilliant tone of colours combined with the greatest delicacy of marking; and our common field-snail, the *Helix nemoralis*, may be quoted as an instance of an European mollusc vying in beauty with any of oriental origin, a circumstance rarely exhibited in shells of these northern latitudes. The facility which many species of this order affords the naturalist of consulting and examining the structure of testaceous molluscs renders them peculiarly interesting, and the animal organisation is so marvellous, that every young malacologist should patiently watch the development and habits of the snail, in which he will find many difficult solutions of Nature's operations more readily understood than the most able writer could explain; by this humble preceptor he cannot for one instant be led astray in drawing false conclusions as to the structure of all testaceous molluscs, and more particularly such as are univalve shells. Under the article CONCHOLOGY this fact is more amply detailed, we will not, therefore, longer dwell upon it, merely acknowledging our own gratitude for the instruction and delight we have derived from this source.

PULMONARIA (Linnæus). A genus of North American and European herbaceous perennials, bearing pentandrous purple, blue, or white flowers, and belonging to *Boragineæ*. These hardy plants grow on any light garden soil, and are known as lungworts from the speckled appearance of their leaves. Several of them were formerly known as *Lithospermums*.

PULTENÆA (Smith). A genus of greenhouse or conservatory evergreen shrubs, natives of New Holland. The flowers are decandrous, and the genus ranks among the *Leguminosæ*. The species, which are pretty numerous (above forty), thrive well in loam and heath-mould, and are increased by cuttings.

PUNICA (Willdenow). A genus of two shrubs or small trees, bearing beautiful icosandrous flowers, and belonging to and constituting the order *Granatæ*. Of one of the species *P. granatum*, there are three varieties differing in the colour and fulness of the flowers. See POMEGRANATE.

PUPA. One of the states through which the metamorphotic insects pass immediately preceding that of the imago or perfect form. See the article INSECT.

PUPIPARA. A group of dipterous insects, which do not bring forth their offspring until it has attained the pupa state. See HIPPOBOSCA.

PUPIVORA. A section of hymenopterous insects, which are parasitic upon other insects, which they generally destroy in the pupa state. See HYMENOPTERA.

PUPPA (Lamarck; TURBO, Linnæus). This genus of molluscs has very properly been separated from the *Turbines* of the Linnæan school, from which and the *Helices* this family is perfectly distinct; they

more nearly approximate the genus *Clausilia*, with which it properly should be united, as the animal is now ascertained to be precisely similar in its organisation. Shells of this genus are mostly terrestrial, few of them attain a large size, and many of them are quite minute; their form is cylindrical, generally thick, aperture irregular, half ovate, rounded, and sub-angular at the lower part; the margins nearly equal, reflected outwards, and separated at the upper part by a thin columella lip; the whorls at both extremities nearly of an equal size, while those of the body are larger and more ventricose. Some inhabit America, but the greater portion hitherto described are natives of Europe, many must also exist in India and Africa not yet enumerated by naturalists. Only one species in a fossil state is mentioned by De France.

PURPURA (Lamarck; Buccinum, Linnæus). This genus was blended by Linnæus with the genus *Buccinum*; it is the last in Lamarck's arrangement of that confused mass which presents the appearance of a canal at the base of the aperture, it consequently leads in order of proximity to the genera *Monodon*, *Concholepas*, *Harpa*, *Dolium*, *Buccinum*, &c., in all of which the canal has quite disappeared, and a notch merely remains. The gradual diminution of the canal, till it became altogether obsolete, probably occasioned Linnæus to arrange some of the species with the Murices, and others with the Buccina; there are, however, characters which distinctly mark this genus, and render it necessary to separate the molluscs composing it from the arrangement of previous authors. The aperture is never narrowed in the middle, either by plaits on the columella, or by teeth on the right side, but is always dilated; the columella is smooth, flattened, and terminating in a point at the base, where the notch is more or less obliquely placed, and appears a little ascendant backwards. The form of the shell is oval, either smooth or tuberculated, or angular on the exterior surface; the aperture ovate, dilated, sometimes internally grooved and slightly crenated or dentated at or near the right margin which is sharp. It has a semi-lunar shaped thin, horny operculum. The species of this genus probably amount to sixty, a few only of which inhabit the northern seas. The animals of many of these molluscs secrete a fluid which possesses a purple-tinged colour, but one in particular furnished that celebrated and costly dye of antiquity, called the Tyrian purple, now superseded by vegetable and mineral matter, at a price within the reach of every one, and not inferior in lustre.

PYCNOGONUM (Müller). A genus of marine aquatic arachnida belonging to the order *Podosomata* of Leach (see Arachnida) having the legs as short as the body, and robust, the antennæ and palpi obsolete. They are parasitic upon the cetacea, the type *P. balænarum* being about three-quarters of an inch long, and of a whitish colour (see Nymphon). Both in respect to their general appearance and parasitic habits this genus is very analogous to that of Cyamus (which see).

PYRALIDÆ (Leach). A very extensive family of small lepidopterous insects, belonging to the section *Nocturna*, and having the antennæ setaceous, and but very seldom pectinated; the palpi two, recurved, or four; the thorax not crested; the body long and slender; the wings placed in a triangle in repose, the anterior pair being rather elongate and glossy. There is considerable diversity of appearance in these moths, which were united together with the *Tortricidæ* by Latreille; and some of these species, including the type *Pyralis rostralis*, Linnæus (forming the genus *Hypena* of Schrank), are of considerable size, being more than an inch in expanse, but the majority are of a smaller size. They are in general active on the wing. The larvæ have fourteen or sixteen legs, those at the extremity of the body never being deficient; they are naked, or have only a few scattered hairs. They often reside in a rolled up leaf in which, having first closed up the mouth, they change to pupæ. Mr. Stephens has established nearly thirty genera in this family, in his Illustrations of British Entomology

PYRAMIDELLA (Lamarck; Trochus, Linnæus). This mollusc has been separated from the genus *Trochus*, to which Linnæus united it, principally because Lamarck supposed it a terrestrial species. The animal is, however, undescribed, and there appears no strong ground for supposing it other than a marine inhabitant. The shell is subconical, turreted without an epidermis; aperture semioval entire, and the outer lip sharp, the lower part of the columella a little projecting and sub-perforated at the base, with three transverse plaits; the umbilicus enlarged; about five living species are known, which are said to inhabit the Indian and American seas. Several fossil species are known, all from formations posterior to that of the chalk.

PYRETHRUM (Smith). A numerous genus of annual, biennial, and perennial herbs and shrubs, mostly European. The flowers are syngenesious, and belong to *Compositæ*. The shrubby species are green-house plants, and desirable as flowering in winter; the herbaceous sorts, commonly called feverfew, grow any where in the open ground.

PYROCHROIDÆ (Leach). A family of heteromerous insects of small extent, belonging to the section Trachelides, having the body narrowed in front and depressed, the thorax orbicular or trapezoidal. The antennæ, in the males at least, are pectinated, the maxillary palpi somewhat serrated, and terminated by a hatchet-shaped joint; the abdomen is elongated, and entirely covered by the elytra, which are rounded behind. These insects are gaily coloured, and are found in the spring months in hedges, &c. The larvæ reside under the bark of trees. That of *Pyrochroa coccinea* has been recently described and figured in the Revue Entomologique de Silbermann. The family comprises only two genera, *Pyrochroa*, Geoffroy, and *Dendroides*, Latreille, the first of which is British, and is distinguished by the antennæ of the males being simply pectinated, the eyes apart, and the thorax sub-orbicular. There are two handsome British species, *Pyrochroa rubens*, a very common species, of a fine red colour, and *P. coccinea*, of a bright red, with a black head.

PYROSOMA. A very singular naked mollusc, whose discovery is due to M. Lesueuer; it inhabits the Mediterranean and Atlantic seas; three species are known.

PYRULA (Lamarck; Murex, Linnæus). The molluscs constituting this genus, as well as many other of different genera, were confounded by Linnæus with the genus *Murex*, in the classification of which he appears to have included all the shells having a canal at the base, rendering it an extremely incorrect and widely-extended genus. Bruguière,

who separated them the first, was only guided by the want of varices, and he did not distinguish the pyrula from the fusus, from which it widely differs; the spire of the former being short and very much depressed, and the last whorl extremely large and ventricose, frequently extending at its margin above the elevated point of the spire, and giving the shells of this genus the form of a fig or pear, which never occurs with the genus fusus. The pyrulæ are in shape subpyriform, channelled at the base, without varices; columella smooth, and without a notch at the lip, to which may be added, that the edge of the aperture is most generally crenulated. The substance of this shell is very thin, semi-transparent, and with internal and external slight transverse ribs, interrupted by the sutures formed at the previous stages of the growth of the opening; they possess most of them a very wide umbilicus, and the aperture is closed by an ovate pear-shaped horny operculum. The animal is at present undescribed. About twenty-eight species are known, in a recent state, only one or two of which inhabit the Northern seas. Some fossil species are described.

PYRUS (Linnæus). A genus of ornamental and fruit-trees, the latter forming the chief of our orchard fruit, viz. the pear and apple. The service, whitebeam, medlar, Siberian crab, &c., all belong to this genus, and to the natural order *Rosaceæ*. The varieties of these different species are most valuable, and are propagated by grafting on the common wild crab, or on their own seedlings.

PYURA (Molina). A species of Ascidea, evidently forming the connecting link in malacology between the simple and aggregated Ascideæ.

QUADRUMANA. Animals having the extremities of all their limbs formed like hands, including apes, baboons, monkeys, and a few others, for which see those articles, and the general article MAMMALIA.

QUARTZ. There are few mineral productions more beautiful or diversified than rock crystal or quartz. It is of great specific gravity, and its hardness fits it for the most enduring labours of man. It is frequently milk white, and of a more or less granular texture. The Sugar-Loaf Mountains near Dublin, the Paps of Jura in Argyleshire, and some of the mountains of Sutherland and Caithness present well-marked instances of this geological formation. Brown and yellow crystals of quartz are found in great beauty in the mountains of Cairn Gorm in Scotland, and are much admired by the jewellers: they are sometimes called topazes. The purple quartz owes its beautiful colour to the presence of a little iron and manganese, and the rose quartz to the action of manganese alone.

QUASSIA (Willdenow). A South American tree having diandrous flowers, and belonging to the natural order *Simarubaceæ*. The generic name commemorates a negro of that name, who first used the bark as a medicine, and administered it with success in the treatment of malignant fevers endemical to Surinam. Quassia bark is sometimes surreptitiously used instead of hops, but a penalty attaches to the public brewer who uses it. It is neither so pleasant in beer, nor will the beer keep so well as if made of hops.

QUEEN BEE. The name usually given to the only fully developed female insect in the community of the hive, all the other inhabitants being either males, or drones, i. e. females, whose development has been rendered partially abortive by reason of a certain peculiarity of food. See the article BEE.

QUERCUS (Linnæus). Of all hardy forest trees this genus is perhaps the most interesting as well for ship and other building, as for its grandeur in landscape and value of its fruit as pannage. The oak bears monœcious flowers, and belongs to the natural order *Amentaceæ*. There are already described sixty-two species and above twenty varieties, all natives of Europe and America. Some of them are shrubs, but the great majority are useful timber-trees, and at the same time highly ornamental. They are all propagated by seed when they can be procured, though some of the choice American kinds are increased by engrafting on the common British oak. There are two species (or one species and one variety) in the native woods of Britain; and it is somewhat remarkable that it is not yet (1837) clearly ascertained which of the two is the true naval oak of this country. The botanical difference between the *Q. robur* of Linnæus and the *Q. pedunculata* of Willdenow, is the circumstance (perhaps accidental) of the latter bearing its acorns on footstalks, while the former has its acorns *sessile*, that is, sitting close upon the bearing twigs. The *pedunculata* is a more elegant and freer growing tree; but the *robur* or sessile fruited has more the tufted and picturesque character of the British oak. That the timber of one of these is superior in durability to the other is well known to builders, but the best of the two has not yet been identified; some being of one opinion, and others of another. The authority of *mere* botanists is of no value in this question; and from the evidence of an eminent builder, Mr. Atkinson, it appears that the *Q. robur* yields the superior timber. This is a question of the greatest importance to nurserymen who raise seedlings for sale.

Besides timber, the bark is most valuable for tanning leather and cordage. The *Q. suber* yields the material for the manufacture of corks; the *Q. tinctoria* supplies the quercitron, and the *Q. coccifera* the galls for dying.

QUINCE is the fruit of the *Cydonia vulgaris* of Tournefort. A common orchard fruit used by the cook and confectioner.

QUINOA. The specific name of a *Chinopodium* indigenous and cultivated in Peru for its seeds, which are used in that country as millet is in Europe. It has been introduced here as an economical plant, but does not answer.

QUISQUALIS (Linnæus). A genus of climbing shrubs, natives of Africa and the East Indies. The flowers are decandrous, and the genus belongs to *Combretaceæ*. The species (except *Q. indica*) are not much known in our collections; but they seem to be easy of culture, striking root readily by cuttings.

QUIVISIA (Cavanille). A pretty genus belonging to *Meliaceæ*. It is a stove plant introduced from the Isle of France, and succeeds well in heath-mould and sand, and in which soil cuttings strike roots freely.

RACOON (*Procyon*). A genus of plantigrade carnivorous mammalia, having some resemblance to the bears, but still sufficiently distinct for being regarded as a separate genus. Their cheek-teeth are

six in each side of each jaw, the three posterior ones tuberculated, and the three anterior with sharp points; they range in a more uniform line than in the bears, which have the anterior cheek-teeth small, and not lasting; the canines of the racoons are flat lengthwise, and straight in their axes; the tails of the animals are also long, but in other respects their bodies are very like miniatures of bears. The carnivorous tooth bears a considerable resemblance to that of the cat family, and thus shows that the habit of the animal is more decidedly carnivorous than that of the bear. The head is large, and triangular in the profile, and the muzzle is slender and pointed, but not so much produced as in the *Coati*; the ears are short, and of an oval shape; the eyes are of mean size, and have the pupils round; the tongue is soft and smooth. The females have six mammæ, which are seated in the groin; the legs are short, and they have five toes upon each, armed with sharp and crooked, but not retractile claws. Though this genus of animals is included in the plantigrade group, it is not so decidedly plantigrade as some of the others. It is true that, when it stands still, it applies the whole sole of the foot to the ground; but, when it walks or runs, it raises the heel, and rests on the fore part of the foot only. It is thus a much more nimble animal than the bears; and, though its habits are not very well known, it is understood to be an expert climber, using either the claws or the embrace, as may be best, and speedily getting to the tops of the highest trees. They eat indiscriminately animal and vegetable substances; and in the state of nature they are understood to be great destroyers of eggs. Their sagacity is considerable; but still, as they are not very powerfully armed, they are rather timid animals, and do not approach dwellings with the same hardihood as animals decidedly carnivorous. There are two species, both inhabitants of America, though not of the northern parts of that continent.

The Common Racoon (*P. Lotor*). This is the one which is best known. It inhabits the warmer parts of America, especially Guyana; but it is rather an animal of concealment, and therefore its manners are but little known. In size, and in the colours of its fur, it bears some resemblance to the foxes, but this resemblance does not extend far; the hairs are white in the middle, and black at the roots and the points, which produces a kind of grey resembling that which covers what are called the black and silver foxes; the tail is deep russet, surrounded by four or five rings of black; the under parts of the body are whitish, and so are the feet and the face, with the exception of a black band, which begins near the eye, and extends down the side of the neck; the claws have more the character of digging than of prehensile claws; the soles of the feet are furnished with five elastic tubercles upon each, one near the heel, one at the base of the thumb of the first toe and of the last toe, and the remaining one between the basis of the two middle ones, which toes are longer than any of the others; notwithstanding that it is partially digitigrade, and does not apply the whole length of the foot at every plant, the racoon is rather a clumsy walker, and their gait may be described as being heavy compared with the true digitigrade animals, though it is light as compared with that of the bears. They can readily stand erect on their hind feet, and lay hold with their fore ones; but this operation of grasping is not performed by the contracting of one paw, but by pressing both together. They do not possess the same pliability in the internal part of the fingers as the quadrumana, but, by clasping both paws together, they can by this means carry their food to their mouth. The animals have a habit of plunging their food in water, and then rolling it between their paws, before they devour it. Their sight is very delicate, and they have great difficulty in distinguishing objects in the bright sunshine, or any other strong light. In the day-time they generally remain inactive, seated on their posteriors, with the head reclining between the thighs, thus presenting the appearance of a ball; but, in the night, they evince considerable activity in roaming abroad in quest of their food, which consists of worms, insects, fruits, and the roots of plants. They move about in all directions on the surface of the earth, searching the most minute and unfrequented holes and corners in quest of these; and they also climb trees with great dexterity, for the purpose, no doubt, of robbing and plundering the nests of birds. They are particularly fond of drinking water, which they do by sucking it up into the mouth, and there is no necessary of life on which they seem to set greater value, or to relish more. They are said to frequent the banks of rivers and the sea-shore, for the purpose of catching mollusca and fishes, which are their most favourite food. They are very delicate in the sense of smelling, but their organs of hearing are very imperfect. Their appearance resembles the bears more than any other of the carnassiers. Their generally fat condition of body, together with the thickness of fur with which they are clothed, gives them a clumsy rotundity of form. They have an extremely tufted tail, but it does not appear to be employed for any particular purpose in the economy of the animal. They are by no means difficult to tame—soon become familiar—and seem to court caresses; but they do not seem to possess the quality of attachment to their master, or the docility to obey his commands. In order to prevent them from escaping, it is necessary to keep them chained up; for, though captivity softens their nature to a considerable extent, they never seem to yield up that spirit of independence which they possess in the wild state.

Animals of this species have been frequently brought to Europe, and thus people are well acquainted with its form and structure; but very little is known of its economy in a state of nature, as this can never be learned from an animal in a state of confinement. We do not know the period of gestation, or the numbers of the young, though, from the six teats on the female, one might be inclined to suppose that it is considerable. Something must no doubt depend on the fact of all the teats being in the groin, for females which produce numerous litters generally have them distributed over a considerable length of the under part. In some parts of South America there are either different species or variously-coloured varieties, as some are of a rosy hue, and others are yellowish. In other respects, however, they are much alike. The fine fur of all of them felts remarkably well, has a fine lustre, and retains its colour well when dyed, so that it is in considerable request with the manufacturers of hats.

The Crab Racoon (*P. cancervorius*) is an inhabitant of the warmer parts of South America, where it frequents the shores of the sea and the banks of the rivers, where it subsists in considerable part upon

molluscous and crustaceous animals. The other one is very partial to the same kind of food when in confinement, and therefore has its food and feeding in a state of nature little known. They very probably bear a good deal of resemblance to those of this one. This is rather a larger animal than the common racoon, but it has the tail shorter. The fur upon it is shorter, but closer, finer, and more valuable than that on the other. Its general tint on the back is brownish-ash, produced by the mixture of black, grey, and yellow; the black predominates on the middle of the back, and also on the head and neck, but the general tint becomes lighter toward the sides, where the dull brownish yellow is nearly entire; the feet are brown; and the tail, though short, is marked with a greater number of black rings than that of the common racoon; the end of the nose is black; and a blackish-brown patch surrounds the eyes, reaches back on each side nearly to the ears, and the two portions meet together on the top of the head; the cheeks, sides of the jaws, fore-neck, breast and belly, are yellowish-white. As this species of racoon is less in the woods, and more in the open places, than the former, and as the shores of the wooded parts of South America are the places most easily explored, a little more is known of the habits of this one in wild nature than of those of the other. According to the accounts, its breeding-time is in May, and the litter generally consists of three. The two species have, however, been much mixed up with each other in the popular description; and the racoons and the coatis have sometimes had each other's descriptions applied at rather cross-purposes. Altogether, the animals of South America require to be carefully examined, as the manners of most of them are peculiar, and very little known.

RADIOLA (Dillenius). A small curious annual, a native of Britain, called allseed. The flowers are tetrandrous, and the plant belongs to *Lineæ*.

RAFFNIA (Thunberg). A genus of undershrubs from the Cape of Good Hope, belonging to *Leguminosæ*. The species, of which there are several, succeed well with ordinary greenhouse treatment.

RAIA, the rays or skate, or more correctly perhaps, Raiidæ, the skate family—a very remarkable family of *Chondropterygous* or cartilaginous fishes, resembling in their physiology the shark family much more than any other; and following in their forms the angel-fish or monk-fish of that family. There are very great differences between them in the details of their appearance and form, as well as in the estimation in which their flesh is held as food; but notwithstanding this, there is a strong family likeness that runs through the whole of them.

They form a family hardly less numerous than that of the sharks. Their bodies are flat and much extended in breadth, with the exception of the tail, which is usually long, slender, and round, and very frequently carries the dorsal fins as well as the caudal one. Though the body of the rays is often much flatter and broader than that of the flounders and other flat fish properly so called, it is not flattened in the same manner. The flat fish is compressed, that is, it is narrow and deep; the ray, on the other hand, is depressed, or broad and shallow. There is accordingly no twist in the head or neck of a ray, and the whole body of it can be symmetrically divided on the mesial plane. The great breadth consists in the extraordinary development of the pectoral fins, which extend along the sides and run into, and sometimes in advance of, the snout. They do not keep to the banks and the bottoms as the flat fishes do, but range far to sea, and are, like the allied family of the sharks, powerful swimmers. They almost all grow to a great and sometimes to an enormous size; there really not being any known limit to the size, or even the age of any one of them. The broad part is frequently of a sort of rhomboidal form, with two angles in the snout and base of the tail, and other two in the longest parts of the pectorals. The general form resembles that of a paper kite, tail and all. The action of their enormous pectorals is so powerful in the water, that they have been compared in that element to the birds of prey in the air; for as these drive along the sky for long distances, so do the others range over the breadth of the wide seas and oceans.

The backs of the rays are variously coloured, but the under sides of all are white. The eyes and the air-holes are on the upper surface of the head: and the nostrils, mouth, and openings to the gills on the under side. From the position of the eyes, it is by no means likely that they can be of much use to the animals in directing the mouth toward the prey. But the mouth is powerful as a prehensile instrument; and teeth, which are the only bones in the body that acquire the consistence even of true bone, are furnished with very hard enamel; though in many of the species, there are very hard spines upon various parts of the back, the use of which in the economy of the fishes is not very well known.

The gill openings are situated behind the mouth, and they lead to cavities in which the gills remain fixed. The blade-bones of the pectoral fins are articulated upon, or rather soldered to, the spinal column, farther backwards than where the gills are situated; and though the whole motions of the fish are motions of elastic cartilage rather than of articulated bones, they are powerful, rapid, and not nearly so fatiguing to the animals. The tail, which generally has some twisting motions, and is pretty much produced, is by no means an inefficient swimming instrument; although the great pectorals, from their flexibility, are no doubt efficient in producing forward motion, as well as in ascending and descending. Though in the ordinary arrangements of the class, the rays stand near the end, as differing widely from the bony fishes, of which Cuvier very properly takes the perch family as the leading one, and the common perch as the typical species; yet in some parts of their physiology they stand higher than even those typical fishes, and may be considered as approaching in their characters to some of the batrachian reptiles, more especially in their eggs, which are discharged from the body of the female in an impregnated state; and in their skins, which are smooth and without proper scales like those of fishes, but have a tendency to be more or less roughened by spines and tubercles of bony matter. Their skins are lubricated with a copious musical secretion. It is probable that their senses of hearing and sight are pretty good; but it is certain that the sense of smelling is the most acute one, and the one upon which they chiefly depend for finding their prey. The union of the sexes is real, though not performed in the manner of land animals. This fact has been well ascertained ever since the days of Aristotle; and it has also been pretty well ascertained that the discharge of the eggs is gradual,

and that the fishes are not thereby exhausted in the same manner as those which part with the whole of a large roe at one time. It follows almost necessarily from this that the time of production is carried on through great part of the year, and that the fishes are generally in good condition; though from their ranging habits they are not found in the same fishing stations at all seasons. It does not appear, however, that any permanent attachment exists between the sexes; and indeed attachments of this kind seem to be quite unknown in the whole class of fishes.

The proper cranium of the skate occupies but a small portion of the volume of the head, and, small as the skull is, the brain does not fill it. The vertebræ of the neck, the back, and the tail, the last of which are very numerous, are soldered together; the ribs and sternum are entirely wanting; the rays of the pectoral fins are very numerous, placed laterally with each other, and nearly at right angles to the spinal column; they are jointed at intervals throughout the whole of their length; they taper toward their extremities, and the muscles with which they are loaded, and which have firm fibres in the same direction as the rays, gradually diminish in volume of matter as the extremity of the fin is approached. In many of the species, those muscular fibres, and also some of the softer cartilaginous parts, are very wholesome food; but, generally speaking, they are improved by being kept for several days; and it is a popular remark in some parts of the country, that "a large skate should be used a week as a mat at the door before it is prepared for the table." This species of fish, however, is so very common, that it is held in comparatively little estimation where fish are abundant; but it is on this account highly valuable as food to the poor.

As is the case in the birds of prey, the female rays are larger than the males. The eggs, of which the empty envelopes, which are strong and tough, are of an oblong form, are rounded at the sides and ends, and gathered into a sort of lump or knob. The substance of them bears a considerable resemblance to that of whalebone. They vary from an inch in length to nearly six inches; and in some places they are popularly known by the name of skate-purses. They are sometimes met with in a very recent state, and when they are so, the appendages to the corners are generally longer than in those which are old and dry; and it is understood that, by means of these appendages, the eggs cling to the stalks of marine plants, and are thereby prevented from being washed ashore by the storms. Those which are found adhering to sea-weed are considerably softer in texture than those which are washed ashore; and in very recent ones the white and yolk of an egg may be distinctly seen. There are still some points connected with the economy and hatching of those eggs which would require a little clearing up. Thus, for instance, though it is probable that the eggs grow in size after they are deposited, because those of apparently the same species differ so very much in bulk, yet the fact has not been ascertained in a manner perfectly satisfactory.

Cuvier divides the family into various sections. First, *Rhinobatus*, or shark-rays, which have the tail thick, fleshy, and furnished with two distinct dorsals, and a caudal fin well developed. Their bodies are in the form of a rhomboid, much pointed at the snout, and not so broad in the pectorals as the rays properly so called. Their teeth are also closely placed in fives, arranged quincunx; but in other respects they are like the rest. The name *Rhinobatus* does not mean shark-skate, but nosed-skate, meaning thereby that the snout is very much produced in them. Some naturalists have subdivided, thereby separating from the rest, certain species which have the same characters of the tail, but the muzzle short and rounded, approaching in form to that of the *Torpedo*.

Secondly, *Torpedo*, which have the tail still stout and fleshy, but shorter than in the long-nosed ones. In them the disc is rounded, and the muzzle divided into two parts, upon each of which a portion of the pectoral fin advances, till their edges are farther forward than the central part of the muzzle. Between the pectorals and the gills in this section there is an electric, or rather a galvanic apparatus, capable of giving pretty powerful shocks in the case of a large fish; but we shall have to notice that when we come to the details of a few of the species.

Thirdly, *Raia*, the rays properly so called, or the true skate. They have the disc rhomboidal, the tail slender, with two very small dorsal fins near the extremity, and sometimes with a mere rudiment of a caudal fin at the end, sometimes with none. Their teeth are slender, and placed in quincunxes upon the jaws.

Fourthly, *Trigon*, sting-rays. They have the disc in general short and obtuse, and each side of the tail furnished with a sharp and hard spine, roughened or toothed, which inflicts very painful wounds, but is not poisoned, as is sometimes alleged.

Fifthly, *Anacanthus*, spineless rays, resembling the sting-rays in the general shape of their bodies, but having the tail long, slender, and without either spines, appendage, or dorsal fin.

Sixthly, *Myliobatus*, sea-eagles, which have the head partly detached from, and in advance of, the pectoral fins; the anterior rays of their fins very long, and the others gradually shortening backwards, till the whole fin has a slight resemblance to the wing of a bird.

Seventhly, *Cephaloptera*, winged heads, which have the pectorals very long, the head in general truncated, and two portions of the pectorals advancing by the sides of the head, something in the form of horns.

In some of these sections the species are numerous, and in others they are comparatively few; but in one or other of their species they are found in almost all seas, some numerous and others rare. The ones which are best as human food are always the most numerous; and this is especially the case in the British seas, where the valuable ones can be had in great abundance; while those that are of comparatively small value, except as curiosities, occur only as stragglers, for the use of naturalists. We shall confine our short notices of the details chiefly to the British species, as they will afford the means of glancing at all, or nearly all, the sections.

Rhinobatus.—There are several species of this section, all of them having a good deal of resemblance to the sharks; but it does not appear that any of them have hitherto occurred in the British seas, though they are found in the Mediterranean, the Red sea, the seas within the tropics, and in some of the temperate latitudes of the Pacific. The short-nosed ones are found in the seas of China; and there is said to be one on the coasts of Brazil which gives shocks like the torpedo. The species of the Medi-

terranean was the earliest known, and it may be considered as the typical species of the section.

Torpedo.—One species of the torpedo, or "cramp fish," has been known as a rare straggler on the south coast of Britain for a considerable length of time. But still, as no very correct description has been given of any of the specimens, the particular species or variety which is thus found on the British shores has not been clearly ascertained.

The Mediterranean is the European sea in which the torpedoes are most numerous. It is indeed, in some respects, a sea of tropical character, far more tropical than the mere consideration of latitude would lead us to suppose. How much this may depend on the volcanoes near its shores, and the volcanic fires under its bed, it is not easy to say, but these have unquestionably a very considerable effect upon it. They appear to have had even more effect in more early times, when they were numerous and more distributed, when the extinct volcanoes in France, which are now separated from the sea by the plain of Languedoc, were near the shore, or rather, when the shore was near them, and they were blazing away in all their majesty. The fossil fishes and shells of decidedly tropical character, which are found in vast numbers in some parts of Italy, especially near the Apennines, furnish the most conclusive evidence of this; and there is a conformity in the characters of many of those that remain at the present day.

In the matter of many of its fishes, the Mediterranean has been fortunate in an observer and describer of the very first order. Risso, of Nice, who published the Ichthyology of that city, that is, of the sea in its neighbourhood, in 1810, corrected many blunders, and added much to our knowledge of the fishes of the Mediterranean, and of none more than of the torpedos.

According to Risso, there are various species of torpedo in the Mediterranean, all resembling each other very closely in their more essential characters, but differing much in size, in colour, in the strength of the shocks which they are capable of giving, and in their numbers and disposition to range. The one most frequently met with is the common torpedo, the *Raia torpedo* of earlier writers, and the *Torpedo narke* of Risso. It is easily known by the number and distribution of the ocellated spots on the dorsal surface of the disc. The ground colour of the upper part is clouded or marbled with white, with russet, and with brown; and marked by five large spots of a blue colour, with brown margins, which render them very conspicuous. Another species not so common is the one-spotted torpedo (*T. unimaculata*), which has the back of a yellow colour, dotted over with small points of white, and one large blue spot on the centre of the dorsal face of the disc. A third is the marbled torpedo (*T. marmorata*), which is without distinct spots on the back, except brown ones; and the ground of the whole upper part is marbled flesh colour. To a fourth, Risso gave the name of Galvani's torpedo (*T. Galvani*), in compliment to the discoverer of humid or chemical galvanic action. It is without any spot whatever on the back, which is of a plain reddish or greyish brown, becoming darker toward the sides. This is the largest of the Mediterranean species, and the one which gives by far the most powerful shocks, though both analogy and observation lead us to conclude that, with equal health, the shock is always violent in proportion to the size of the fish that gives it. This species is described as being of a more ranging disposition than the others; and in consequence of this last habit, it is probably the one which is occasionally found in the British seas, though, as we have already hinted, the fact has not been clearly established.

Of the figures given by the earlier writers on British fishes, it is impossible to speak with certainty with the view to the ascertaining of the species. The reason of this arises in part from the fact that only one species had been described by the systematic ichthyologists, namely, the common one with the five blue spots margined with brown upon the back. This was always what they had reference to in their descriptions, and sometimes the figures which they gave agreed with this description, sometimes not. Whether they did or did not agree does not appear, however, to be a matter of much consequence, as none of them appears to have been directly taken from a specimen obtained on the British shores. The figure given by Donovan has the five spots, but the source whence he obtained the copy is not known. Pennant's figure, on the other hand, is without them, and the origin of it is understood to have been a specimen, without any spots, obtained on the western shores of France, and most probably the *Torpedo Galvani* of Risso, which agrees with the discursive character which he ascribes to that species; and some other observations tend to confirm this by the large size of some specimens which have occurred. The late Colonel Montague was always attentive to every thing which could advance the knowledge of animated nature, and he mentions a specimen, taken on a turbot hook off Tenby in Wales, which weighed one hundred pounds; and he adds that "it was dead when disengaged from the hook, or the fisherman would certainly have had a shock that would have made him remember the species again." So unusual was it, however, that the Tenby fishermen knew nothing of its characters, or even of its name, and merely mentioned it as a strange monster of the deep, exhibiting it as such for the gratification of the curious.

The most extraordinary part of the organisation and character of the torpedo is its electric or galvanic apparatus. This apparatus lies in the anterior part, in two lobes or portions, situated on each side of the eyes, and temporal vents which are behind the eyes, but not reaching so far backwards as the gills, or principal articulations of the dorsal fins, thus leaving both the breathing and the swimming of the fish comparatively free. It must be, however, that this apparatus must to a certain extent encumber the fish, and diminish its swimming power; and all who have had opportunities of observing it agree in representing the torpedo as a dull and sluggish fish in the water. It is said to keep on the banks of soft mud, such as are frequented by turbot and soles, and to move about rather heavily, though that does not agree exactly with the ranging character ascribed to the most powerful species. It agrees, however, with the analogy of all other fishes which are furnished with an electric apparatus, and capable of giving shocks; for the *Gymnotus* and the *Silurus electricus* are both dull and sluggish fishes.

In the whole of them the electric or galvanic apparatus is constructed in a manner somewhat similar. It consists of a series of prismatic tubes, arranged close together, with thin membranous walls, and divided into short lengths by cross partitions, a fluid being

contained between every two of the latter. In the torpedo these extend all the way from the integuments of the upper surface to those of the under, their ends being fastened to those surfaces, and their axes perpendicular to the plane of the fish.

It is unnecessary, however, to go into any minute description of these with a view of ascertaining in what manner the energies are connected with the structure. No doubt they are connected with that structure; and the different tubes or columns, with their partitions, and their intermediate fluid, have some slight resemblance to the common galvanic trough. But here the parallel stops, and a new element comes in, which forbids all farther comparison. The action of these organs depends upon the life of the animal, being vigorous or feeble, according as that is more or less; and while the electrical fishes benumb the senses of whatever living creature they strike, they become greatly exhausted by the effort, and soon lose their power, until they have rested and recovered themselves; and when life is extinct, the power of giving shocks is at an end, and cannot be revived in the dead body.

This species of electric, galvanic, or whatever other action it may be called, is therefore a phenomenon of life, modified by organisation, and not belonging to, or producible in, dead matter. It tends, however, to show that there is a close connection between the electricity or galvanism of matter and this power of these fishes, though in the fishes it belongs to the life acting by means of organs, and in the other cases it belongs to matter, as such, without any reference to life or organisation. In this it follows the general law of the animal economy: it is a universal property of living creatures to assimilate substantive matter, and turn it into the substance of their own bodies; and the very same law demands that in every case, according as it may be necessary to the part which the animal has to perform in the grand system of nature, it should have the power of assimilating action, and modifying that by its organisation, so as to accomplish those purposes for which it is appointed. But when those modifications, either of substantive matter or of action by a living creature, are introduced, they completely destroy the analogy between the action of animals and the action of inanimate matter; so that, if we attempt to reason from a comparison from the whole of the one case to the whole of the other, we are sure to fall into error; and if we say one word beyond this we destroy the simpler and more useful part of the comparison, which is really matter of philosophy.

There is another circumstance connected with these electric fishes which is worthy of attention, as tending to establish the distinction which we have endeavoured to point out. If the expression may be used, the electric action of matter, in what manner soever it is exerted, appears to act on the matter of the body as obeying the life, rather than on the life itself; whereas the animal electricity appears to act directly on the living principle, and only through that upon the material part of the body.

This may seem a nice distinction, and one which is much too subtile for popular description. Such, however, is not the case; because those nice points of physiological distinction have a far more extensive range than the mere natural history even of animals; and it is in the misapprehension of them that the foundations of our most serious errors are laid. Observation shows that the muscles, as organs of motion in obedience to the animal life, but not that life itself, or capable of acting without, are affected by ordinary electricity and galvanism; and in proof that they are so affected simply as matter, and not as living matter or life, is established by the fact, that they can excite the muscles after life is extinct, and until decomposition has made certain advances. The shock given by the electric animal does also affect the muscles; but this is not its ultimate or its most powerful effect. Its tendency is to stupify the senses, and take down not the tone of the mere muscular system, but the energy of the life which puts that system in motion.

We have felt it necessary to make these remarks at some length, in consequence of a remark by Mr. Couch contained in a quotation which we shall presently make from Mr. Yarrell's excellent "History of British Fishes," to which we have so often to refer, and always with pleasure. Mr. Couch deserves the greatest praise for the zeal, assiduity, discrimination, and success of his observations. But Mr. Couch must look to his philosophy even with keener eyes than if he were an inferior man; because in him the sterling metal so preponderates, that it is almost sure to carry whatever of alloy may accompany it into general circulation. The passage is as follows, the quotation within single commas:—"The whole use of the electrical apparatus and power to the fish can only be conjectured. That it serves as a means of defence is very probable. Mr. Couch thinks other powers may be derived from it, and his opinion is thus expressed:—'One well-known effect of the electric shock is to deprive animals killed by it of their organic irritability, and consequently to render them more readily disposed to pass into a state of decomposition, in which condition the digestive powers more speedily and effectually act upon them. If any creature more than others might seem to require such a preparation of food, it is the cramp-ray, the whole canal of whose intestine is not more than half as long as the stomach.

"'So long ago as the time of Dioscorides, the physician of Antony and Cleopatra, the shock of this fish was recommended for medical purposes, and especially for pains in the head; and this may be considered as the earliest record of the application of electricity to medicine. In later times it was applied to the cure of gout, the patient being directed to keep his foot on the fish until the numbness extended to the knee. Baron Humboldt (speaking of the *Gymnotus*, we presume) remarks, that the will of the fish directs the effect to whatever part it feels most strongly irritated, but only under the influence of the brain and heart. When a fish was cut through the middle, the fore part of the body alone gave shocks.'"

Mr. Yarrell makes no remark on any portion of this passage which we have quoted; though it appears that his own conjecture of the electricity being a means of defence is far more probable than the conjecture of Mr. Couch. The tail of the torpedo is without spines, or any of those weapons with which the tails of the true rays are furnished, and which weapons they use with no inconsiderable effect, lashing about with the tail, somewhat as a man would defend himself with a threshing flail, or with the *morgensteirn* of the ancient Saxons. The tail of the torpedo is quite unfit for this, both from its stiffness and its want of armature; and thus, were it not for its power of giving shocks, it would be one of the

most defenceless inhabitants of the deep, and, as its motions are slow, it would become an easy prey to fishes of more activity and better armed. It may be, too, that this power is exerted in benumbing the prey of the fish, in order that it may be more easily captured, though this is a little more doubtful than the hypothesis of a defence. At all events, those electric fishes do not always direct their discharges against what may be considered as their natural prey. *Gymnoti* certainly do not eat horses as their natural food in the pools and slow-creeping streams where they have their sluggish dwellings; yet Humboldt mentions, and describes in his usual graphic manner, a battle between horses and *Gymnoti* in a large pond in South America. On that occasion the horses were unquestionably the aggressors, though involuntary ones, and they were put to the rout, though the *Gymnoti* were much exhausted by the effort. We think that Mr. Couch's notion of the electric action being a sort of cookery is far more unlikely and untenable than this. Cooking is so exclusively the privilege of the human race, that it has been proposed to distinguish man, considered as a mere animal, by the appellation of the "cooking animal;" and we should be sorry for the sake of those (and they are not few), who have little human distinction, except their love of cookery, to deprive them of their solitary privilege, by allowing "a cold long-winded native of the deep" to share it along with them. We do think, therefore, that Mr. Couch must give up the idea of the cooking; and we have a more weighty reason for this than the depriving of our gastronomes of a portion of their privilege, in order to bestow it upon a fish, of which they cannot even have the luxury of making a delicious meal in return. The flesh of the torpedo is, we believe, eatable, but it is no *bonne bouche*. The objection which we have to Mr. Couch's hypothesis is the avowed confounding of the electricity of the living animal with the electricity of dead matter; and it this which involves a grand physiological error, which goes much farther, and works more seriously, not only upon the physiology of animal life, but upon the intellectual physiology of man, than those who have not followed out the train of connexion would readily suppose. That he does identify them is proved by his appending, as a note, that "the bodies of animals killed by lightning do not become stiff;" and we have already endeavoured to show, that though the original action may be exactly the same in these, and in all other cases, the modification is very different. We are ready to admit that, considered abstractedly in itself, all action of matter may be the same: but it is fully as certain that every instance of action which can come before us in its results, and it is only in these that it can come before us, takes its particular character from the particular kind of matter, or organisation of matter, in which, as an instrument of action, the result becomes apparent to our senses.

The true doctrine, therefore, appears to be, that the principle is one, and the modifications of that principle many. This is very obviously the case in substantive matter, where all the differences that we meet with seem to be modifications. Experiment shows that they actually are so in all cases to which we can extend our analysis; and that we have not demonstration in every case is obviously owing to the imperfection of our analysis, rather than to any thing analysible in nature itself. There is no probability that we shall ever, by any refinement in chemistry, arrive at the ultimate atom of matter, that is, at matter which we can pronounce to be absolutely simple. Nor need we expect this, for it is the same with every thing which can become the subject of thought: we can see a portion of the middle, as much of it as is necessary for all practical purposes; but we can see neither the beginning nor the end. This is true in the simplest of all subjects—time, space, and number; and if we find ourselves unequal to the full understanding of these, we cannot hope to understand better the more nice and complicated subjects of the modifications of matter, and of action as displayed in matter.

But, though our knowledge is limited, it is our own fault if it is not free from error so far as it goes; and though we cannot understand the whole of any one subject, that is surely no good reason why we should confound one subject with another.

Yet this confounding is very often practised; and it is more practised by naturalists, especially those microscopic naturalists who investigate the precise minutiæ of the production of nature, than by any other class of persons whatever. This is so generally the case, that every minute observer and precise describer of details is almost a synonym for a bad philosopher; and the man who shows us most clearly the individual beauties of nature is the very man who destroys the beauty of the system, and severs the connexion between Nature and Nature's Author. The remark of Mr. Couch on the electricity or galvanism of the torpedo belongs to the class of errors of which we have been treating; and this is the reason why we have endeavoured to explain the true philosophy of the subject. We shall now pass to some examples of another section of the ray family—the rays, or skate, properly so called—which are the most useful to man, and for that reason the most interesting of the whole.

These are numerous in species, and most of the species are abundant in one part of the sea or another. They all have the rhomboidal form of the body, and the muzzle more or less pointed, advancing far in front of the eyes on the dorsal aspect, and of the mouth and nostrils on the ventral. There is not the slightest external distinction of head, neck, and body, the whole appearing a flat rhomboidal disc, with a long and slender tail at one of the angles. The tail, from the peculiarity of its form, and the smallness of the fins upon it, or their total absence, can be of little or no use in swimming, either in forward motion or in changing the direction. The pectoral fins may, therefore, be considered as the sole organ of motion in the true rays, and in this they differ from every other kind of fishes, as in all the others the grand organ is the caudal fin, or where the body is elongated, and that is small or wanting, the flexures of the body. When a skate is swimming at its ease and undisturbed, its motion is peculiarly smooth and gliding, and puts one more in mind of a kite sailing along with motionless wings, than any other motion which we are accustomed to see. There are no doubt constant flexures in the pectoral fins, but these are done so neatly and easily, that the fish appears to slide along without the slightest effort.

In this the skate form a striking contrast to the flounders, and it is one which is worth attending to, as showing how particular parts of the bodies of animals act, whatever may be their form in the indi-

vidual. The swimming fins on the margins of a flounder—we say margins, for they are the upper and under margins, and not the sides—are the dorsal and the anal fins, which are the least efficient for motion of all the fins of any fish. They are not directly connected with the spinal column, but have three even bones simply imbedded in the flesh. Whenever, therefore, a fish is thrown upon these as a means of forward motion, that motion cannot be performed without a caudal fin, or flexures of the body, or both. Hence the twisting and wriggling of all the flounder tribe when they do move, and the limited range to which their very laborious motion extends.

Swimming with the pectorals is a very different matter, especially swimming with pectorals so well developed as they are in the skate. The pectorals answer to the fore legs of animals and the wings of birds; and in fishes the shoulder is always better made out than the support of any other of the body fins. In the skate, which has no caudal fin, and no very useful fin of any kind upon the tail, the blade-bone of the pectoral is peculiarly firm, and the jointed cartilaginous rays in the lobes of the fins admit of very free, rapid, and consequently powerful motion. The length of the rays gives great rapidity of motion to the margin of the fin; and as each ray appears to be capable of a separate motion, especially toward the terminal part, the directions and degrees of action on the water are almost countless, fully justifying the comparison that is usually made between them and the most powerfully-winged of birds.

When a skate is excited, and swims with rapidity, there is still little or no flexure or wriggling of the body, that is to say, of the spinal column, the flexures of the pectoral fins being still sufficient to perform the motion. Indeed, the absence of flexure in the spinal column is one of the means of power in the fins, and far from the least efficient means. In this again they agree with birds, in which powerful flyers always have the spine much stiffer than birds of feeble wing. Against that part of the length where the swimming fins of a skate have the most powerful effect, the vertebræ of the spine are soldered together, and they approach more nearly to the character of the bones of common fishes than any part of the skeleton in those cartilaginous fishes which do not require so powerful a use of the pectorals.

In all the motions of a skate through the water, the above notices of its structure and action will show that the tail is quite free, and fit to be used for any other purpose. We have already mentioned that the chief purpose of it is defence; and in the using of it the spine is much rounded, so that the head and insertion of the tail are much more elevated than the middle part of the body. The tail admits of flexure in every direction, which fits it for being an efficient lashing weapon, but makes it less adapted for a swimming organ than if its action were confined to one place, as it is in all fishes who depend much upon its use in swimming. We have been somewhat particular in describing the motions and organs of motion of these animals, because, on account of the peculiarity of their forms, there is a very general notion among persons not acquainted with the economy of the sea and its inhabitants that they are very unwieldy and helpless creatures in the water; whereas, the fact is quite the reverse, and, even among those fishes which are regarded as models of perfection as swimming animals, there are none who have more command, or even as much command of themselves, as the skate.

As is the case with all animals of great muscular power and activity, skate are very voracious and indiscriminate in their feeding. Their teeth are not well adapted for biting, in the ordinary sense of the word, and the mouth being a sort of slit, without very produced jaws, they do not catch their food with a rapid snap of the mouth. The teeth are in curved tufts, adapted for breaking and bruising; though the full-grown, or rather mature males, in some of the species, at least, have the same rows of teeth directed backwards, and drawn into sharp but not very lengthened points. They feed upon fishes, and also upon crustacea and mollusca, whether with shells or without; and the power of the muscles of their jaws, as well as of all the other muscles of their bodies, is understood to be very great.

Grey Skate (*R. batis*) is the skate by way of eminence, and the one of which the flesh is so much esteemed as food. It is very common on some parts of the coasts of Britain, though comparatively rare on others. It is a bold and powerful swimmer, and frequently attains a very great size, sometimes weighing two hundred pounds or more; but these very large ones are not so much esteemed for food as those that are smaller. The colour on the upper part is dull greyish brown, and that on the under part dull grey, marked with dark spots; the snout is pointed, and the lines from the broadest parts of the disc to the snout, which are longer than the two remaining sides of the rhomboid, are nearly straight; the breadth of the disc of the body is one-third more than the length; the hinder part of the disc makes a more obtuse angle than the fore part; but, if the measures are taken to the extremities of the ventral fins, the two angles are nearly equal; the eyes are slightly raised above the general surface of the head; their irides are yellow, and each is defended by one elevated tubercle in front, and another on the inner side; the vent-holes are near the eyes, and defended by valves; the dorsal ridge, or rather mesial line on the back, has no spinous appendages as far as the dorsal fins; but below this there is a single row along the mesial line, reaching as far as the two small fins on the tail, which appear to occupy the place of dorsal fins, and a single one between these fins; these spines are sharp-pointed, of very hard consistency, and have their points directed backwards. The male has also spines on the sides of the tail, with the points directed forwards. The mouth is rather wide, with blunt teeth in the young, and sharp ones with the points inclined backwards in the mature species; they have this difference between the young and the adult in both sexes; whereas in others the change is peculiar to the male. The change begins when the extent of the disc is about fourteen inches. This appears to be the beginning of maturity; but no limit is known to the subsequent growth. The claspers, or "tags," as they are called in some parts of the coast, with which the male of all the species is furnished, one on each side of the root of the tail, are long in the male of the grey skate, on which account it is sometimes called the three-tailed skate.

In this, as well as in all the other species that get the common name of skate by the fishermen, the

females get the name of maid, maiden, or lady. They are larger than the males, and more numerous, or, at all events, there are many more of them caught. It has been supposed that the males are polygamous; and it is highly probable that they are so, but there are no means of establishing or disproving the fact by observation.

Skate are most plentiful upon those parts of the coasts where the fry of fishes which spawn in numbers on the shallows are considerably advanced; and the structure of the teeth shows that the mature ones are fully as well adapted for eating fish as for bruising shells and crusts, though the power of their jaws is quite equal to the latter.

The grey skate appears to be more numerous on the east or leeward coasts of the British islands than on the west or windward coasts. On the north-east of Scotland it is particularly abundant, and the fishers salt and dry great numbers of them, but in that state they are very inferior to the recent fish; in these places they are but little esteemed as food, so that a large one may be had for a few pence; but this is perhaps as much owing to the abundance of fish of better quality as to anything else. White fish, haddock especially, if they can be had recent, are always the better the more simply they are dressed; but as the flesh of skate consists of long fibres, not of flakes, it requires more of the culinary art to render it palatable. It keeps longer, however, than the more delicate fishes, and thus it might be made a very cheap fish for inland consumption.

White Skate (*R. oxyrhynchus*). This species grows to a still greater size than the former, mention being made of specimens weighing nearly half a ton, but, as it is thicker in proportion, its lineal dimensions are not so great. The male is furnished with spines on the upper surface, near the margins of the pectoral fins, opposite the eyes and vent-holes; and again with three rows near the margin of each produced lobe of the pectorals, or "wing," as it may be called. The ventral fins are small, the claspers are very large, and the tail is furnished with a row of spines along the mesial line, and one on each side. The shape of the body, or disc, is quite different from that of the grey skate. The posterior margins of the pectoral fins, up to the greatest lateral extent, form a semiellipse; the extremities of the fins are rounded, and the anterior line upon each side is convex on the middle part, and concave at the greatest breadth, and near the snout. The mouth is also narrow and pointed; the upper surface is of a plain brown colour, without the greyish tinge which characterises the other; and the under side is white, which gets it the name of the white skate; but it is known by different names in different parts of the country. The eyes are near to each other, and furnished with thin sharp spines at the inner edge of each; the vent-holes are close behind the eyes, and both they and the nostrils are protected by valves as in the others. The teeth are, in the mature specimens, still more produced and pointed inwards than in the grey skate, indicating that this one is still more piscivorous.

They are powerful swimmers, keeping much to the deep water for great part of the year, especially the larger ones, but approaching nearer to the coast in summer and the early part of autumn. In-shore they are not so numerous as the grey skate, but they appear to be fully more so at some distance off; and when the fishermen wish to have them in numbers in the early part of the season, they set their lines farther to sea than they do for grey skate. Of the skate which are salted and dried in the northern parts of Scotland many belong to this species, and in that state they are better than the grey ones; the smaller specimens of both are found at a moderate distance from the shore all the year round, and they are the best for the table in the recent state, if they have reached maturity. At the places where numbers of skate, of whatever species, are salted and dried, the livers are boiled into oil, which is said to answer as well as cod oil in the dressing of leather.

Homelyn Skate (*R. maculata*). This is also called the spotted ray, the narrow ray, the sand ray, and various other names. The spots are on the back, of a darker colour than the ground, and ocellated or marginated; but they are subject to variation. The shape is different from that of either the grey or the white; the snout is pointed, but not produced; the front sides of the pectorals are concave opposite the eyes; they end laterally in rounded angles, and are then nearly straight to the hinder part, where they form rounded lobes, deeply indented at their union with the body; the spread of the pectoral fins is about one-fourth greater than the length of the body; the eyes are rather large, fortified by spines in front and rear, and there are some hard tubercles and small spines on the snout, especially that of the male; the spines on the mesial line begin about the middle of the length of the body, and gradually become larger and more curved toward the rear as they approach nearer to the middle length of the tail, after which they become smaller again, but not so small as they are on the back; besides this single row, very old males acquire another row on each side, though smaller than the middle ones; the females have the spines and tubercles on the head less conspicuous, or altogether wanting; the colour of the upper part is nearly that of brown sand when wet, but the name of sand ray is given on account of the rough tubercles, like grains of sand, which appear on the anterior part of the male.

This species is by no means rare on the south and southerly coasts, and it is one of the species which are most frequently and abundantly brought to the London market, where the grey and the white skate are not so common. It does not grow to so large a size as either of these, or, at all events, those that are taken are in general smaller, though they are thick, and firm in the flesh; it is also, frequently at least, captured in a different manner. In the northern fisheries the trawl-net is not used, at least in the capture of skate, the price obtained for them not being equal to the expense; thus, excepting on the shores, none but surface fishes are taken with nets there. Both the trawl-net, and the "great-line," as that which is laid in the deep-sea fishing is called in the north, have these advantages. The net is more certain in its capture; but both the net itself, and the working of it, are more expensive than the line; besides its cheapness the line can be laid in deeper water than the net can be worked, and thus it has the chance of capturing larger fish, and capturing them in good condition when they have got to seaward beyond the reach of the nets. Fishing to the greatest advantage would thus require the use of both on the same coasts, and for the very same kind of fish.

The variations which occur in the markings of the

upper part of this fish have caused some confusion in the description of it. In all cases the principal part of the upper surface is smooth, and the conspicuous spots vary a great deal; at times there are only two, one on each side of the ridge of the back, and near the middle of its length; at other times there are several, and at other times again there are none at all. These variations in the spots do not appear to depend in any way upon age or sex, but the spines on the snout, near the eyes, and on the anterior margins of the pectoral fins, are characteristic of the adult male only, and become more conspicuous with age.

The Thornback Skate (*R. clavata*) is not unlike the last-mentioned species in its general shape, only the notches at the posterior part of the pectorals are not so deep, and the ventral fins are broader. This species is very common in all the British seas, and more easily obtained than some of the others, though not esteemed equal to them in quality; still, however, the flesh is not bad, and in places where fish are not very abundant, or other provisions are costly, it must be regarded as rather a valuable fish.

It has a much greater tendency to the production of spines and tubercles on the upper surface than any of those that we have previously mentioned; the adult male has also the teeth considerably produced and pointed, but that does not appear to extend to the female; the eyes and vent-holes are proportionally larger than in most of the species, and they are defended by strong and crooked spines; the whole of the upper surface is granulated with hard tubercles, which have their bases polygonal or star-shaped, and among these are arranged the spines from which it gets the name of thornback, and which make it not very pleasant to handle even after it is dead. Those spines or thorns are of peculiar form, their bases are oval discs; from the middle of these the thorns arise, not long, but strong and sharp, and with their points inclined backwards, or backwards and obliquely outwards. Their number increases as the fish gets older, and their principal distribution is on the mesial line of the snout, along the anterior or margins of the pectorals, upon the posterior parts of those near the notches, and a few irregularly disposed on the back. These strong-hooked spines are not very numerous, varying from a dozen to twenty or more on each side of the back, and not always symmetrically disposed on the two sides, so that their number and distribution cannot be admitted as a constant character.

The spines on the ridge of the back begin a very little in the rear of the vent-holes, and they are alternately larger and smaller, but none of them are so large as those on the snout and the pectoral fins; the tail is armed with three rows of spines throughout its whole length, and, though individually these are not large, the tail is a dangerous instrument, and must be very formidable against an enemy. Defence against a pursuer is obviously the use of these spines, for they can do mischief only to that which comes upon the animal in the rear or on the flank, the more mesial ones being directed to the rear, and those on the pectorals obliquely outwards.

All the danger of enemies to which these fishes are exposed must come from the plane on which they swim or above it, for the whole of the under part is white and smooth, and quite destitute of every kind of defence; the mouth is on the under part of the body, no doubt, and its teeth are numerous and its muscles powerful, but still it is an eating mouth only, and not a fighting one. What the enemies may be against which the thornback especially is thus powerfully armed it is not very easy to say, as a large skate, even without any spines upon it, would be rather an ungainly mouthful for even the largest of those fishes which swallow their food and do not bite it. The sharks and grampuses bite, it is true, and the former can hold the prey with one set of teeth while they use another in sawing off the portion within the mouth; hence it is probable that these are the principal enemies against which the skate tribe have to defend themselves.

Armed for its defence in this formidable manner, the thornback appears to have little to suffer from any large enemy save man; we say "large enemy," for there are many little parasitical foes against which the size, strength, and armature of a large animal are of no avail. The thornback, however, appears not to suffer much from any enemy, and not to feel in its number the captures which are made by man. It is abundant on every part of the coast adapted to the habits of skate, and it is so abundant on the Cornish coast that it is the *ray* there. It has been conjectured that the name is a corrupt pronunciation of the Anglo-Saxon *reah* (rough, the *h* being not only aspirated but guttural); but there is little probability of this, as the old Cornish language continued to be spoken in that duchy after the Anglo-Saxon had ceased to be the language of England. Autumn and winter, or rather a portion of time where these meet, is understood to be the prime season of the thornback, though in the season of production it is more abundantly found on the banks; the probability is, that it is firm in the deep water, and softer in the flesh when on the shallows, where it commits the greater number of the germs of its progeny to the keeping of the waters. Like all the rest of the family it is a very voracious fish, and not very particular in its choice. Flounders, crabs, shelled mollusca, or anything that inhabits below it, and can be come at, do not appear to be rejected.

Starry Ray (*R. radiata*). If many of the other rays are interesting from their numbers and their value as an article of cheap and not unwholesome food, this one has an interest of a very different character. It is rather a handsome fish, not apparently growing to any great size, and it is very rare. The sea which it more immediately inhabits is not very well known; but, considered as a British fish, it appears to be of the north rather than of the south, though the fishermen have no particular name for it on any shore of our seas.

The form of its disc is nearly that of a square; but with the three terminal angles rounded, and the sides a little convex. The ground colour of the upper part is pale orange brown, but is marked with spiny tubercles, differing, however, from those of the thornback. There are no small tubercles granulating the general surface, as in that; but the spiny tubercles are much more numerous: they are largest along the dorsal line, but small ones alternate with the large ones there; there is one in front of each eye, a few small ones along the inner margin of each eye; two or three large ones behind the vent-holes; and some more not far from the dorsal ridge, and nearly opposite the largest part of the pectorals; the rest of the upper part is irregularly sprinkled with smaller ones; and there is a regular row of small ones run-

ning along each side of the row of large ones on the back; the three rows being continued on the tail, which has also a pectoral row on each side. In these spinous parts, or bosses, these are not very unlike those upon the thornback, only they are not so prominent, but the basal parts, or bucklers, instead of being simple ovals like these, have their margins with radiated points like stars; the under side is of a clear and uniform white colour; the eyes are moderately large, well defended by lids, besides the spines; and the vent-holes and nostrils are also rather large, and have membranous valves; the mouth is small; and though many specimens have not been examined, the probability is that the lateral and interior angles of the teeth are produced and pointed in the mature individuals of both sexes.

We are not aware that any specimens have been met with on the south or even the west coast, or indeed on the east coast of England, except in the extreme north. In the "Fauna Groenlandica" of Othon Fabricius, published in 1790, there is a description of *R. fullonica*, which appears to answer to the specimens that have been met with in the British seas; and from this it would appear that the fish is better known in the Greenland seas than in those of Britain. In consulting the work of Fabricius, much stress must not be laid upon names, as he often erred in their application. But his descriptions are remarkably precise and excellent, and may be implicitly depended on in all cases where they agree with a specimen.

The fact of being found on the north and east coasts of Britain, and not on the south and west, is a corroboration of the starry rays being a fish of the northern seas, because part of the "set" of the current on our north-east shores is from those seas, whereas the set of the current to and along our eastern coasts is from the Atlantic. Even in the north, however, nothing appears to be known of the habits of the fish, so that it either keeps much out at sea, or it is rare in any locality where it occurs. It is said to be more common on the coasts of Denmark and the north-west of Germany than with us; but it is not of value in an economical point of view in any locality.

The bordered Ray (*R. marginata*) is a rare species as well as the immediately preceding one; but it comes from the opposite direction, as any specimens of it that have been found have been on the south and south-west coasts. It occurs more frequently on the French coast; and it is abundant in the Mediterranean, well known to the fishermen there, and much esteemed as food. In the form of its disc it is not unlike the Homelyn ray; and like that it has no spines on the body, but those on the tail are more developed than in the Homelyn. The mouth is moderately large; the teeth numerous and pointed; the nostrils about midway between the corners of the mouth and the edges of the pectorals; the eyes and vent-holes large, with a single spine at each of the former; the snout and anterior edges of the pectorals roughened with small tubercles and a few little spines, but all the rest of the body quite smooth; the tail is about the length of the body, rather stout, and a little flattened; the spines in the three rows upon it formidable and curved backwards, the two fins near its extremity very small, and the terminal one a mere rudiment; the ventral fins are of considerable size, divided into two lobes, and notched or toothed in their margins; the upper part is reddish brown, with very obscure spots of darker; and the under part white in the middle, but marked all round with a border of dark reddish brown, broader at the external angles of the pectorals, and nearly or altogether obliterated at the snout. The south and southern part of the west coast of England are the places where this rare stranger is most likely to be met with, yet some instances of its occurrence on the east coast are mentioned, though only on the southern part.

The small-eyed Ray (*R. microcellata*) is another very rare species, found only as a straggler on the southern coasts. The specimens that have occurred have been of considerable size, though not large. They are remarkable for the smallness of the eyes and the beauty of the colours on the dorsal surface of the disc; the ground colour of this surface is clear light grey; a white line passes down the dorsal ridge; and there are arches of the same colour near the sides of the disc; those on the front sides begin by small points a little in advance of the eye, and proceed toward the distal angle of the pectorals in curves, with their concavity toward the margin, and the one next the centre of the disc; there are three of them on each side; although the marginal one is smaller and more obscure than the rest. From the angles of the pectorals at which these terminate, or rather vanish, three others begin on each side, curving inwards like the others, having the outer ones small and obscure, and the central ones terminating near the middle of the posterior lobe of the dorsal. These arches form the disc into a set of regular figures, becoming more concave in the sides, and sharper in the angles, as they approach the central one; that one still occupies the greater part of the disc, and is marked with whitish spots, as well as divided longitudinally by the pale stripe on the dorsal line; the eyes, as has been hinted, are very small, but the vent-holes are large, and show much more conspicuous than the eyes; the upper part of the body is rough with granulations, but there are no spines upon it, except a row of small ones on the lower two-thirds of the back, which are also continued on the tail to the fins; and there is another row of very small ones upon each side of the tail; the tail has also very narrow membranous margins on the sides, and the two fins are small rounded lobes, without even a vestige of a terminal fin; the under surface is pure white, and so full of mucous follicles, that their openings appear as if they had been punctured all over with a pin; the mouth is rather large, and the teeth very much resemble those of the thornback. This species appears to deposit its eggs early in the spring, or at least to begin doing so at that time, whereas the more northerly species, which are found in numbers on the British coasts, do not begin till the season is pretty far advanced.

The long-nosed Skate (*R. shagrinea*). The English name of this species is given to it on account of the great length of the snout, which is the most remarkable feature in the shape of its disc. That disc is nearly triangular, only the two anterior sides are a little concave in their outlines, and the posterior or third one consisting of the two lobes of the pectorals, which have no cuticle at their termination backwards, is considerably convex; the snout, besides being long, is very much pointed, and its distance in advance of the opening of the mouth is about one-third the length of the body, exclusive of the tail;

the upper surface of the disc is leaden grey, and the surface is beset with tubercles, whence the name of the shagreen ray; there are two rows of small spines on the snout; and the old males have often a tuft of small spines above each eye; there are a few scattered spines down the dorsal ridge, and some near the anterior edges of the pectorals; the tail has one mesial row of small spines and two lateral ones; it lessens to a point, and the fins upon it, and also the ventral fins, are very small; the under part of the body is dull greyish white, marked with dusky spots, something in the same manner as the grey skate. Indeed, in its general form, this species has more resemblance to the grey skate than to any of the others, notwithstanding the greater length of the nose, the rougher character of the upper surface of the disc, and the greater number of the spines on the tail. In the summer it comes upon the banks within reach of the trawl-net; but in the cold weather it betakes itself to deeper water, in which, however, it is highly probable that it could be taken with the hook; and if so, there is no doubt that it would be found in better condition than it is in summer, when it comes into more shallow water for the purpose of depositing its eggs. No mention is made of the long-nosed skate on the north coasts.

The above enumeration contains all the species of this very curious and interesting section of the ray family which have hitherto been found in the British seas. Those that are different from these, and occur in other parts of the world, are of comparatively little interest to the general reader. We must, however, notice one species at least of each of Cuvier's other sections of the family.

The Sting-ray (*Trygon pastinaca*). This is a curious species. It has been long known, and not a little celebrated on account of the formidable weapon with which its tail is armed. It is distributed over a very considerable range of latitude, and though as a British fish it is rare or unknown, except on the south coasts of England and Ireland, it is met with on the coasts of Norway, and it is common in the Mediterranean. The severe wounds which the weapon on the tail is capable of inflicting, led to a very general belief that the weapon was envenomed. We need not wonder at this, for the same was long believed of the antlers of deer. Ragged weapons, though they of course infuse no positive venom into wounds made by them, yet have often effects more fatal than venom, unless it be venom of the more deadly reptiles, of which the ancients knew but little. The lacerations which they make may bring on great pain, and even tetanus, which was no doubt the cause of these notions of poison. The disc of the sting-ray approximates to the form of a hexagon, of which the terminations of the ventral fins form the posterior and shortest side, but they extend beyond the posterior lobes of the pectorals; the body is smooth on the upper part, excepting a few tubercles on the dorsal line, and others near the posterior margins of the pectorals. It is thicker in the middle than the disc of any of the other rays, but gets thin toward the sides; the middle of the upper part is bluish brown, passing into dull yellow toward the margins; the under part is white; the irides are golden yellow; and the vent-holes opening obliquely behind and outwards of the eyes are very large; the membranes of the nostrils are also large, but the mouth is small, compared with the size of the fish.

The most peculiar part of its structure is the tail; it is very thick, strong, and muscular at the base, tapering gradually to a very slender point, and without the smallest vestige of a fin on any part of its length. About one-third from the base of the tail, the weapon called the sting is inserted on the dorsal aspect; this spine is nearly one-third the length of the body, exclusive of the tail; on the upper and under sides it is flat, but the two edges are serrated with very awkward-looking crooked teeth, and the point is very sharp. In a specimen measuring about two foot in breadth from angle to angle of the pectorals, this weapon is not less than six inches in length. In illustration of the manner in which the sting-ray uses its formidable weapon, we cannot do better than quote a short passage from Mr. Yarrell's "British Fishes," vol. ii., pp. 443, 444.—"Mr. Couch in his MS. says, 'This species keeps on the sandy ground at no great distance from our land, and in summer wanders into shallow water, where it is often entangled in the fishermen's nets—the only way in which it is usually caught, for it rarely swallows a bait. The manner in which this fish defends itself shows its consciousness of the formidable weapon it carries in its tail."

It shows no such thing, and we sincerely wish that these accurate and excellent observers would learn a little—a very little—of sound philosophy. Consciousness, even in man, is very like one of those words which are invented in order to have the semblance of knowledge in cases where there can be none of the reality; and when we use it with reference to any other animal, it is jumbling man and animal together.

"'When seized or terrified, its habit is to twist its long, slender, and flexible tail round the object of attack, and with the serrated spine tear the surface, lacerating it in a manner calculated to produce violent inflammation.' Other authors state that it is capable of striking its weapon with the swiftness of an arrow into its prey, when with its winding tail it secures the capture. These spines, as may be supposed, possess no venomous quality: when lacerated wounds happen to men of bad habit of body, the symptoms are frequently severe. In some countries, serrated fish-spines, admitting of easy application by tying, are used to point arrows and spears, which, when thus mounted, become very formidable weapons." Such is the latest, and, we may confidently add, the best account of the mode in which the sting-ray uses its caudal blade; but we are constrained to add, that these notices show upon the face of them that the parties know very little about the matter—indeed they cannot, for the use of the weapon in wild nature; when the fish has its free range of the sea, is not a subject open to human observation. Analogy—and we have nothing else to guide us in such cases—would lead to the conclusion that this caudal blade is a weapon of defence; but in what manner it is used against the natural enemies of the fish in its own element we have no means of ascertaining. Still, the sting-ray is, from the peculiarity of its structure, a very interesting animal; still it is only to the students of nature, and as an object of curiosity, that it has any value; for, in an economical point of view, it has none. Mr. Yarrell says, "The flesh is said to be rank and disagreeable, and when laid bare by skinning, or by cutting into, is very red—a circumstance which may account for the old name of Fire Flaire."

The Eagle Ray (*Myliobatis aquila*). This is a rare species upon the British coasts, though pretty well known on the shores of the Mediterranean. In form it differs much from all the other rays that we have enumerated. The head is considerably disengaged from the pectoral fins, so that the eyes, which in most of the others are actually within the disc, are in this one about midway between the anterior margins of the pectorals and the termination of the muzzle. The muzzle is also short and truncated, the eyes much farther apart from each other, and nearer the sides, and the whole head has much more the air of that of an ordinary fish than in any of the other rays. In these there is some difficulty in drawing a line of distinction in the disc between what is the body of the fish and what are the pectoral fins, from the gradual manner in which the one passes into the other. But in the eagle ray the body of the fish can be easily made out for the whole of its length, and the pectoral fins have the appearance of what they are in reality—appendages. On the upper side the body appears elevated above the pectorals, tapering in a sort of spindle shape toward the caudal extremity, and terminating in a very long tail, which tapers gradually, and is very slender at the point. In the distal, and by far the greater part of its length, it is perfectly plain, without either spine or fin. It resembles the tapering thong of a whip, on which account the fish is often called the "whip"-ray. Toward the base it is different; for there there is a little lobe of fin, and under it a serrated blade like that of the sting-ray in form, but not quite so large in proportion to the size of the fish. The pectoral fins in this species are very tiny, pointed, and narrow in proportion to their length, which gives them much of the character of wings. It is generally supposed that, in the sting-ray, in this, and in all the rays that have a single powerful serrated weapon, or an otherwise simple and tapering tail, the weapon is either renewed periodically, or provision is made for the replacing of it by another in the event of its being broken off; for a smaller one has been observed by the side of the large one attached to the same base. The eagle ray has no pointed teeth in the mouth, though the jaws are abundantly supplied with both teeth and muscles. The outline of the jaws is rounded so that the one is capable of having a rolling or grinding motion upon the other, for which reason the fish is sometimes called the "miller." The teeth are very hard, and nearly flat in their crowns, forming a sort of mosaic pavement upon the jaws.

This curious species is found in the Mediterranean, and in various parts of the ocean, especially in the Pacific and the southern seas, where several other species having similar characters are said to have occurred. All of these appear to be very seaward and discursive; and the character of the mouth and teeth would lead to the supposition that they feed upon crustacea and shelled mollusca much more than upon fishes, though it has been stated, but without direct proof, that they use the caudal dagger in transfixing their finny prey, after having entangled it in the coils of the long tail. This is, we think, very unlikely, and would require to be established by direct observation, which, so far as we are able to ascertain, has not been done. In the absence of such observation, we would say that it is impossible. The tail, though long and flexible, is not absolutely prehensile, and must be regarded as an instrument for striking, not for grasping. Even supposing that the tail could grasp, and that it actually coiled itself round the supposed prey of the fish, where is the force by means of which the weapon could be made to inflict a wound under such circumstances? Neither it, nor any other spine or weapon with which we are acquainted upon the body of any fish, has any means of motion in or of itself, independent of the motion of the part upon which it is placed. It has not an apparatus for protruding and withdrawing like the sting of a bee, and, therefore, it can inflict no wound, unless it gets its momentum from the muscular action of the body and tail of the fish, acting as one whole. It follows, as a necessary consequence of this, that, in order to use the caudal weapon with effect, the body of the fish must be free. In proof of this, it will be seen that, both in the sting rays and the eagle rays, the weapon is placed near the base of the tail, where that organ is thick and strong, can have little motion in itself, and thus give but small momentum to any weapon, unless the whole body of the fish moves. All this tends to show that the weapon in the tail of these rays has really nothing to do with the capture or the killing of that on which they feed, any more than the electric or galvanic power of the torpedos has to do with such a purpose. It is purely a defensive weapon; and the fact of its being so tends to prove that these fish do not contend with formidable prey. The law is general throughout all animated nature, that, wherever an animal is furnished with defences, it is an animal more subject to be attacked than disposed to attack. Those defensive weapons never in the least assist in obtaining the food of the animal.

"Bulls aim their horns, and asses lift their heels;" but neither the horns of the bull nor the heels of the ass are of any service to them in the taking of their vegetable food. The same runs through all the defended animals: the insects which have stings never use those stings for the purpose of killing or wounding their prey; and the lancet-fishes and others, which have a powerful defence in spines upon their bodies, are most of them vegetable feeders, or feeders upon animals of such small dimensions that the spines could not possibly be used against them. There is no reason why those rays which have their tails armed with formidable spines should form an exception to this general law. We are, therefore, warranted in saying that they do not form an exception to it; and that the conjectures to the contrary are altogether groundless, and calculated to mislead, in a manner far more serious than the individual case, inasmuch as they are at variance with a principle of natural history, from which there is no deviation in nature itself.

That the eagle ray ever made its appearance on the British shores is a point not fully ascertained, though, as the habits of the fish are understood to be discursive, and it is certainly well organised for vigorous swimming, it is by no means unlikely that it should come into our seas; but it does not appear to be a very shoreward animal in any part of the world. Some fragments have been noticed that were supposed to belong to it, but the supposition rests upon very slender foundation. The fish is so curious, however, that it is well worth looking out for by all who take an interest in the inhabitants and the wonders of the deep.

We shall close this brief sketch of the very

interesting family of the rays by noticing at least one of the remaining, and most singular section of the whole, *Cephaloptera*.

These, from the singular projection of a lobe of the pectoral fins in advance of each side of the head, but attached to it as far as it goes, have been called horned rays. They are found in nearly the same seas as the eagle rays, namely, the Mediterranean and the distant oceans; and mention is made of one as having occurred on the shores of North America. Some years ago a specimen was found washed ashore, we believe, on some part of the south coast of Ireland; and the mutilated remains are, or were, in the possession of the Dublin Royal Society, though not in a condition for enabling any one to make out the species.

In their general form the *Cephaloptera* resemble the eagle rays; but they have the distinction between the body and the pectoral fins still more marked, the body shorter and thicker, the fins longer in proportion to their breadth, and the serrated weapon nearer the base of the tail. The eyes are also nearer the extremity of the head (there is no muzzle), and farther apart from each other laterally. The membrane which advances on each side of the head forms a curved margin to the front, with the concavity outwards, and the points advancing till the curved margin forms an arc greater than a semicircle. The under side of the membrane returns in straight lines to the lower part of the head, giving this singular appendage something the appearance of a sort of scoop, with the opening downwards, and bevelled off at the end till the angles at the opening are considerably in advance of the edge between them. The pectoral fins have a solid appearance for great part of their extent, and then a radiated border, which is much larger at the tips of the fins than anywhere else. The anal fins appear as if they were part of this border, only separated from the rest of it by a small notch, and rounded at their extremities. The body has but a very slight resemblance to that of any other fish. It is thick and round, a little narrower at the origin of the tail than at the head, but narrowing rapidly at both ends, and having something the form of an oblong gourd.

The specimen found on the south coast of Ireland measured three feet nine inches from tip to tip of the dorsal fins; but that is nothing to the size of some (whether of the same species as that one or not we cannot determine) that have been seen in the Mediterranean. These are the *Cephaloptera giorna* of Risso. The body is large, turned, elliptical in the cross section, and smooth on the surface, there being no serous appendage except the serrated weapon near the base of the tail. The colour is indigo blue, but with reflections of blackish blue, brown, and violet, when seen in different lights. The under part is dull white, without any reflections. The eyes are silver grey. There are other species, or at all events coloured varieties, in the Mediterranean; but they are not very clearly made out. Some of them are huge fishes, for a specimen has been mentioned which weighed fully six hundred pounds. They appear to keep out at sea; but nothing is known of their manners or their food. Their teeth are, however, much smaller than those of the sting ray and the eagle ray. They are strangely-formed animals; and with them we must close our notice of the family of the rays, which, to those who study the structure and action of animals, is one of the most interesting in the animal kingdom.

RAJANIA (Linnæus). A genus of West Indian climbing shrubs, belonging to *Dioscoreæ*. The species are stove plants, and are increased by dividing the root.

RALLUS—Rail, or rather perhaps Rallidæ, the rail family. A genus of *Echassiers*, or stilt-birds, belonging to Cuvier's macrodactylic or long-toed family. Bechstein and some others have divided them into two genera, from the different lengths of their bills, considering those that have the bill longer as the true rails, and those which have it shorter as crakes; but, for popular purposes, the distinction is of very little use.

Taking the whole of them together, the generic characters are as follow: the bill longer than the head, straight or slightly curved, compressed at the base, and cylindrical toward the tips, the upper mandible channelled; the nostrils opening longitudinally at the base of the bill, in the grooves, open through and through, but in part closed with membrane; legs very stout, bare of feathers to some distance above the tarsal joints, with three long toes to the front and one to the rear articulated on the tarsus, the front toes free or divided to their bases; the wings of mean length and rounded, the first quill being shorter than the second, and the third and fourth the longest in the wing.

Though the rails are entirely without webs to their feet, yet, with the exception of the coots and gallinules, they are among the most aquatic birds in the whole order. In this respect there are differences among them. Some are constantly by the banks of streams, often running along the submerged plants, and sometimes along the water itself, where they move so rapidly that the water actually appears to support their footsteps; while others do not go directly into the water, or even lurk in the aquatic herbage on the margin, but they run about in the tall herbage of moist corn-fields and meadows, where their notes are often and readily heard, though the birds themselves are but seldom seen. Of this the common cornerake affords a remarkable instance; for there are many districts where its cry is heard from every humid field during the season, and yet where the oldest of the country people never saw a corncrake, or have the least notion as to what it is like.

The food of the whole genus is understood to be chiefly animal, consisting of worms, mollusca, and such insects and larvæ as are found in the damp and shaded places which the birds frequent. They may be understood as preserving from the ravages of small animals the vegetation of places which few other birds frequent. In one or another of these species they are found in almost all parts of the world where there are water and herbage to conceal them. They very rarely take the wing, unless it be the migratory ones in seasonally changing their habitations, and in these cases they are rarely seen. They do not flock at any season, and they come and go in so stealthy and silent a manner that they are not seen. Those which inhabit the banks of streams are more frequently seen than those which live in the corn-fields and other expanses of tall herbage, but even with them it is only a sight and away. They may be caused to run along the side of a pool where the banks are clear, but they are never far from a cover of bushes or herbage, in which they very quickly con-

ceal themselves. Indeed if one searches the place in which a bird of this kind has taken refuge, the bird is not to be found, neither is there any clue to the direction that it may have taken. Their running powers are so great that hardly any animal can keep pace with them in the cover, and they turn and double with such rapidity, and disturb the vegetation so very little, that they cannot be tracked. Thus, if one rouses the common water-rail in the bed of a stream, and pursues it up the current, it will run and wade and scramble in that direction, but the moment that it gets to a cover it bores through, gains the opposite side, doubles, and never stops till it is farther down than the point at which it was first seen. During the day too they repose in silence and secrecy, and do not rise if they can avoid it. Very early and very late, when the ground is damp, and the mollusca and worms out, are their feeding times, and some of them continue even the whole night long. This is especially the case with the corncrake; and so close does the female of that species sit, that there have been instances of the sithe of the mower destroying her on her nest, without his being aware of her or her nest being there. All the species nestle in as close concealment as they live. The nest is formed in a thick tuft of rushes, sedges, or other aquatic plants, in the case of those that frequent the banks of streams; and those that keep in the cover of the broad herbage, without approaching close to the waters, nestle in that. In this close cover, little labour is bestowed on the construction of a nest, as the nest is used only during the time of hatching the eggs. No ground or running bird exhausts much of its energy in nest-building, and it would be contrary to the general law of nature's economy that it should, for nature never overdoes any more than she fails. The young are able to run and seek their own food almost the moment that they break the shell, but what attention the mother pays to them after is not well known, in consequence of the hiding dispositions of the birds. The family may keep together, and with the mother, while they are very young, but the family are not found in a society after they are fledged; their instinct for solitude and retirement appears to operate at a far earlier age than it does in even the least social of the gallinidæ, which these birds resemble in some particulars, though they differ greatly from them in others. The eggs, as in most ground birds that breed in rich places or in cover of any kind, are rather numerous, rarely fewer than six in the hatch, and often as many as ten. The eggs are generally of a dull sand-yellow colour, mottled with reddish-brown spots, and not very easily distinguished from the withered grass and moss on which they are placed. We shall now notice a few of the species, first of the rails properly so called, and then of the crakes, though we do not think the particular distinctions of them as subgenera or sections are of very great importance.

The true rails have the bill longer than the head, slender, and sometimes slightly arched; the nostrils in the channel of the upper mandible; the anterior toes quite free, and the hind one articulated a little higher up than the others. The head is small, the neck rather long, the shoulders tapering, and the body narrow and compressed, obviously formed for making its way through close bushes and herbage. In its form it is the very reverse of a swimming body, and yet the birds can, upon emergency, swim a considerable way, though they never do so if they can avoid it. They eat, in addition to the animal food that has been mentioned, the pulpy seeds of aquatic plants, but they prefer the animal substances. Their pastures are always rich, as they form the most productive portions of the countries in which the birds are found; and they shift about, so as to avoid equally the effects of heat and of drought. They do it in such a way, however, that very little can be observed of their movements. Their slow march is stately, and with long steps; and in their running they bring the whole axis of the body to a horizontal line. Their flight is more rapid and less fluttering than the roundness of their wings would lead us to suppose; but, as is the case with almost every bird of the order to which they belong, they fly with the legs hanging down, ready to alight whenever they come to a locality that suits their purpose. In general they take their repose upon the ground, but they sometimes perch upon bushes, or low branches of thick trees, though they never fly to a high perch, except to get out of the reach of a ground enemy. The predatory mammalia, which lurk and prowl among the bushes near the waters, are their chief enemies; and, as these are chiefly night-feeders as well as themselves, they are on the watch against them. From birds of prey they have not much to fear; for, though bog eagles and marsh harriers often beat over their pastures, the birds are in the cover, and still, at the times when these are on the wing.

The Water Rail (*R. aquaticus*) is the species best known. It inhabits watery places; but the banks of running streams, rather than the borders of fens and marshes, in most parts of Europe and Asia. In some parts of Britain it is not so, as it is rarely seen, but it is not found in the cold and upland districts. It breeds in the country, and remains nearly stationary all the year round in some places, but it migrates entirely from others during the severe weather.

The length of the full-grown male bird is about ten inches, and the stretch of the wings sixteen. The bill to the gape measures an inch and three quarters. The upper mandible is black, except the edges, and the tip of the lower mandible is the same colour; the remainder of the bill, the inside of the gape and the irides are orange-yellow; but the narrow naked border of the eyes is greenish black. The general plumage on the upper part is black, but each feather tells distinctly in consequence of being margined pretty broadly with olive-brown. The feathers on the front have a portion of the tips of the shafts enlarged, and without any webs. The chin, a spot under each eye, and the naked skin from the gape to the eye, are white. The throat, the neck, and the breast, are bluish-grey; and the belly whitish-orange, passing into pure white on the under coverts of the tail. The wings are dusky with whitish margins, the inner webs of the quills broad, and the outer ones narrow. The tail-feathers, which are twelve in number, are also dusky, but their margins are olive. The sides of the body are mottled, and barred with black, white, and some orange. The legs are dusky, naked to about three-quarters of an inch above the tarsal joints; and they and the toes are covered with shielding plates on the anterior and upper surfaces, and with reticulated scales on the posterior, and under. The female is marked nearly in the same manner as the male, but has the bill

shorter, and the dark colours paler; and both birds have the plumage paler in winter than in summer. The nest is in close concealment near the edge of the water. The eggs are nearly or altogether white; they are rather numerous, but the number varies considerably.

The water-rail is a very cautious bird, as well as a very concealed one; and, though each individual, not having the benefit of sentinels, as flocking birds have, must keep its own watch, yet it is very seldom surprised, and still more seldom taken: what with running, wading, dashing across the brook, boring through bushes, brakes, and herbage, doubling, turning, and otherwise shifting its course, it defies both the dog and the gun. There is no very great temptation, indeed, to kill it as game, for, though it is generally fat, the flavour of its flesh is unpleasant. When it can be seen alive, and displaying its agility and its wiles, it is a very interesting bird.

America is much more of a rail's country than Europe or the greater part of Asia; and therefore we must notice some of the American species. The great difference of the seasons in the United States makes the greater part of them migrant in that part of America.

The Clapper Rail (*R. crepitans*) is one of the most remarkable of the North American ones, and, like our corncrake, it makes itself to be heard all the night long. It is larger than our water-rail, being fourteen inches in length, and eighteen in the stretch of the wings; the bill is two inches and a quarter long, slightly bent, and of a reddish brown colour; the upper part is black, streaked with dull brown; the chin and streak over the eye are brownish white; the fore neck and breast are reddish brown, the flanks and vent black, with white tips to the feathers; the coverts of the wings are dark chestnut brown, and the tail-feathers and quills dusky, without any margins; the legs are dull brown, and the irides dark red.

This species is very common, during the summer, through all the latitudes of the United States; but it keeps near the sea-coast instead of passing into the interior. It is different in habit from the water-rail of Europe, as it prefers the salt marshes to the small streams which scum the dry ground. It is a very noisy bird, especially during the night and before rain, which are of course the times when those mollusca, crustacea, and other small animals upon which it feeds in the marshes, are in greatest activity and most easily obtained. Wilson compares the cry which it utters to that of a Guinea fowl, which is not the most musical note in the world. They arrive in the northern states about the month of April, and, though its flight is not seen, its note is very speedily heard.

Wilson's account of the casualties to which it is exposed in the breeding time is so graphic, that we shall, in part, quote it:—"About the twentieth of May," says he, "they usually begin building and laying at the same time; the first egg being usually dropped in a slight cavity lined with a little dry grass pressed for the purpose, which, as the eggs increase to their usual complement, is gradually added to till it rises to the height of twelve inches or more, doubtless to secure it from the rising of the tides. Over this the long salt grass is artfully arched, to conceal it from the view above; but this very circumstance enables the experienced egg-hunter to distinguish the spot at the distance of thirty or forty yards, though imperceptible to a common eye. The eggs are of a pale clay-colour, sprinkled with small spots of dark red, and measure somewhat more than an inch and a half in length, by an inch in breadth, being rather obtuse at the small end. These eggs are delicious eating, far surpassing those of the domestic hen. The height of laying is about the first of June, when the people of the neighbourhood go to the marshes *an egging*, as it is called. So abundant are the nests of this species, and so dexterous some persons at finding them, that one hundred dozen of eggs have been collected by one man in a day. At this time the crows, the mink, and the foxes, come in for their share; but, not content with the eggs, these last often seize and devour the parents also. The bones, feathers, wings, &c., of the poor mud hen lie in heaps by the hole of the minx; by which circumstance, however, he himself is often detected and destroyed."

It seems as if the very elements were in conspiracy against these birds: they "are subject to another calamity of a more extensive kind: after the greater part of the eggs are laid, there sometimes happen violent north-east tempests that drive a great sea into the bay, covering the whole marshes; so that at such times the rail may be seen in hundreds floating over the marsh in great distress; many escape to the main land, and vast numbers perish. On an occasion of this kind I have seen, at one view, thousands in a single meadow, walking about exposed and bewildered, while the dead bodies of the females, who perished on or near their nests, were strewed along the shore. The last circumstance shows how strong the tie of maternal affection is in these birds; for, of the great number which I picked up and opened, not one male was to be found among them; all were females; such as had not yet begun to sit, probably escaped. These disasters do not prevent the survivors from recommencing the work of laying and building anew; and instances have occurred in which their eggs have been twice destroyed by the sea, and yet in two weeks the nests and eggs seemed as numerous as ever." This passage would afford much scope for meditating on the physiology of birds; but our limits forbid our entering upon it, and so we must leave it as an exercise for the reader.

If all is well, the young are soon able to run about, which they do with great swiftness, and tread the grass and other marsh plants with wonderful dexterity. They can swim in smooth water, though they are of course ill able to contend with an inbreak of the sea. Swimming is a much more severe action in them, however, than in birds which have the feet webbed or lobed. Though they strike powerfully, their stroke tells but little upon the water; and, consequently, though they strike rapidly, they move slowly. Their feet are for the land, not for the water; and on level ground they run as fast as a man, while among the hummocks, and under the cover of the marshes, they very speedily get out of reach.

The Virginian Rail (*R. Virginianus*) is not, upon the whole, unlike the European species, but it wants the grey on the breast, and has the toes less produced. This bird is not so abundant as the former, and it does not choose its nesting-place so far into the salt marsh, but remains on the margin. It is also found by the streams and pools of fresh water, on which account it is locally called the fresh-water mud hen, while the other and larger one is the hen of the salt water. Its manners appear to be as like those of

the European species as the difference of the countries which they inhabit will admit. Though they are not subject to the same calamities as the clapper rails, yet their eggs are often washed away by the floods. They are much more given to concealment than the clapper rails, and they are not so noisy. In fact, the Virginian rail hardly has a story, after that of the European rail is told, only that it is much more migratory, as most birds are in North America.

The rails of the other parts of the world have got no story to tell, or, rather, they have found no one to tell one for them; but we may name one or two.

The laughing-billed Rail (*R. ridirhynchus*) is a South American species, measuring nearly a foot in length. The upper parts are brown; the top and sides of the head dull brown; the occiput and upper neck bright brown; the quills and tail-feathers black; the throat mottled with brown and white; the breast and flanks bluish brown; a white stripe from the lower neck to the belly; the rump and thighs black; the fronts of the tarsi red, but the posterior surface of them black; the bill long, blackish, and with the mandibles gaping at the base. There are other rails in South America; indeed the species may be said to be numerous there as well as the individuals, but nothing peculiar is known of their habits. There is, however, one South American species which we may mention on account of its great size.

The gigantic Rail (*R. giganteus*). The general colour is blackish, glossed with reflections of green, and whitish streaks along the centres of the feathers; the feathers on the rump, and also the quills and tail-feathers, are without the reflection of green and the streaks. The length is upwards of two feet; but it is doubtful whether this is a true water-rail, and not intermediate between these and the land-rails, or crakes.

In Southern Africa, Australia, the Asiatic Isles especially, and in many of the groups of islands of the Pacific, there are many species of rails. They are indeed one of the most generally distributed sections of birds with which we are acquainted; but, generally speaking, they are birds which come little into view; and, accordingly, the interest of their history bears no proportion to their numbers.

We shall now notice one or two of the crakes, but retaining the same generic name. Their general characters as distinguished from the rails are: the bill shorter than the head, stouter at the base than in the rails, and tapering to a sort of cone; higher than broad at the base; both mandibles of equal length, and compressed at the tips; the tarsi long; anterior toes also long, and slightly margined. The typical bird is

The Corncrake (*R. crex*). The corncrake inhabits all the humid tracks of Europe and Asia which are covered with tall and close vegetation, but not absolute marshes. It endeavours to find always the same kind of pasture; and, therefore, it migrates equally before the parching heats of the warm latitudes, and the pinching cold of the more polar ones. When it makes its summer appearance in places where quails are also summer visitants, it comes about the same time, and as it has some resemblance to a quail, though much larger, it sometimes gets the name of "king of the quails!"

As a British bird, the corncrake makes its appearance, or rather comes, for it can hardly be said to appear, about the month of April, sooner or later, according to the place and the season; they go to the inland and upland districts rather than to the warmer places near the sea, and they appear to do this because such places are more moist and subject to rain. They are said to give the preference to slovenly farms, probably because the cornfields in these abound more in the animals on which they feed; they are also said to visit very sparingly those fields which are highly dressed with lime. The birds, as we have already said, are not seen, as they are not only in cover, but, generally speaking, in a state of repose during the day; but in places favourable to them the cry of *crec, crec*, is incessant after twilight and during the night, especially in those northerly places where the twilight is tolerably bright all the summer nights through. They run among corn or tall grass with wonderful rapidity, without making any rustle or sound; and they shift about in such a manner, that, if one crosses their cover, they call upon all sides in turn, even though there is probably not more than one male bird. The call is continued during the incubation, and the object of the male seems to be to keep danger away from the female and the nest, by drawing it upon himself: of course we do not mean that this is a purpose which he contrives and puts in execution as expecting a certain result, because that would require the use of reason, which he does not possess; all that is meant to be implied is that this is the purpose which the instinct serves, though of course the bird himself knows nothing about it.

The nest is very rude, and it does not require to be otherwise, as it is a mere hatching spot, and not a nursery for the young birds. The eggs are very numerous, sometimes as many as fifteen or sixteen, and yet there are very few birds of which the young are so seldom got sight of. The birds linger till about September, at which time some at least of the fields, in which they had been bred in the earlier part of the season, are cleared; but the birds are not very much more seen then than when the fields are covered with tall green vegetation. For a short time before their departure, too, they are silent, and few think of looking for them. They lurk during the day, and, as their colours are not very unlike those of clods and stubble, one may pass close by them without noticing them, the more especially as they lurk singly, and not in families, or even in pairs. If a dog finds one he cannot raise it on the wing without pushing it to the very utmost extremity, and if he gives chase with eagerness it is not destitute of stratagems whereby to throw him out; when the dog is almost close upon it, down it drops flat on the ground, and lies motionless as a stone till he overshoots it in his eagerness, and then it is instantly on foot again, and off in the opposite direction, generally out of the reach of the dog before he can turn.

The *crec, crec*, of this bird, which, in lonely upland places, makes the summer nights rather lively, is not the love song of the corncrake; it is rather the household song, serving, as we have said, to attract the attention of any enemy that might otherwise invade the nest. In the early part of the season, and before the birds are paired, which is of course the time for the love song, the summer cry may be repeated often enough by the closest imitation of the calls of birds, without attracting a single corncrake; but there is another short calling note often repeated, like the sound produced by running a bit of stick very rapidly across the uprights of a close railing, which takes the

ears of the birds in early spring, and is sometimes used in order to capture them.

The corncrake is between nine and ten inches long, and sixteen in the stretch of the wings, and when in the best condition it weighs nearly half a pound. The upper colour is grey, mottled with blackish; the under part reddish white, and nearly pure white on the chin; and the wings are rust-coloured. All the colours are, however, clouded and broken. The bill and feet are brownish ash-colour.

The spotted Crake (*R. perzana*) is a summer visitant in Britain as well as the former, but it is rare and local, being found only in the south and west of England. It is more aquatic in its habits than the corncrake, and frequents the tall herbage by the banks of streams in lonely places; it is a bird better adapted for getting through very close covers, as it is much more slender and not above two-thirds the weight of the corncrake, though nearly of the same lineal dimensions. It gets very fat before its departure, and is then in estimation for the table.

Baillon's Crake (*R. Bailonii*) is not uncommon in some parts of France, but very rare in Britain; and as it is a bird with short wings it is not well adapted for flight. Its colours are not so mottled as those of the others, and blackish-brown is the upper tint, with the head olive and the nape yellow, and ash-colour the under tint, darker on the belly.

The little Crake (*R. pusella*) is also very rare in Britain, and a very hiding bird in its manners. The upper part of it is brown, of different shades in different parts, and the under part is white, passing into cream-colour on the belly.

There are various species of crakes in different parts of the world, the known history of which has but little popular interest. They are not so numerous as the rails, however, and we might be prepared for this by the difference of their haunts. The rails are on the very margin of the water, and wherever there is water there may be a rail's pasture; but the crake is at some distance from the water, and there its pasture may be burnt up and fail, while that of the rail remains.

RANATRA (Fabricius). A curious genus of hemipterous insects belonging to the section *Heteroptera Hydrocorisa*, and family *Nepidæ*, which see for its characters. The type is the English linear water scorpion, *Nepa linearis*, Linnæus, which is about an inch and a half long. There are five or six other exotic species. They are all aquatic, but their motions are very slow, their legs being unprovided with the five rows of hairs which are so serviceable to the motions of other allied aquatic insects; the female deposits her eggs in the water, inserting them in the stems of aquatic plants; these eggs are of curious form, and are represented in our second volume, page 834, fig. 15. The larvæ and pupæ resemble the parent insect in their motions and habits, making use of their raptorial fore legs to secure their prey and convey it to the mouth. The perfect insect flies well, but chiefly in the evening and during the night, and is thereby enabled to quit a spot when the water is on the point of being dried up.

RANDIA (Linnæus). A genus of evergreen shrubs, natives chiefly of South America. The flowers are pentandrous, and have some resemblance to those of Gardenia. The genus belongs to *Rubiaceæ*, are inmates of our stoves, and require to be grown and propagated in moor-earth and loam.

RANINA (Lamarck). A curious genus of crustaceous animals, belonging to the order *Decapoda*, and section *Brachyura*, having the body of an oblong oval form, the tail extended, and the legs (with the exception of the claws) terminated by paddles, and arranged in two series, the four posterior ones being dorsal. The species are very few in number, and frequent the Indian seas.

RANUNCULACEÆ. The first natural order of the sub-class *Thalamifloræ*, having the petals and stamens inserted into the receptacle. This is one of the most numerous orders of the Jussieuan system, it comprising twenty-nine genera, and above six hundred and thirty-two species.

The frogwort, or crowfoot, and its allies, are herbaceous, very seldom shrubby plants, with aqueous juices, round or irregularly angled stems, alternate petiolate leaves, destitute of stipules, but with dilated leaf-stalks more or less amplexicaul. The dise of the leaf is either entire or variously lobed, seldom compound, sometimes abortive when thee xpanded petiole becomes a phyllodium; the pubescence, when present, is simple. The inflorescence is variable, either solitary, scattered, racemose, or paniculate; the flowers regular or irregular, and united, or by abortion separate. The sepals are free, definite, from three to six, deciduous, often petaloid, and rarely absent. The petals are equal in number to the sepals, and alternate with them, or two or three times as many, often deformed, being transitional towards either sepals or stamens, or nectaries. The stamens are indefinite, free, and deciduous. The anthers are adnate and two-celled, opening behind by longitudinal chinks. The pistils are numerous, exserted from a ring or torus in one or more series. The styles are free and terminal, short, and often persistent, and the stigma simple. The fruit in general consists of small nuts, or akenia, occasionally becoming baccate, with one or more seeds, or capsular with one or two valves.

The *Ranunculaceæ* are in general poisonous plants, as remarkable for the acridity of their juices and venomous properties as for the beauty of their flowers. Their deleterious qualities are so volatile, that in most cases simple drying or infusion in water, or decoction, is sufficient to remove them, and to render the plants innocuous. It is said to be neither acid nor alkaline, but its activity is increased by the addition of acids, or the admixture of sugar, honey, wine, spirits, &c., and that it is only effectually destroyed by the agency of water.

In this order there are many beautiful flowers: beside the ranunculus, there are the peony, anemone, delphinium, hepatica, aconitum, together with the graceful clematis, and atragene climbing shrubs.

The *Ranunculus Asiaticus* is one of our most admired bed-flowers, and its varieties are innumerable: and every year many new ones are obtained from seeds saved from the best breeder flowers. The butter-cup of our meadows is one of the most conspicuous of British plants.

RAPE is the *Brassica rapa* of Linnæus, a common agricultural plant found wild in many parts of Britain. The rape is a biennial, and is chiefly cultivated for its seeds, whence a valuable oil is expressed. It is also sown for winter food for sheep, and it is sown like cress and mustard, for early sallad.

RAPHANUS (Linnæus). The *R. sativus* is the

common radish of our gardens, of which there are many varieties. The seed-leaves are an ingredient in salads, and the green pods are used as a pickle.

RAPHIDIIDÆ (Leach).—Snake-fly. A curious family of *Neuropterous* insects, belonging to the section *Filicornes*, having the antennæ setaceous and multi-articulate, the head narrowed behind, the prothorax very long and narrow, forming a slender neck; the wings large, and disposed, when at rest, like the roof of a house; the tarsi are four-jointed. The family, according to Latreille, comprises two genera, *Raphidia*, Linnæus, and *Mantispa*, Illiger. The latter, however, agrees only with the former in the position and neuration of the wings, whilst in the raptorial structure of the fore legs, and more especially in the structure of the mouth, as ascertained by dissections made by the writer, it most certainly belongs to the family *Mantidæ*. *Raphidia*, therefore, constitutes the only genus in the family, and is distinguished especially by its long and slender neck, simple fore-legs, as well as by the long ensiform ovipositor of the female. Mr. Stephens describes six British species, varying very slightly from each other; the type being the *R. ophiopsis* of Linnæus, the body of which is about half an inch long; the wings are large and numerously veined. The insect when alive is extremely active, its long cylindric neck giving it the power of moving its head in all directions, whence the English name of the group. The larvæ are long, narrow, and fleshy, rather broader in the middle of the body; the head large, square, and depressed; the legs, six in number, short, and armed with two terminal hooks. This larva is very active, rolling itself up when disturbed, and twisting itself in various directions; its food, as well as that of the perfect insect, consists of small insects. The pupa is at first quiescent, with the limbs laid along the breast, but subsequently appears to obtain the power of locomotion previous to assuming the perfect state. (See the Memoirs of M. Percheron, in the "Magasin de Zoologie;" and of Mr. G. R. Waterhouse, in the "Transactions of the Entomological Society of London.") The larva resides in crevices in the bark of trees, and it is upon the trunks and amongst the foliage that the perfect insects are found. They chiefly appear in the month of June, and are said to prefer the neighbourhood of streams. According to Mr. Curtis, the ovipositor is exceedingly dissimilar to those of any other insects; it appears to be formed by two canals united, with a space between, being composed of transverse rings, which enable the insect to propel the eggs to the apex, where they are received and deposited by two minute appendages, in clusters like flyblows.

RASPBERRY is the *Rubus idæus* of Linnæus. A wild British shrub, but long cultivated in our gardens for its fruit. The raspberry belongs to *Rosaceæ*, and several new varieties have been originated by the Dutch gardeners, who excel in the culture of this fruit.

RAT (Mus, Linnæus, or rather perhaps Muridæ, the rat family). A genus of rodent mammalia, numerous in species, and beyond all possibility of numbering in some of them. One or another of the species is familiar to every body; and they are among the greatest animal pests in dwellings, storehouses, and magazines of provisions. They are all lively animals, and some of them are very pretty; but there is a "Cain's mark" set upon the whole race, and "whosoever findeth them" endeavours to "slay" them. Not only this, but there are more engines made for the capture of animals of this genus than for those of any other; and "rat-traps" and "mouse-traps," though not perhaps the very first contrivances of art, certainly had their origin at a very early stage. As a domestic pest, the smaller species, the common domestic mouse, which Linnæus took as the type of the genus, appears to have claimed the earliest attention; as we find it made a character in some of the ancient Grecian fables; and in the *Batrachomyomachia*, or "Battle of the Frogs and Mice," which is usually ascribed to Homer, and which is perhaps the finest burlesque satire on wars and heroes that ever was written, we find them named after the different kinds of stores and provisions upon which they levied their contributions. In the original strife of these mighty combatants, the folly of the mice in being persuaded to go into the pond, for which nature had not fitted them, brings very forcibly to our mind the invasion of Russia by Napoleon, and the fatal consequences of his temerity. There is also something peculiarly fine in the final destruction of the mice by the crabs, which are aquatic animals, and of the frogs by the storks, which are land ones. The fable of the lion and the mouse, in which the monarch of the forest is compelled to beg of this little animal to release him from the net of the hunter, is also full of point. Thus the ancients were, in one respect at least, superior to us in their study of animals. They studied the manners, and by this means contrived to make every animal suggest a moral lesson; we, on the other hand, merely study the forms: and thus, though such of us as are naturalists can as naturalists say much more about them than the ancients could have done, yet they have now far less interest in the eyes of those who are not naturalists than they had then. Thus, though in some respects we have gained, and gained greatly, yet there are others in which we have lost; although *we ourselves* are of course fully convinced that, upon the whole, we have gained.

Taken to the full extent which is included by Cuvier, the rat family is a very numerous one, comprehending not fewer than fourteen or fifteen genera. These have all some resemblances to each other, but most of them differing so much from the true rats in their dispositions and manners, that the same general description cannot be made to apply to them all. Under the title Arctomys in this work there will be found some notice of the marmots; under Avicola some of the field-mice; and various others under their names; so that we shall confine most of what we have to say in the present article to the rats and mice properly so called.

Viewing them thus, the outline of those characters which are common to them will be stated after we notice some of their habits. They belong to a vegetable-eating family, and yet they are all more or less partial to animal substances; and some of them attack living animals, without much regard to size, but when they do so it is still in accordance with the general gnawing character of the rodentia. They do not kill, but begin to eat the living body; and there are instances of rats having in this way inflicted terrible lacerations upon infants and persons otherwise helpless, when neglected by those who ought to take care of them. This has sometimes been pushed to such lengths as to become ludicrous. Mice and rats are known to be very fond of fat bacon, and indeed of

fat of all kinds. Hence we have had stories of them making their holes in the bodies of pigs when k pt long in a state of great obesity. We believe that there are well-authenticated instances of the toes and part of the feet of bed-rid and neglected persons being eaten away by rats; but they, at least used to, carry these matters much farther in Germany; and a curious ancient tale of a Saxon duke is thus transformed from German prose to English rhyme.

> "A Saxon duke had grown so fat,
> 'Tis said that many a mouse and rat
> Ate grots and labyrinths to dwell in
> His pastick parts, without his feeling."

In addition to this fondness for animal matter, there is little doubt that the mice and rats destroy a vast number of offensive animals and offensive substances. It is well known that the mice are great eaters of those beetles which so much infest houses during the night; and there is no doubt that in cities where there is an under drainage by sewers the brown rats, which make the sewers their principal haunts, contribute not a little both to cleanliness and health. As matters are at present, the drainage of London stains the water of the Thames as much as the fondest admirer of substantial waters could wish for; but when we take into consideration the countless millions of brown rats which are supported in the sewers, and of which the greater part are produced, and live, and feed, and thrive there, without any other store for their support, we can readily understand what would be the case of matters were it not for them. In this view of the matter, the murine races, whether they come under the common name of rats or of mice, are in this respect highly useful, that they play the scavenger for man in cases where he either cannot or will not play it for himself. Every animal indeed which follows man in all his migrations, and multiplies in proportion as his numbers multiply, is always useful to him. Most of these animals are, no doubt, annoying, and many of them are positively offensive; but, in all cases where they are so, man will find that he himself is generally to blame. They come to consume that which is at variance with health and cleanliness; and if the latter is properly attended to, there is no place for them.

In the family under consideration, there appear to be species, chiefly of rats, which are the most powerful and efficient, suited to different states of society. This is well exemplified in the two species of rat which are found about habitations in Britain, and indeed in most temperate countries—the black rat and the brown one. The black rat is the oldest inhabitant of the country, or, at all events, it was plentiful in former times, when the brown rat was comparatively rare; and its numbers have fallen off very much, while those of the other one have increased in a far greater proportion.

The usual method of explaining this is to say that the brown rat has eaten up the black one, and done so to absolute extermination in many instances. But both the analogical presumption and the observed facts are against this. If the brown rat had come to eat up the black one, the increase of its number should have become less, and so indeed should its numbers altogether, as those of the other were eaten up. The fact, however, is exactly the reverse of this; for the brown rat has, in all cases in which observation has been made, increased much faster after the total disappearance of the black rat than it did before. Besides, there are some parts of the country where both species haunt the very same buildings, and there is no account of any instance in which the one species made an attack on the other. Rats, as we have hinted, are not very particular in their eating; and, if pushed to extremities, it is very likely they would eat their own species; but this is not their general food, for we know of no animals, even in the sea, where cannibalism is by far the most common, far less on the land, which are entirely, or even chiefly, self-supported in the way of food. This would, in fact, be defeating the grand purpose of nature, which runs through and is observable in all that lives and in all that grows, namely, that of each being supported upon the surplus of another.

When they have been found together in the same house or other building, these two species of rats have always taken up separate localities; and localities which show that they are adapted to different states of society, or, which is the same in effect, to become of different character and construction. The black rat is properly a murine animal, lodging in holes of walls and crevices of roofs, and therefore it lodges higher than the other. The brown rat is more an animal of the foundations, loving cold and damp, and preferring a sewer or drain to a palace. As inhabitants of the same building, therefore, the two do not come upon each other's ground in such a way as that the one could exactly replace the other, and this leads us to the particular state of men and their dwellings, in which the one or the other is likely to be the common rat.

Mud walls, and turf and thatch roofs, are the places for the black rat, because it can most readily find or form a lodging for itself there; and although during the night they may range on the ground, their escape is always to the upper part of the building. There is no better authority than Burns as to the conduct of all rural creatures, and indeed all creatures whatever that came under his observation. In his time, whatever may be the case now, those parts of Scotland to which his observations were principally directed abounded much in mud walls, and still more in thatched roofs—in roofs particularly well adapted for affording lodgings for the black rat, in which it could rear its litter, or hide itself during the day. In "the Vision," where he gives so true a picture of the temporal privations to which he was subjected in consequence of his devotedness to the muse, he, without specially intending it, throws more light upon the habitation and character of the black rat than all the professed naturalists have written on the subject. He says that, as he sat "right pensilie" by the fire in the "spence," or inner room of the rude old-fashioned farm-house, "musing backwards on misspent time," he

> 'Sat an' e'ed the spewing reek,
> That filled with host-provoking smeek
> The *auld clay biggin'*;
> An' heard the *restless rattans* squeak
> *Aboon the riggin'*."

Burns did not, like the "starveling bards of these degenerate days," who gather poppy petals for the fine but fading winter nosegays of easy printing, use to hunt for inapplicable epithets to make his rhyme clink. With him, wherever he came by the art, the word which is best in rhyme is always best in reason too; and on this account he is a first-rate authority in all points of natural history which he touches. The "auld clay biggin'" is the very place for the

"restless rattan," which always means the black rat; as the word was fashionably cut down to half its number of letters before the brown rat was common in the country. The "riggin'" is also the very place of the roof for the black rat. We need hardly say that "riggin'" is merely the Scottish mode of pronouncing the word ridging. A strong tree or pole, laid from end to end, is the "riggin'-tree," and by way of eminence the "roof-tree" of these old-fashioned houses; and so essential is this to the stability of the houses, that it was the emblematical word for the chief of a clan, or the master of a house; it is even the same in the English language. "Husband," *q. d.*, "House-band," is the very same idea as this; for the "riggin'-tree," or "roof-tree," is "the band of the house." The poor vassals used sometimes to feel this in a very cruel manner; for if a barbarous chief wished to drive a number of them from any locality, he sent his myrmidons to pull all their roof-trees during the snow; and down fell roof, snow, and all, destroying their few sticks of furniture, and driving them and their children, and, in most cases, their sick, homeless and foodless, to the snowy desert. An instance of this occurred as recently as in one of the early years of the present century. It was during a heavy snow, and many roof-trees were drawn. Our present business, however, is with the rats.

This "riggin'" forms a very convenient lodgment for whole colonies of them; for the way in which the rest of the roof is applied leaves a vacant space over it, which is covered by the thatch, and farther made warm and dry by an external ridging of turf, or some other protecting material. This is, therefore, the appropriate place for the black rat; and it is most partial to an apartment in which there is a fire. In such places they often set up a terrible squeaking; but as it is usually in concealment, there is no knowing whether love, war, or family discipline is the principal cause; though each may be a cause in turn. Even in barns and other outhouses they prefer the roof, and are rare in places where that is not suited for being their abode. This also is noticed by Burns. When one of the "lasses" went to the barn to lift the veil of futurity by dire incantation there, a frightened black rat is described as frightening her still more than she had frightened it.

> "A *rattan* rattled *up the wa'*;
> An' she cried Lord preserve her!
> An' ran through midden-hole an' a',
> Prayin' wi' zeal and fervour."

The escape of the *rattan*, which the entrance of the damsel had probably disturbed when at its supper in the corn-bin, or heap, was "*up the wa'*," to seek safety in the roof; and indeed in all allusions to this species of rat, running up the wall is mentioned. There is a puzzle in pronunciation common among the children in the country places of Scotland, which confirms what is said by Burns, and completely establishes the habit:—

> "The rattan lap up the wa'; loup, rattan, loup."

These matters are of some consequence in the natural history of rats. Rats are associated both literally and figuratively with many points of domestic story; and as, in modern times, the brown rat is the only known rat in most parts of Britain, it is found that the rat of history and the rat of personal observation do not agree; and of course the historical one is put to the wall, and the whole point of it, and story concealed under it, are lost.

The brown rat does not take possession of the roof of the house, and its escape is more frequently downwards than upwards. It is, in fact, much more different from the black one in manners than it is in appearance and colour; and the places where they are met with in the same building are few and peculiar, generally where some "auld clay biggin'" stands in a place where all around has been modernised, where the houses are formed of such materials, and so built, that there is no shelter for a rat in the roof. It does not appear that the black rat was ever much of a city rat, or resorted to houses built of masonry and roofed with tiles or slates, though in the thatched towns, which, being generally enclosed, and often having farm or dairy buildings attached to them, partake more of the character of concentrated groups of country houses than of towns in the proper sense of the word. It also used to be said, and, so far as our observation goes, there is some truth in it, that rats never haunted the poorer cottages, but abandoned them to their more small and feeble congeners, the mice. On this account rats were accounted concomitants of riches, just as the gout is so accounted in other states of society. The truth appears to be pretty much the same in both cases. The gout appears to come chiefly in those cases where the quantity ate and drank is too great for wholesome assimilation, or, at all events, for the proper supply of the waste of the body. This waste bears always a proportion to the quantity of exercise to which the body is subjected when that exercise is not carried to undue severity, and thus indolence aids excessive supply in occasioning gout. Gout may thus be said to be the effect of, to use a homely word, "a litter in the system"—useless lumber lying in the way of the working parts; and if this "litter" is removed, there is no more gout. Now, the case of the rats is exactly parallel to this case of gout. It is not the wealth and leisure of a man that brings this painful and little-pitied malady upon him; it is the improper use of them; and, in like manner, it is not the wealth that may be in the house, but the fact of substances tempting to rats lying littering about, that brings them; and upon this principle a tidy house is always less infested with them than a slovenly one. This may be, in so far, true of the brown rat as well as of the black one, but it is by no means so generally true. Clean houses, and plentifully-supplied sewers and drains, are the places for the brown rat, which, so that it gets enough, is perhaps less particular as to the quality and cleanliness of its food than any other animal that could be named: all carrion, all garbage, all refuse and slops, so that there is animal matter or vegetable matter in them, recent or in a state of decomposition, are welcome to the brown rat. Instances have occurred in which there were none but black rats in the old-fashioned parts of a town where there were thatched roofs, stagnant pools, and no underground drainage; while in those parts of the very same town which were modern, clean, and well drained, there were abundance of brown rats in the underground places, but not a single black one in any part of the houses.

Such appear to be the chief reasons that bring these two species of rats each to or near the habitations of men, when these habitations are in a particular state; and the fact that the black rat has disappeared from most parts of Britain, and the brown one come in its stead, proves that the houses and

habits of the people have become more cleanly, and not by any means that the one species of rat has eaten up the other. In wild nature, the attack of animal upon animal is never carried on to extermination even as between prey and preyer. On the contrary, they appear to increase and decrease together. The lions of western Africa prey upon the antelopes and the quaggas, but these animals never fall off much from the usual average of their numbers; and if the state of things with regard to any other preyers and prey in any other place is examined, it will lead to the very same conclusion. Any other means would not do. The prey may exist without the preyer, and under that state of things its numbers may increase farther than they do in free nature; but the preyer cannot possibly exist without the prey.

We have preferred making these comparisons of the two species of British house-rats here rather than in the notices of them as species, because here we can refer to both with equal ease and without repetition. The comparison is necessary in order to a right understanding of the animals; and from their numbers, and the frequence of their appearance, to say nothing of their boldness, their briskness, and the services which they perform, rats are among the most interesting of all our wild mammalia. Their history is also both old and familiar; and this is one of the reasons which renders a clear distinction between the two so very desirable, the old history being wholly that of the black rat, and the current history as completely that of the brown one.

It would have been singular, if so bold, sharp-looking, and strong and daring an animal as a rat is, and so familiar as people must have been with it from the earliest time at which their houses could shelter and feed a rat, had escaped without having some marvellous story fastened upon it; and supposing the story to exist, it would have been still more wonderful if some writer *about* animals, full and overflowing as a fountain with the most ready, willing, and universal belief, had not given the public the benefit of the story with a certificate of its truth.

The story that rats anticipate the fall of a house, and take their departure while yet they can do it with safety, is one of the most current stories in the whole old coin of speech. So generally and so readily has it been believed, that it is made the foundation of the common name of all changes of party and opinion, all tergiversations when taken in the bad sense, and especially in those of a political nature. Tergiversation of this kind, more especially when it consists in deserting one party in its weakness, and going over to the opposite one, in its strength, for the sake of personal advantage, is invariably called "RATTING;" and it is held, and very properly held, to be the worst species of political crime of which a public man can be guilty, and characteristic of the very meanest cast of mind and lowest depth of political corruption. In private life there is probably a great deal more of this ratting than in public life, for it is the way of the world, to use an every-day proverb, that a man can always find plenty of friends when he does not need them, but few or none when he really does. The prevalence of this, even to "a beam," in the eye of the generality of men in private lives, ought to make them a little forbearing in the matter of the "mote" of political ratting; but it does not; and it is possible that men make much of their outcry and noise on political subjects merely for the purpose of concealing what they themselves do in private society, just as the idolatrous Jews beat drums, and made all other sorts of din, in order to drown the cries of their helpless children which they were burning in sacrifice to Moloch in the valley of Rimmon, in the vain hope that they would thereby procure pardon for their own sins.

Even granting the truth of the story upon which this name of ratting is founded, there is very great injustice done to the rats. Admitting that they quit the house previous to its fall, their so quitting it does not tend, in any way, to accelerate the said fall; for rats, though they may take up their residence in a house, and thus be in some sort members of the household, never, in any way, contribute to the stability of the house, or in the least help one house in the demolition of another. Upon this plain and simple ground, therefore, the epithet "ratting," as applied to an influential member of one party going over to the opposite party, is a misnomer. If the word is to be used at all, it should be applied only to those hangers-on upon a party which live at its expense, and render it no support in return; and the "ratting" of such is, under all circumstances, an advantage.

But the fact that rats do leave a house, *in anticipation* of its fall, is not only untrue, but impossible. There are no means of what we call anticipation possessed by any animal; and the belief that there are, belongs to the very worst species of superstitious delusion, and is one of the very worst parts of it. Animals, being more completely under the influence of natural circumstances than we are, are very often sooner affected by changes; but still the change must happen before it can possibly affect the animal, whether it happens to such a degree as affects us or not. To suppose that an animal, which shows not the least symptom of ever proceeding upon the precepts of cause and effect, can be affected by any change or event whatever, before that event happens, is just about as absurd as to say that an animal could be shot with a leaden bullet, while that bullet remains as galena, in sulphate of lead, in an unopened part of Minera or Halkin mountain. It is even something worse than that; for it is *de facto* making a god of the animal, endowing it with the power of knowing without any means of knowledge. It is astonishing how much language is made the source of the most mischievous of all errors, by the working of these dogmas of superstition into it.

Granting that a rat were the most sensitive of all animals to coming changes, and that it felt them in the very dawn and twilight of their existence, the fall of a house does not come within the class of which its sensibility would give it this early warning. Whatever these are, they must be all purely natural; and though the fall of a house cannot be called an operation of art, it is an operation which could not be produced unless art had been previously employed in building the house, and it is an operation which art, judiciously applied in the repairing of the house, could have prevented. The cause of the fall, therefore, belongs to the category of art, not to that of nature.

It follows, as a necessary consequence of this, that, if rats quit a house in anticipation of its fall, they must understand what are the frail parts of it; and, by understanding this, they must, of necessity, understand how it could be repaired, and the fall pre-

vented. If so, they might be turned to excellent account as surveyors, especially in the matter of such works as the sewers and subways in and about London, which are not very pleasant places for human surveyors to examine. The rats are also always in those places in great numbers; and if they possess the knowledge, there must be some means of getting them to communicate that knowledge. If they know that a house *is to* fall, they must, on the very same principle, know that a sewer *is to* get out of order, because there are no means of knowledge open to them in the one case which are not just as open to them in the other. The notion that rats abandon a house in anticipation of its fall must, therefore, be held as nothing but a piece of superstitious nonsense, and, consequently, all that has been founded upon it, with regard to the conduct of men, must fall to the ground.

It by no means follows, from this, that rats may not desert old houses, and that to the very last rat, in a very short period of time; and it is certain that rats, the black ones especially, migrate in flocks on some occasions, though we are not informed that any unusual falling of houses follows these migrations. The probability is, that they migrate in search of food, and quit places which no longer afford them subsistence and shelter. These are no doubt the real reasons why they quit old houses, just as they are the real reasons why they are not found in the cottages of very poor people, which do not afford food for a rat, or in houses of modern construction, in which a rat can find no shelter.

On this subject we shall quote a passage from Mr. Bell's very pretty book on "British Quadrupeds," now in course of publication. We do this for three reasons:—first, the book is very carefully written and very beautifully illustrated; secondly, the passage which we shall quote contains much valuable matter respecting an animal the facilities of observing which are diminishing every day; and thirdly, because there is a quotation contained in it which calls for a remark or two. "Although," says Mr. Bell, "its disposition appears to be naturally exceedingly ferocious, there are instances on record of its evincing considerable attachment, not only to each other, but to mankind." There is a slight depression of the skull of Priscian by the hit here, but *n'importe*. "Mr. Jesse, in his usual amusing and pleasant style, gives us an anecdote, which the respectable authority from which he derived it forbids us to doubt, exhibiting a degree of tenderness and care toward the disabled and aged members of their community, which, were it imitated by Christian men, would either render our poor laws unnecessary, or remove the disgrace and opprobrium which their mal-administration too often causes to attach to them." The reader will please to mark this with particular attention; it is meant to be very pathetic and philanthropic, and we shall have two words to say upon it, after we have heard Mr. Bell and his informant to the end. Now for the anecdote:—"His (Mr. Jesse's) informant, the Rev. Mr. Ferryman, walking out in some meadows one evening, observed a great number of rats migrating from one place to another, which it is known they are in the habit of doing occasionally. He stood perfectly still, and the whole assemblage passed close to him. His astonishment, however, was great when he saw an old blind rat, which held a piece of stick at one end in its mouth, while another rat held the other end of it, and thus conducted his blind companion. It appears also, from several instances, that this animal is not insensible of kindness, and that it may be powerfully attached to those who feed and caress it." So far Mr. Bell and his respectable authorities. We trust we have shown already that we have no *malice prepense* against this active and ferocious little beast; and so, as we wish to hold the scales even between rats and ratters, we must look to the high character which is here given to the black rat, as a schoolmaster to "Christian men" in the nobler works of Christian charity. If the rat really deserves this high character, then he ought to be exalted above all beasts, whether quadrupeds or not; but if the character is a false one, then all who are concerned in the imposture ought to be made to feel it. But before we can be quite sure of the merits of the case, we must look at "the act."

Now we find that, in the whole code of animal legislation, there is no such thing recognised as any sort of kindness to the "disabled and the aged," but quite the contrary. Dogs always worry the dog that is down; the herd forcibly eject the stricken or the hunted deer; and, among animals of every kind, the weak are always driven to the wall. This is not only what actually is, but, if the expression may be allowed, it is what should be. There is no place in the economy of nature for an old and useless animal, any more than there is for a withered leaf, farther than the gathering of it to the common store of materials. This does not apply to human beings, because there is a part in them which does not partake in the "disabled and aged" state of the body, though its connexion with material nature is of course weakened by bodily decay; and, for the sake of this, the existence of which is demonstrated by Christianity only, "Christian men" are bound to cherish the aged to the very last. With animals it is quite the reverse; their affection, if instinct ought under any circumstances to get such a name, is all for the young and the vigorous; and their attacks are directed against the feeble and the exhausted. If there is any hospitality in them, it is Homer's hospitality—"Welcome the coming, speed the going;" and many of them, and the rats and mice among the rest, even in the most small and delicate of their species, have no objection to Malthusianize, by applying the "positive check," and eating the superabundant population of their own nests. We find therefore that the statute is against Mr. Jesse and his authority. Then for the facts of the particular case.

Mr. Jesse is a great zealot in the observation of all sorts of productions and phenomena in nature; and, moreover, he is a great zealot for the truth of stories, and the more the story is out of the common way the stronger appears to be Mr. Jesse's desire that it should be true. But though we state this as a general inference from the tenor of Mr. Jesse's writings, and think that he has it in common with all zealous observers who are very amiable and not very profound, we must dismiss the present case both as against him and his informant; for the very same story has been told and believed before either of them was born, and long anterior to that. We have heard it in fifty places, and that from people who had no communication with each other. The first time we heard it was forty years ago, from a man turned ninety; so that if time gave validity to stories as well as to the possession of estates, the truth of

it ought to have been fully established many years ago.

It might be as well, however, to "call" the Rev. Mr. Ferryman; as there are one or two questions to which his answers would be very desirable. How many black rats make a "great number," for the breed is getting rather scarce? How near to him did they pass? and at what rate were they moving? What kind of pace had they? did they walk, or trot, or leap, or amble, or gallop? How near must one be to a rat when in motion, in order to ascertain whether the said rat is or is not blind, if its eyes happen to be shut at the time? Satisfactory answers to all these questions are necessary, in order to establish any thing like an hypothesis in the teeth of the general law of nature, as it happens to be here; and much more are they necessary for the establishment of the fact. We believe that rats never migrate till they are starved out at those places which they quit, and nearly at the extreme pinch of hunger, which they can endure a long time, voracious as they are. In their hunger they snap at all sorts of substances, especially if an animal or animal matter has touched them; and although they prefer animal food to vegetable, and vegetable food in proportion as it is pulpy and savoury, yet, as is the case with most of the rodentia, they will gnaw straws and twigs in the extremity of their hunger. We have fifty times seen straw cut to chaff by the teeth of these same black rats; and therein we think may be found a complete explanation of all the tenderness and care towards the disabled and aged, without any infraction of the general law of animals. One rat gets hold of a straw or bit of stick, not with his chisel-shaped incisors, which would soon divide it, but with his tuberculated cheek-teeth; another seizes the end of it in the same manner, in order to pull it from him; and onward they move in their contest.

In all the species, the tendency to production is very great; and, where they have food and shelter, and moderate warmth, it is not confined to any one season. As the rats, that is, the black rat and the brown rat of this country, never live but in situations where they are less exposed to the weather than some of the mice, there is little or no pause in their activity in the whole course of the year, and they breed as readily in winter as in summer. It is in fact their love of a uniform and rather high temperature which brings them in such numbers to the subways and sewers in cities. In these the temperature, taken on the whole, is never nearly so low as that of freezing, and it is generally much higher, often indeed it is absolutely warm, when the free air above is cold. The number of young in a litter is often considerable, exceeding that of the teats of the female, and in some cases double the number of these. The teats are six in number, and the young are often twelve. Many of the other rodentia are very prolific animals, but the rats are to be considered as the most prolific of the whole, especially in situations in which their breeding is not suspended seasonally.

The general characters which distinguish the genus from the other rodentia may be stated thus: the teeth consist of two incisors, no canines, and three cheek teeth in each side of each jaw. All these teeth have roots independently of the coronal part which stands up above the surface of the jaws; the crowns of the cheek teeth are tuberculated, and thus bruising teeth rather than grinding ones; and the incisors are firm, strong, hard in their enamel, sharp in their edges, and well adapted for gnawing. There are few animals which can gnaw their way through a board more expeditiously than a rat; and even the most diminutive of the mice can eat their way, by runs and galleries in every direction, through a rick of corn, which is very acceptable quarters, and prevents them from feeling any winter when the fields are bare. The ears of the genus are generally large, of an ovate or rounded form, and well developed; and it is understood that the sense of hearing in all is very acute. Their habit requires that it should be so, as they are chiefly nocturnal in their feeding, and not often seen abroad during the day, though the cries of the field ones are often heard from under cover, if the weather is dry and sultry. The ears are usually nearly naked of fur; and none of the genus have cheek-pouches to the sides of the mouth. The feet are plantigrade, and in most instances almost naked, or covered with very short fur thinly set; the fore feet have only four toes fully developed, the one answering to the thumb being merely a rudimental tubercle, though it is furnished with a little flat nail; the nails on the other four toes are well adapted for digging, and the articulations of the shoulders are fortified with clavicles for this purpose, so that the animals can bring the fore feet to the mouth in feeding; the hind feet have all the four toes fully developed; the tail varies in length, but it is generally long, naked, except a few short hairs, and it is covered between them with a sort of scales, which are not true scales however, but merely little hardened plates of the epidermis, which easily fall off and are replaced by others. The principal fur is very soft, but it is generally interspersed with larger and thicker hairs which are shining in their lustre. In place of these last, the spiny rats (*Echimys*) have their spines, though these are sometimes concealed in the fur. When they live in constant warmth and shelter, they have the produced hairs less abundant than when they are more exposed to the weather. Many of them take the water readily, and preserve their fur dry; but there are some which are easily wetted. They are all, however, very fond of drinking, which operation they perform by lapping with the tongue.

Destructive as the genus *Mus* are in themselves to all those matters on which they feed, and fast as they multiply, where the abounding of their means of subsistence, and especially the continuance of it all the year round, are favourable to their multiplication, they have many enemies to thin their numbers. We have evidence of the avidity with which they are sought by the smaller of the feline tribe, in the domestic cat, which is always on the *qui vive* whenever there is a mouse stirring, and watches and steals upon them with such consummate art that she captures them readily under circumstances where the capture appears to us to be very difficult. The owls (see the article Owl in this work) are even more destructive of them, especially the field and forest ones. The kite also makes many a meal of mice, and in this way makes some slight compensation to the farmer for the few chickens which it contrives to steal from the outskirts of the brood, when the brood-hen is off her guard. The weasel tribe are, however, among the fittest of their foes, as the little and slender bodies of these animals enable them to twine into places where no other of the same power can enter. In wild nature indeed, the weasel tribe, in one or other of

their species, are always numerous in proportion to the food and consequently the numbers of the murine rodentia. About a farm-yard, one weasel or ferret can do the work of a dozen cats in the destruction of mice; and in as far as vegetables are concerned, whether in the store or in the growing state, the mice are really the grand pests of the genus.

All the natural enemies of the genus, whether mammalia or birds, are so formed and so furnished in the covering of their bodies that they come upon them in the most stealthy manner. Not a foot-fall of the cat or the weasel can be heard by the keenest ear; the owl, if it can keep its tongue still, and it "sings out" to rouse and so find the prey, and not to rush upon it after it is found, gets through the air more silently than one current of the air can do when it sets strongly against a counter-current; and this is the reason why the owl is so very successful a mouser. The weasel family are, however, the most scientific destroyers of the whole. The cat catches with the claws, and thus takes hold of any part that it can catch, and it very often sports with the victim before inflicting a wound which is to be speedily mortal. The owl too is a clutcher, whether the original clutch is made by the beak or the talons. The weasels, on the other hand, divide the vessels of the neck by the first and only bite which is necessary for the effecting of their purpose; and this not only with a small animal like a mouse or rat, but with one as large as a hare. In consequence of this "art of killing," possessed by the weasels, they have no equals in those cases where the war has to be carried on against large colonies of mice. One of the chief of them is the taking down of an old rick of corn, either where the base of the rick has not been provided with pillars with caps to prevent the invasion of mice, or where mice have been carried to it in the corn from the field. If this rick is allowed to stand for a few years, the colony produced by a single pair, or one pregnant female carried to it in this way, may be vastly more numerous than any multiplication of ordinary mammalia, under ordinary circumstances, would lead one to suppose. A farmer, by having had mice carried in this way to a rick, the supporting pillars of which are so formed that no mouse can enter it afterwards, and who is not aware of the pest that has been carried there along with the corn, may have full confidence that that rick, carefully thatched above from the weather, is safe as a store against the time of need; but lo, and behold! when he comes to have it cast down, in order to be put under the flail or through the thrashing machine, he finds chaff and cut straw, and hundreds of full-grown mice, and bushels of blind and furless young ones, while the value of his rick is reduced thirty or, in many cases, fifty per cent. On such occasions, it is desirable to have all the cats and curs in requisition, in order to prevent the plague which the rick has fostered from spreading to the other parts of the farm-yard and to the buildings. The cats proceed by ambuscade, and therefore they are not so efficient against the flying multitude; but a good terrier, especially one of the wiry-haired Scotch curs, may be of yeoman service, and will snap here and snap there, finishing his hundreds, apparently quite pleased with the glory of the triumph, and giving himself no trouble about the *spolia opima*, which is the grand object of ambition with the cat. The ferret or the weasel, especially if it has been kindly treated and trained (for if an animal has activity and *nous* in wild nature, these can always be turned to account by skilful management on the part of man), is the chosen one for this kind of slaughter. It goes where no dog can go, it does its work effectually and quietly, and it is long in being tired. Indeed it appears to be the habit of these singularly active, lithe, scientific in the art of killing, and we may add pretty animals, that the glory of the work appears to be their chief pleasure; and one weasel or ferret will put the seal of death upon a hundred mice without giving itself the least trouble about eating one out of the number.

Interesting as the murine rodentia are, however, we must close our general remarks upon them, and say something about the different species. In doing this, we shall not attempt to enumerate the whole, neither shall we follow any of the attempts that have been made to arrange them into sections or subgenera, because, in many of the species, there is not information sufficient for such a purpose, and even if there were it is very doubtful if it would be of much use to the general student. The technical distributions of animals are, in a great measure, made by the museum naturalists, who are more conversant with skins than with living animals; they are not unfrequently made by them of themselves and for themselves, and therefore they are of comparatively little use in a popular point of view. This being the case, we shall take the species which we mention at random, and under their common names.

The Brown Rat (*Mus decumanus*). This species, though now so very numerous in those localities which are favourable to its habits, some of which we have mentioned, is but a recent importation into this country, or even into Europe, or the north of Asia. Considered as a British animal, it is therefore not a native; but, as it was imported without any desire to have it, and rather with the opposite desire, it of course takes its station among our wild mammalia. This species is sometimes called the Norway rat, and it *may* have been introduced into Britain from Norway, yet it is no more a native of that country than it is a native of the cross of St. Paul's, or the throne of our sovereign lord the king, in the audience chamber, or the house of lords. The animal itself is of course silent on the subject of its migrations; and, as some parts of its progress are quite unknown, the whole falls under that common law of all concatenations, philosophic, historical, or otherwise, that no one of them, taken as a whole, is stronger than its weakest part. Pennant says that it originally came from the East Indies; but Pennant is no authority beyond the scope of his own organs of sight, and perhaps not quite so far; and therefore this part of the subject must be set aside. Professor Pallas is a better authority, though, from the materials out of which he had to furnish qualifications for entering the field of observation for himself, even he is not implicitly to be relied on. His account is that they came to Astrachan in the year 1727; that they came from the western desert, and not from the meridian of India; and the accounts add that they have not yet penetrated far into the *steppes*, or wide arid plains of Siberia. It is not very likely that they should, for their habits with us are any thing but those of animals likely to make plains which are dry for a considerable part of the summer, and covered with snow for the greater part of the winter, the places of their abode. According to the Professor, they came to

Astrachan in formidable numbers; in numbers so formidable, indeed, that no means of resisting them could be found. They had, moreover, to stem the Volga, which is no stinted tide for a river, as the numbers and size of the sturgeons can testify, without any reference to the measurement of its actual dimensions, the length of its course, or the velocity of its current. That they had to cross this majestic river is obvious, from the fact that the city of Astrachan is on the right bank of the river, and the western deserts are on the left; and to have worked round the sources of the Volga in the central marshes of Russia, and round those of the Oural in the mountain ridge which bears the same name, would have been too much for the most migrant rats on the face of the earth, more especially if, according to the Rev. Mr. Ferryman, and the older accounts to which we have alluded, they had led the "disabled and the aged" along with them. Pallas conjectures that numbers of them must have been drowned in the Volga; and this is highly probable, if it can, *in limine*, be established that any of them did cross that river, upon which point we have some doubts. If it was the fact, however, the "disabled and the aged" must have gone to feed the fishes in the Volga and the Caspian. This may be in part, or in whole, the reason why the party that arrived in Astrachan were in such "prime feather," we mean prowess of tail, as that the people of that curious city, though they are made up of almost every people under the sun, were unable to withstand the inundation or the overflow of those canine thickly-serried foes. Into some parts of Europe they came much earlier, though the precise hour of their coming, the country of which they are natives, and the mode of their march has not been ascertained. This is the case in Britain, though they are understood to have made their appearance there earlier than in France. The accounts state that they were first found in ships, and thus it is probable that they have been carried by these to all parts of Europe. This is rendered more likely by the fact that they were first observed in seaport towns, and in the vicinity of the harbours. In such towns they are met with in all parts of the country, even in the extreme north; but there are some inland places which are not yet infested with them, though such places are comparatively few. Their first appearance in France is just as little known; but it is supposed that they were imported, unintentionally of course, from Britain. In Paris the authorities say that they were first observed about the middle of the eighteenth century, but it is probable that they existed in some of the seaports before that time. There are still some of the inland parts of France where not one is to be met with in a whole district, or even in a whole department, thickly as they swarm in other places.

If, as is generally supposed, they have been carried from place to place in ships, we may readily conclude that animals which require so much food, would not land excepting at places where food was to be had; but sea-ports generally are receptacles of garbage; and while the brown rats confine themselves to these, their labours may be accounted useful. Their powers of multiplication are so great, however, that, if they once take up their abode in the sewers and drains opening into harbours, they very speedily extend to other places.

They are properly ground animals, and in those places where the two species of this country are found together, they are called ground rats or flax rats, in distinction from the black ones, which are roof rats. In towns where they are found together, and they still are so in more places than is commonly supposed, the black rats have their rendezvous in the cock-loft, or above the ceilings of the uppermost rooms; while the brown ones are in the cellars under the lower floors, or in the foundations of the walls, if these are such as they can be worked into burrows. The brown rats make burrows with great vigour and expedition; but not if they can find some ready made. When they are in a house, both endeavour to open for themselves a communication with all parts of it, and especially those that smell of animal matter. The black ones descend between the walls and the plaster, if there is an opening there, or between the two coats of lath and plaster in a partition which is left open in the centre. When this is the case, and the space between the joists are not deafened, the house is very apt to become a rat's palace, where they stride about and squeak the whole night long, so that it is not easy to sleep in any apartment. If a post comes in the way, they set very determinedly to work in cutting through it; and at this they will continue with little intermission night and day; but whether by the same individual, or by successive reliefs, has not been ascertained.

In the neighbourhood of Paris they are exceedingly numerous; and the chief places of attraction for them are those at which worn-out horses are killed; for it does not appear that the French are such great economists of carrion as the English in London. A report of these slaughter-houses and their rats was not long ago made to the French government. The object was the removal of a horse-killing establishment at Montfaucon to a greater distance from the city; and to this it was gravely objected, lest the brown rats, deprived of their accustomed nightly mess of horseflesh, should fall upon the people. It must be admitted that the darings of these rats evinced no small force on their part. Five-and-thirty horses were sometimes slain at this place in a day, and by next morning the rats had made clean skeletons of the whole of them. This it appears is the way in which carrion is got rid of in Paris; and they have rat holes at the bases of the walls for admitting the nightly scavengers. Dussaussois, who keeps one of these establishments, resolved to surprise the rats at their meal. For this purpose he lodged the carcasses of two horses in an inclosure with high walls; and when he judged that the rats were come in proper numbers, he sent round and carefully stopped all the holes by which they could escape. This being done, he mustered his forces for the attack, each man armed with a torch in one hand and a bludgeon in the other, and instantly they closed the door. The rats fled in all directions from the light of the torches, but from the bangs of the cudgels there was no escape, and the result was the death of a vast number of rats. One single night gave more than two thousand five hundred; four nights more than nine thousand; and though the hunt was only occasional, yet, in the course of a single month, eighteen thousand rats had bit the dust. This was rat-catching on a style which the Parisians might well have termed *magnifique*, and we have nothing to equal it in Britain.

It is said indeed that there are often curious encounters between the nightmen and the rats in some of the subways under the British metropolis. None

of these subways are without rats, and they no doubt contribute to the keeping of these troublesome tenants out of houses. Many of the sinks into which offal, which, however, is very acceptable food for the rats, are such, that a rat cannot find egress from them into the house. The walls and archways are also in general rat-proof, so that the fellows are confined to their subterranean dwelling, which, however, is a very ample and widely ramified one, and its inmates are pretty well fed at all points, but chiefly near the terminations of the smaller drains, which are of course the principal points of attraction. Near the slaughter-houses, markets, and other places where there is much offal washed into the sinks, the rats are very abundant; and one may better see and hear them through the gratings; but these are generally so placed or formed, as that a rat cannot get up; and the brown rats are not nearly so expert climbers as the black ones.

Thus there is, in those sewers and drainages, which contribute so much to the cleanliness and health of London, a regular permanent population, probably outnumbering the human population above ground many hundred times. This population disturbs or injures very few, it subsists upon what the above-ground population throw away, and in so doing it is useful. Among such a population the regular mortality must be considerable; though there are no means of ascertaining its amount. Very few dead rats are seen however, and those that are seen belong chiefly to the above-ground rats, of which there are also considerable numbers. Even when at the full flood of their discharge in heavy rains, the great sewers of London roll but a scanty supply of dead rats to the river, probably not more, if as many, as the tale of dead dogs, wafted by the open Fleet Ditch alone in the days of Pope. Where they are long, they waft very little animal matter of any kind, so that the floods which they discharge, unless from places near the banks, are far more unseemly than unhealthy. For this we have to thank the rats; and it is of much greater service than those who have not experienced a city with all its refuse stagnating about it, would readily believe. Cleanliness ought to be generally attended to; but still, human cleanliness is only a transfer, not a removal; and if there are not some means of dissipating the refuse, the cure would in time become worse than the disease. In the case of good under-drainage the rats do this, and carry it to the full length of making, among themselves, the maws of the living the sepulchres of the dead; so that they may be regarded as final consumers.

In ordinary states of things, when the sewers are all sound and free, and the weather steady, matters go on with great regularity, and not with more noise than might be expected among animals so ready to fight, either for love or glory, as these rats are. But when a heavy rain comes on suddenly, the rats are put in motion, and the effect of it upon them may, in part, be compared to that of the setting in of the seasonal rains in the warm countries. It puts them in motion, and makes them scamper about; but it brings an additional supply of food; and if the brown rats have plenty to eat, they are not very particular as to lodging. Although not absolutely aquatic, they prefer places near water, are expert swimmers, and not liable to be easily drenched with wet. When the nightmen get into the sewers with torches, the first rats they get sight of generally retire before the light; but as they proceed, and the numbers accumulate, the rats at last make a stand, and fight desperately. The fight is said (for few see it), to begin among themselves. The party which the light drives up the sewer, are mistaken by the others into whose natural territory they have come, for invaders that have hostile intentions. The tocsin is accordingly sounded, and the natives muster *en masse*, and bearing to the point of attack; between their fear of the torches, and the fact of having no hostile intention, the brown rats are deprived of stomach for fighting their fellows, and so they turn; by this means the whole of the rats are turned toward the human invaders; and though their proper object is in all likelihood merely that of getting past the men, and so escaping, yet the men are said to be sometimes overpowered by numbers, and fairly put to the rout, though the return of the killed is always in the muster-roll of the rats only.

In places where there are no archways for the habitations of these rats, and which yet afford subsistence for them, they often do considerable damage by their excavations. They often undermine the foundations of granaries and store-houses, of manufactories which abound in offal, and of mills; and in the last case they sometimes mine through the dams of the ponds and let out the water. The Parisian horse-killing places are those at which the greatest number have been observed; and there the supply of food is so abundant and so tempting, that they have worked some of the adjoining grounds full of holes like those of a rabbit-warren. This has been done to such an extent, that the surface has, in many places, fallen in; and the distant colonies have made regularly beaten paths from their habitations to places where they find and feed upon the carrion during the night.

They are always apt to accumulate about places where animals are kept, though they do not always lodge in such places. Menageries always have a smell of carrion about them, however clean they may be kept, and, having this, they are sure to attract the brown rats. The Zoological Society of London feel this in their gardens at Regent's Park, which are visited at night by rats from the other side of the canal. Of course they do not offer battle to lions and tigers, or to any of the large animals; but they destroy the small ones, especially the young of guinea-pigs. In poultry yards and preserved grounds they also commit considerable depredations on the eggs and the young birds. Of grain, they are perhaps not, upon the whole, quite so destructive as the mice, and their depredations are not so well seen, as they do not inhabit the ricks, and barns, and binns of corn; but they plunder during the night, and carry off considerable quantities to their subterranean abodes.

Their personal appearance does not require much description, as there are few persons, especially about towns and other thickly inhabited places, that have not opportunities of seeing a brown rat. It is the largest of the genus to be met with in Britain, being, in full grown ones, fully ten inches long in the head and body, of which the head occupies nearly two and a half. The ears are about two-thirds of an inch long, which is less than the length of those of the black rat; the tail is also shorter in proportion; and both they and the muzzle are nearly naked; the tail is annulated with the scaly plates of epidermis, already noticed as being general in the genus; these are without any fur; but there are a few short and scat-

tered hairs between the rings; the upper colour is greyish brown, and the under colour whitish grey; the body is thick and strong; and the expression of the animal is a mixture of cunning and sulkiness. Common domestic rats, especially when young, are hardly able to master these rats; and when they muster in numbers, no cat has any chance with them. There are many instances mentioned in which a cat has been turned into a cellar full of these rats, and been almost instantly killed and eaten by them. Dogs, especially terriers, succeed much better; as they bite with a snap, and dislocate the spine of the rat at a single pinch. If the dog is not staunch, however, and one rat fastens on his nose, he is not very fond of attacking another.

The Black Rat (*M. rattus*) is sometimes called the "old English" rat; but the epithet does not appear to be very accurately applied, as the fact of its being a native of Britain or even probably of Europe, is doubtful. The question of its actually being an imported animal is not so completely settled as the same question is with regard to the brown rat. No mention is made of it by Aristotle, or by any other of the naturalists of antiquity. Conrade Gesner of Zurich, who wrote about the middle of the sixteenth century, is the first author by whom it was noticed; but the mere fact of his being so does not prove that the animal did not exist in Europe before then. Wherever the rats had their original habitation, it is probable that the great intercourse by shipping would carry them to all places to which the ships reach. There is hardly such a thing in the whole navies of the world, as a ship with no rat in it; and, accordingly, the ships of Britain have carried both rats to every part of the world that they have visited. In no place, however, do they appear to disperse themselves very widely in wilds of nature; for though they may be said to be at war with man, they are never far from his habitation.

In all situations the black rat may be considered as a house-rat, generally quiet during the day and active during night; but it is not seen in the fields, neither does it burrow in the ground. Stables are favourite places for it, and it does not hesitate to take up its abode in a cellar; but it prefers a dry one, and lodges in a hole of the wall rather than the flue, unless the latter is very dry.

It is very considerably smaller than the brown species, for it seldom measures so much as seven inches and a half in length; and though its muzzle is larger, its head altogether is shorter. Its ears are also larger and rounder, and its tail is larger than its body, while that of the other is not so long; the ears and tail are naked; the eyes rather large; the fur on the body shaggy; the whiskers and tufts of stiff hairs over the eyes very long, and the whole expression more rough and fierce than that of the brown rat. It is also more rapid in its motion, and a better climber; but whether it enter the water so readily may be doubted. The colour is black, with a tinge of grey above, and ash-colour on the under part, often whiter on the breast and throat. There are apt to be occasional albinos, however, both among these and among those of the other species; and it is said that those which are of the natural colour expel the albinos from their society, or, more strictly speaking, withdraw their society from them.

Advantage is taken of this for the purpose of effecting the expulsion of rats from houses infested with them; but whether it does or does not produce the effect, we pretend not to say. If a rat is caught it is rolled in flour, fine meal, or powdered whiting, until its colour is completely changed; and then it is sent forth to its companions, who are so suspicious of its appearance, that it fairly chases them out of the house. A singed rat is often turned lame with the same intention; but whether either mode produces any effect is not fully ascertained. Rats are, however, very wary animals, and shy of strange appearances. They also often desert one house suddenly and go to another, without any very obvious cause; and when this happens, soon after one of these supposed modes of expulsion has been put in practice, the departure is sure to be ascribed to that. One half of the incantations which are resorted to have been established by being antecedent in time to other unconnected events, the real causes of which were not known. The Welsh have one for the supposed expulsion of mice. They roast a live mouse to death before the fire, in firm belief that the smell frightens away the others, which is the very antipodes of the effect which it would have, if it had any effect at all. There is an American rat, which has been considered as a species by Rafinesque, Dr. Harlan, and others; but it differs from the common British one in nothing except in being duller in the colour.

The rats of foreign countries are pretty numerous; but very little is known of their manners; and it is not easy to say which is a rat and which a mouse, that being more a difference of size than anything else. It is generally understood that the mice are less fond of animal matter than the rats. But the chief difference appears to lie in the rats being able to kill larger animals than the mice. The teeth, which afford the best criterion of the disposition of an animal, are exactly of the same structure in the mice as in the rats. The incisors furnish a pair of gnawing instruments, as in all the rodentia, and the cheek teeth have their crowns with tubercles covered with hard enamel.

The Sumatra Rat (*M. Sumatrensis*), is an inhabitant of the island after which it is named, and probably most of the neighbouring ones. It is also not uncommon in some parts of continental India, and is met with as far to the north as Bengal. The most remarkable of its external characters is its size, which is about equal to that of a common rabbit. The body and head are, together, nearly fourteen inches long, and the tail is about the same. In its general appearance, and also in its colour, it resembles the brown rat more than the black one; but still there does not appear to be sufficient reason for supposing that the brown rat is the same species, diminished in size by being brought into a colder climate. The Sumatra rat is dull brown on the upper part, greyish on the under, and black on the legs and feet. The tail is very thinly covered with hair, but not quite so naked as the tails of our rats. It frequents the neighbourhood of houses, and burrows under the fences of gardens, or the walls of huts.

The Caraco Rat (*M. Caraco*), is a Siberian species, inhabiting the easterly parts of that extensive country, where the brown rat does not appear to have yet made its way. It is about the same size as the brown rat, and not very unlike it in form; but the colours are not the same. But the upper part is a mixture of reddish and dark grey, becoming paler

on the flanks, and passing into whitish ash on the under part, and also on the feet. It is found near the habitation of man, and, like the brown rat, it likes to be near water. The tail is very little more than half the length of the body; and the half-webbed feet show that it is an animal well adapted for swimming if occasion requires.

The Alexandrian Rat (*M. Alexandrinus*), is in some respects the very reverse of the one last mentioned. It inhabits dry places in Egypt. The upper colour is reddish grey, with the hairs on the back flattened, broader at the middle than at either end, and striped on the one side. The under parts are ash colour. The tail is one-fourth longer than the body.

The Iceland Rat (*M. Islandicus*). Even Iceland, cold as it is, and remote from any other land, has its peculiar species of rat. It is grey, with the exception of the back, which is blackish, and there are some yellowish spots on the flanks. The tail is rather longer than the body, nearly naked of hair, but marked with numerous rings of scaly plates on the epidermis.

There are various other rats named in other parts of the world; but as very little is known of their manners, and the little that is known resembles the manners of the rats of this country, they have not much attraction for the general reader. The distinctions of them, as museum subjects, are also a little confused, as the very same species appears to have got two or three different names, from the different authors that have described it. Some of those which have been named rats, are also not true rats; for they both want the tubercles on their claws; and the animals are of course more vegetable in their feeding, and less disposed to haunt houses, or reside in the close vicinity of them. These are the characters which we associate with the name rat, and therefore it were as well that it should be confined to such animals; at least, if that were done, the name would be more expressive of the characters. Of these true or carnivorous rats there do not appear to be any which are more aquatic in their habits than the brown rat; and though that prefers situations near the water, and can swim, it cannot with much propriety be called an aquatic animal. Therefore, in strict language, there is no such animal as a "water-rat."

We shall now notice a few of the leading species of the mice, which, as we have said, have still the same character in the cheek-teeth as the rats, only they are smaller and less powerful, but certainly not less mischievous, than their congeners. They are also more widely dispersed than the rats; for, though "*the* mouse," which is the typical animal, comes more into the dwellings of man than any other species of mammalia, yet there are others which keep more to the fields or the woods.

Mice have been known from the earliest times; and they appear to have been peculiarly numerous in the early ages. While heathen temples were in use, and sacrifices offered, they held out powerful attractions to mice; and when the gods of Olympus are holding a sage council as to what part, or whether any part, they shall take in the war between them and the frogs, Minerva is made to break out in a tirade against them for gnawing her web on the loom and nibbling her sacrifices on the altar. Polytheism thus appears to have been a mode of worship well adapted to the mice; and the temples appear to have been fine and fat pastures for them, at times when the larders of the people were not so well stored as they are at the present day. Matters are now much changed for the worse to mice, and the better to men; for a "church-mouse" has become the current name for leanness and poverty. Yet mice are still not unfrequently met with in churches; and in a country church a mouse may sometimes be seen on the canopy of the pulpit looking down with wondering eyes on the congregation. They meet with more food in such places than one would at first suppose. Mice are very insectivorous, and capture and eat great numbers of flies and beetles, of which there is usually no lack about churches. Thus, in spite of the universality of the proverb, a church-mouse is really not that starveling which it is called.

The name mouse, which, though differently pronounced by the several nations that use languages derived from the same stock as the English, is the same as the Greek name, and that name is from the active form of the verb "*to hide*," and means that which hides itself. The Highland name *luch* is nearly the same, but can hardly be rendered: "that which whisks into holes" is something like the meaning, but not the whole of it. The French name *souris*, and the Italian *sorice*, are obviously from the Latin *sorex*, which does not mean a mouse at all, but is the name of the shrews, which are carnivorous animals, having all the three kinds of teeth, and of course of a totally different order—though the shrews have very improperly been called mice.

The Common Mouse (*M. musculus*). Though a very mischievous little creature, the common mouse is very pretty, and nothing can separate it from the human race; for, let man migrate where he will, the mouse is sure to accompany him, and to share in all his provisions, if it can. The only other animal that has been an equally constant attendant upon man in all his movements is the common house-fly, which serves in part as food to the mouse. Every house and every out-house has mice in it, and wherever the mouse is found the fly is found also. It is the mouse that has led to the domestication of the common cat; and were it not for cats, mice would so multiply in houses as to be intolerable. The mouse is a timid animal, but it can be tamed without much difficulty; and it never displays any of the ferocity of the rats. The taming of mice is, however, rather their consenting to be fed and fondled, than any taming in the proper sense of the word, any calling forth of a proper propensity. Propensity of this kind they have none, for they are not social in any one part of their own economy. They of course pair in a temporary way, but the pair have no attachment to each other. They breed many times in the course of the year; and as they are always in shelter, they breed just as freely in the cold season as in the warm. The breeds are not quite so numerous as in some of the rats, but they breed more frequently in the course of the year; six or seven is about the average number in a brood; and as all the genus come into the world blind and naked, the mother prepares a warm nest for their reception. If they are supplied with food, they continue to live and breed away "in shoals and nations," without coming abroad, or seeking to change their quarters. Aristotle ascertained this fact by the actual experiment of enclosing one gravid female in a vessel of corn, and

carefully preventing all other mice from entering, and it was not very long till he found that he had a colony of six score; nor is there any doubt that they would have gone on until the whole corn in the vessel had been converted into mice, after which they might probably have eaten each other up to the last mouse, though certainly not to the cannibalism of the Kilkenny cats, which, in the course of one single night, ate each other, except "the two tails and a bit of claw." Six weeks is understood to be the whole length of time necessary for enabling the young mice to find their subsistence independently of any attention from the mother, five-and-twenty days of which is occupied in the gestation, and the remainder in the nursing. At what age they become fertile is not exactly known, but it is understood to be at a very early one; and it must be so, otherwise Aristotle would not have obtained 120 in a short time.

Farmers often discover the fact of this rapid increase without wishing for it. If one rick of corn is left in the stack-yard, and all the rest of the crop disposed of, so that the barns, houses, and grain-lofts, are empty, then the whole mice take up their abode in the unfortunate rick, if it is not so built as to prevent their having access. There they are quite at home; and though they are not much seen outside, or much heard, except by their feeble chirpings —by the way, there is no word in English expressive of that class of sounds among which the voice of the mouse may be reckoned. It is not "chirping," and it is not "whistling," but something between the two. The Scotch word *cheeping*, as distinguishing from *wheeping*, which means short whistling, does it exactly. They are, however, not the less busy on that account. They do not disfigure the outside of the rick, but they sometimes, notwithstanding, reduce the whole of the inside to chaff, and put one in mind of the white ants, and other insects of warm countries, which, working in the dark, unheard and unseen, reduce the whole interior of a tree to powder. The length of the common mouse, when full grown, is nearly three inches and a quarter in the head and body, of which rather less than one inch is occupied by the head; the tail is nearly three inches in length, and the ears, which are oval, are nearly half an inch; the fur on the back is of a peculiar brownish ash, technically known as mouse colour, and the under part is pale ash; the ears and the tail are covered with heavy short and soft fur.

Though the colours which we have mentioned be those in which the common mouse is most frequently seen, yet it is subject to some varieties, and also to albinoism; and it is a curious fact that the albinos are based in a variety, the pure white colour and the red eyes being transmissible from generation to generation. This does not, we believe, take place in a state of nature, for the "white mice" are all bred for being kept in confinement as curiosities. The "manufacture" of them, so to call it, was begun in Italy, and they are still carried about in little cages or tread mills by the beggar boys from Cisalpine Italy, of which such numbers infest our streets, and are so cruelly used by the wretches that make a most iniquitous gain of them and their mice. It is not a little singular that northern Italy, the valley of the Arno chiefly, should have been the place where an albino variety of the common domestic ox was bred, and that the small remain which yet exists in England should retain in great part the white colour.

The long-tailed Field Mouse, or Wood Mouse (*M. sylvaticus*). This is one of the most abundant and most mischievous of all the mice; it does not come into the houses like the former species, but out of doors it is here, there, and every where, and always doing mischief to every kind of vegetable and vegetable substance which it can injure.

It is half an inch longer than the common mouse in the head and body, and another half inch in the tail; the ears are also larger, the eyes larger and more prominent, the muzzle darker, the whiskers very long, the feet well adapted for running, the fore ones for grasping and the hind ones for leaping. It is a very pretty little animal, gentle in its disposition, and though very timid in a state of nature it readily bears confinement. The upper parts are yellowish brown, inclining to blackish on the back; the under part is greyish white, with a yellowish spot on the breast; the hairs on the upper part are annulated, being grey at the base, yellowish in the middle part, and some black, others reddish at the tips. It is an exceedingly swift-footed animal for its size, and runs about with wonderful celerity. It is very prolific, having certainly two litters in the year, and probably four, each of which averages about eight. It is a burrowing animal, unless it can find sufficient cover under low and closely-tangled bushes. It is a clever excavator itself, but it sometimes avails itself of the runs of the mole, especially in winter, at which time they are deserted. In its retreats under ground, and sometimes under a bunch of moss which it collects, it stores up the plunder of the fields, which plunder it takes in large quantity. If ricks of corn are left in the fields, this mouse is as apt to enter them as the common mouse is, and it is as often found along with the common mouse in farm-yards. In gardens and nursery grounds it is especially destructive, and every means that can be thought of for destroying it is put in execution. All will not do, however; the mouse returns to the charge, and the watchfulness of the gardener is never at an end; he has a good many fellow labourers too in the destruction of this mouse; the owls are among the most efficient of these, and as such ought to be encouraged about gardens and nurseries. The kites lend a hand, but they are shy of coming so near, and the weasel tribe are conducive to the same end; even the hog helps to carry on the war against this mouse. It does not, it is true, eat the mice themselves, but it, according to Pennant, roots up their hoards of provisions, and thereby mangles and disfigures the surface.

Another formidable enemy of this mouse, and of all the small rodentia that frequent wooded places, is the common wild cat. There are certain seasons of the year when the mice get very abundant and fat in the copses, and where the cats capture them in great numbers. This is chiefly in autumn, and the best places are the hazle copses in remote situations, where few people go to gather the nuts; these fall when ripe, and at this time the mice throng to the copse, dig their magazines, and instantly set about storing them with this favourite food; the cats are there in force also, and keep yelling the whole night long. It is not over pleasant to come upon them at those times. All the feline race are sulky while feeding, or even in the anticipation of feeding; and as the cats among the mice in the wild copse may be said to be upon their own ground, and killing their own mutton, they are not fond of budging, and will

sometimes spring. Now, though a man can of course master a wild cat without much difficulty if he goes the right way about it, he may get an ugly scratching, The best mode of dealing with the cat is, therefore, either to keep out of its way, or to be the first to attack, for unless it springs it is not very formidable. There are sometimes other rodentia in the same copses along with this mouse, the field mole for instance, and sometimes the dormouse, though the dormouse may be looked upon as rather a scarce animal in the copses of the northern glens, where the cats are very plentiful as well as fierce.

The Harvest Mouse (*M. messorius*). This is the only other species of true mouse, that is, of mouse with tuberculous cheek teeth, that occurs in Britain; and hitherto it has been met with only in the south of England, at least not farther to the north than Cambridgeshire. As a British animal it was not known till discovered by White, of Selborne; but it has been much longer known on the continent, in many parts of which it is not rare. It occurs in Germany, in Poland, and Russia, and also in Siberia; but it appears to have, like some of the other species, been called by a great number of names.

It is the smallest of British mammalia, and indeed among the smallest of the whole order. The head and body are two inches and a half in length, of which the head occupies about five-sixths of an inch; the ears are shorter in proportion than those of any of the other British mice, being only a quarter of an inch; the tail is a very little shorter than the head and body, so that the total length of the animal is rather less than five inches; the body is more slender in proportion to the length than in any of the others, and the whole weight is not more than a quarter of an ounce. The tails of all the genus are capable of a good deal of motion, and contribute not a little to the steadiness of their direction when they leap, which they are understood to do when they catch insects on the wing. The tail of this one, however, is prehensile, and so used by the animal when it climbs the cubuss of corn in order to feed on the grains, or the milky juice of the young grains at the top. Its summer residence is chiefly in the corn-fields, where it is supposed to feed upon insects until the grain is ready; in winter it either burrows to a considerable depth, at which it remains torpid, or it gets into the shelter of a rick of corn or some other place, where it can find both warmth and food, and in such situations it continues active, carries on its breeding, and knows no winter. It does not appear that it carries much provision to its under-ground retreats, in which it becomes dormant.

It is a very pretty little creature both in its form and its colours, and it is quick and lively in its action, and capable of undergoing a great deal of fatigue. The colour of the upper part is bright reddish brown, produced by the different colours of the basal and distal parts of the hairs, the basal parts being dusky black, and the terminal or distal parts brown. The under parts are pure white, and the upper and under colours do not pass gradually into each other as they do in many of the genus, but meet at a well-defined boundary.

The nest is not under or even on the ground, but suspended to the stems of the corn, and is a very pretty structure. The annexed cut will give some idea of the external appearance of the nest, and the relative size of it and the animal.

This nest is constructed in rather a laborious manner, wholly of vegetable materials, but varying with such as can be most readily obtained. It is about half a foot from the ground, and, in most cases, fastened to the stems of living plants. It is in the shape of a round ball, neatly woven with vegetable fibres, which the animal appears to obtain by splitting the long leaves of the corn and other plants of the same family with its teeth. These are matted up, with husks and other short substances, until the nest is very compact. The nest appears to be so constructed, that it can by its elasticity accommodate itself to the number of young that may happen to be in the litter, and also to the increase of the edge as they grow. The young vary from four or five to nine or ten; and the nest is made very smooth inside for them; and they always appear completely to fill it, whatever may be their number. The entrance to the nest is by a small aperture in the side, which partially opens and shuts, in consequence of the elasticity of the structure. The manner in which it goes to work in the constructing of this nest is of course not known; but the fore paws of the little animal are what may called very "handy;" and the prehensile tail must enable it to have full command of them in working, which is probably one of the chief uses of that peculiar instrument; though it may also enable the mother to support herself while she suckles her young, as it does not appear that she can very easily get into the nest along with them. Much of its domestic economy, however, is, and we fear must always remain, matter of mere conjecture, of which the accounts that are given in writing will vary with the discretion of the writers.

Though a very timid and delicate little animal, the harvest-mouse will not only live, but breed, in a state of confinement; only it requires a good deal of exercise, and should be provided with a little tread-mill in its cage, to which it does not require to be sent, as it appears to like the exercise. But, notwithstanding its diminutive size, its handsome form and its beauty, it shows the disposition indicated by the tuberculated cheek-teeth. When the female produces young ones in captivity she often eats them, and flies, especially bluebottles, excite the desire for animal food. If they come near its cage it springs at them with its fore paws extended, much in the same way as one may see a cat doing when engaged in fly-catching on a fine day. The preference given to these above any sort of vegetable food is a decisive proof of the general habit of the animal, and renders it highly probable that, as we have already hinted, the summer food consists in great part of insects. As is often the case with the field-mouse, the harvest-mouse is carried in the sheaves of corn, and often produces a considerable progeny in the rick or the mow; and in proportion to its size, it is by no means the least destructive of

tne mice which harbour and breed in such places. In the early period of its history as a British animal, and when it was accounted rare, the harvest-mouse attracted a very considerable share of attention; but, since it was found not to be very rare, though it is rather local, the novelty has worn off, and it has taken its rank among ordinary mice—that is, as being withal a pretty and lively animal, but under particular circumstances a very amusing little pest.

As there are three distinct species of mice with tuberculated teeth in Britain, and only two of rats, it might be inferred, *à priori*, that the species of such mice, taken altogether, are more numerous than those of rats. This is the case; and though mice do not muster in such numbers at particular points as some of the rats do, yet they are distributed into more places, and are altogether more numerous. They are found in very many parts of both continents; but little is known of their manners. The accounts which are given of them would, however, lead us to believe that they are field or forest mice; and that there is no mouse really a household one, and accompanying man in all his movements, except the common mouse with which every one is so well acquainted. We shall merely name one or two of them, without vouching for the perfect accuracy of the nomenclature.

The Subtile Mouse (*M. subtilis*) is a native of the central and northern parts of Asia, and there appear to be some varieties of it differing from each other in some of their habits. They are small animals, not exceeding three inches in length in the body, but the tail is rather more than that; the colour is yellowish ash, with a black dorsal line; the ears are in folds; one variety of this has the fore-paws very large, and is dexterous in climbing trees; their structure has not, however, been examined with the care necessary to fix their place; and it is probable that some of them belong to the section which have no tubercles on the crowns of the cheek-teeth, and are in consequence much more vegetable in their feeding than the true mice which have the teeth tuberculated in the manner of these that have been already noticed. In the American continent, especially in South America, there are a considerable number, some of which are called rats and others mice, but nothing interesting to ordinary readers is known of them, and, therefore, we shall not farther extend the list.

We shall now very shortly advert to the species which have not the cheek tuberculated, which are in consequence chiefly vegetable in their feeding; and our notices shall be chiefly confined to the British species which have, of course, the greatest attraction for the readers of the "British Cyclopædia." We gave a very slight notice of them in the article Arvicola, from that we referred to the French name Campagnol, as we had then intended to go fully into the details of all the species of the mammalia. But finding that, with any thing like justice to the other parts of nature, that would have swelled the size and price of the work to far greater extent than was consistent with its object, and that a very considerable portion of these details, being purely of a technical nature, could have no interest whatever for general readers, we have not only felt it necessary, but judged it for the best, to omit several of the articles referred to in the early numbers, and, among the rest, the intended article Campagnol, and place the substance of what relates to the British species here.

The larger species of these animals have got the common name of rats, and the smaller ones of mice; and among scientific naturalists they have occasioned no small degree of perplexity. Linnæus classed them with the beavers. They agree with the beavers in some particulars, but differ so much in others, that they cannot be classed with the typical or building beaver; because they not only want the peculiarly formed tail of that animal, and have none of its habits as a builder, but have the teeth different—the beaver having four cheek-teeth in each side of each jaw, and the animals in question only three, in the same number as the rats. Their cheek-teeth have the crowns flat, or without tubercles, and only roughened by zig-zag lines which cross them. This indicates that the food is chiefly vegetable; but the smaller number of teeth shows that it is of a less stubborn nature than the bark and twigs upon which beavers subsist during the winter. The teeth are like those of the musk beaver of Canada (*Fiber*); but the feet are different. That animal has no webs to the hind feet, as the true beaver has; but the edges of the toes are beset with stiff bristly hairs which appear to answer the same purpose; but in the animals under notice, even the aquatic ones, which are very expert swimmers and divers, there is neither web nor margin to the toes. It does not, therefore, appear that any real advantage can be derived from the grouping of these animals with any other genus; but that they assimilate so equally to different ones, that the best way of dealing with them is to take them singly by themselves. They are all burrowing animals, which collect in their burrows a store of provisions for their winter support; and therefore we may conclude that they do not become dormant, unless where the winter is excessively cold.

There are three British species, one inhabiting the banks of streams and small rivers, another found in the sides of ditches and under hedges, and the third more generally distributed over the breadth of the fields. The first of these, and by far the largest of the British species, is,

The Water Rat, or rather Water Vole (*A. aquatica*). This is a very common and well known species, being found by the banks of every stream and rivulet, where these banks are not rock, or sand, or gravel, or some other substance which will not admit of a human being under. The opening to this burrow is never very far above the level of the water, or, if that level is subject to variations from floods, there are generally two openings, one higher and the other lower, but not the one immediately over the other. The lawn, or bit of grass in front of these openings, is generally kept cut very close and neat; but what may be the object it is not easy to say. The higher opening answers another purpose besides that of enabling the animal to adapt itself to the height of the water. It is the passage from which the landward part of the pasture is reached. As the water-vole always takes to the water when alarmed, one would be apt to suppose that it found the whole of its food in the water. But this is not the case. It is a vegetable feeder, and the fleshy and bulbous roots of plants form the chief part of its food. Of these it obtains a good many in the water no doubt, but they are still more numerous on the soft and moist meadows and borders, especially where, as there often is, a stagnation of water behind the immediate bank of the stream. These little accumulations of stagnant water have generally many plants about

them with fleshy roots, and thus find the water-vole in plenty of food, both for summer consumption and winter store. Even in these places, however, the burrow is in the bank of the running stream, and not in that of the stagnant water.

These animals stand accused of having predatory and even sanguinary habits, of eating worms, the fry of fishes, and even the young of aquatic birds. This is wholly unfounded; and it is either a mere analogical reference drawn from the fact of the animal being called a rat, or it has been confounded with the brown rat. The brown rat is, however, always nearer habitations than the water-vole, as it is constantly on the hunt for animal refuse, which the other does not eat, but contents itself with its meal of roots summer and winter.

The water-vole is intermediate in size between the brown rat and the black one; but the tail and ears are much shorter, the fur finer and closer, and the whole expression of the animal more soft and innocent. The shape of its head and muzzle, and the total absence of every thing like a harsh line in the whole of its contour, would induce one who knows any thing about the agreement between the expression and the disposition of animals, to set down the water-vole as one of those gentle rodentia that would not, under any circumstances, hurt a worm or any other thing having, or ever having had, animal life; and it is one of the cases in which the expression and the fact are remarkably true to each other.

As usually found in the richer parts of England, the water-vole is about eight inches and one-third in length in the head and body, of which the head occupies about one inch and five-sixths. The ears are less than half an inch in length, and almost entirely hidden in the fur. The tail is about four inches and two-thirds, being thus a very little more than half the length of the body. The head is short, rounded in its outlines, and the muzzle is blunt, the nose not indicating that keenness of scent which is possessed by the rats. The incisive teeth are yellow in their anterior surfaces, chisel-shaped, not unlike the fore teeth of the beaver. The body is also thick, but part of the thickness is made up of the very closely-set fur. The tail is not naked like those of the rats, but has fine short fur on the upper surface, and pretty long hairs on the under. The fur on the flanks is pretty long, and so it is on the upper parts of the legs. The fore feet have five toes completely formed, and a rudimental thumb consisting of a single phalanx. The hind feet have five toes all fully developed, not webbed or marginated, but connected by a small membrane at their bases. The fur is of that shining character which has, in the hairy animals, a strong repulsion to water, so that it does not get matted or even wet when the animal is under water. The colour of the upper part is a mixed brown, having both a reddish and greyish tinge; and the under part is grey, with a yellowish tinge in some individuals, and a greyish in others. When the animal is alarmed, by any one treading heavily over its burrow, or surprised on the trimmed grass at the entrance, and makes, as it does in all cases of alarm, its escape into the clear water of a pool, it presents a very pretty appearance. The rapidity with which it gets to the bottom of the pool causes it to take down with it a considerable portion of air in the fur. This collects into little bubbles, without being detached, and the creature appears as if, by going into the water, it had got its jacket spotted over with pearls. But, though it takes to the water as a means of safety, and gets down till it is quite submerged, it has not the same power of continuing below, as the otters and other mammalia which prey in the water. It must very soon come up to breathe; but if the cause of alarm continues, it puts up only the point of the muzzle, and cannot very readily be seen.

It is found in all parts of Britain, and also of continental Europe, where the waters and their banks are suited to its habits. It does not indeed occur on the more elevated of the mountain rivulets, or where the heath comes down to the edge of the water; but it occurs as high as there is a sufficient supply of fleshy roots to be had. It is always most abundant where the banks are of a rich and loamy character, and on some of the trouting streams it is often a considerable annoyance to the angler. Not that it does any active harm either to man or fish, for it is at perfect peace with the whole animal kingdom; but the angler frightens it; it enters the water with a plunge, and thus frightens the trout, and, once alarmed, they are angled for in vain.

There appear to be some varieties, probably climatal ones. That which we have described seems to be the one of low-lying and rich places; and when a greater elevation is gained, and the climate colder, the size is smaller and the colour different. In the upper part of the valley of the Rhine, a variety is known locally by the name of "Schermaus," and called the Strasbourg mouse (*A. terrestris*, Linnæus). This one is only six inches long, with the tail one-third of the length of the body, and the ears almost entirely concealed in the fur. The colour is dusky grey, more or less black, and sometimes entirely black on the upper part; and there is a whitish trace on the sides of the mouth. It is very probable that this is the upland variety in many countries, and in Britain among the rest, and some colour is given to it by the fact that the Alsatian name of "Schermaus," altered in the pronunciation of course, is in common use in some of the midland parts of Scotland. They pronounce it "Shear-mouse," and probably give it that name on account of the neatness with which it keeps the grass shorn at the entrance of its burrow. Its colour is dusky grey, more or less blackish, and it is smaller than the water-vole of the lower and richer parts. This shear-mouse is chiefly found on the smaller branches of the rivers, after they so far leave the hills and moors as to have rich banks; and we are not aware that there is, in these situations, any water rat of a reddish-brown colour, though the shear-mouse is very abundant, and a subject of alarm to the infant poachers who grope for little trout under the banks. We never heard of a bite being inflicted by the animal, though rustics speak of it as being capable of dinting a spade with its teeth; but as they say the same thing of the eel, if it happens to be of more than ordinary size, it signifies not much what they say. Lower down, in what may be called the final valleys of the rivers, and in their effluents that come through the rich fields there, the water-vole is larger and brownish, and gets the name of water-rat; and if we remember rightly, there are some places between the localities where both animals may be met with. Their habits are very much alike, only we are inclined to think that the larger and brownish ones prefer broader, stiller, and deeper water. We are much in want of a good natural history survey of the whole

course of some of those rivers which rise in the most elevated, bleak, and barren places, and flow through all varieties of soil till they meet the sea in the very richest. The Tay is the preferable river for this purpose; but years would be necessary for the proper examination of it. Until such surveys are made by competent persons, untrammelled by any preconceived theory, the natural history of our river animals, few as they are, in so far as the mammalia are concerned, must remain very imperfect. This species is known to the Highlanders; but they have not an original Gaelic name for it. They call it *radan uisg*, which is the Gaelic for "water-rat."

The Bank Vole (*A. riparia*) is a much smaller animal than the former, and not so aquatic in its habits. It lives much under covers, and, on account of this, and of its small size, it is but rarely seen. There has been no very good description of its habits published anywhere, and, as a British animal, it has been known only during a very few years, and it is still known only as rare and local. Ignorance of the existence of a rodent animal may be in general taken as a presumption, though not perhaps as an absolute proof, that it is harmless. This species was first observed in Essex, in the year 1852, by Mr. Yarrell, and it has since been found in various other places, but always on the low and rich grounds. It may have often been seen before this, but mistaken for the field or meadow species, which are very abundant. To a cursory observer they are not unlike each other; but this one is smaller, more feeble and contracted in the anterior part of the body, and has the ears more conspicuous, and the tail larger—considerably larger. The habitats are different too, at least in so far as the localities of this one are known; for the common field-vole does not reside chiefly about hedges and ditches, but rather in the meadows; and, according to Mr. Yarrell, this one uses wool and other animal fibres in the construction of its nest, while the other uses vegetable substances only. The colours are: rusty brown on the back, ash colour on the sides, and white on the under part; the tail is dusky on the upper side, and whitish on the under. The tail is slender, but it does not taper to a point like the tails of rats, and it is a little bushy at the end. The dimensions as given are: the head an inch long, the body two inches and a third, the tail an inch and two-thirds, and the ears rather less than half an inch. There is every reason to believe that this species is pretty generally distributed in the warmer parts of the country, and that the low siffling noise that we so often hear under hedges and low creeping brakes on fine days is its cry. It is probable also that some of the little foot-prints that are made in the snow under hedges are made by this animal.

Field-Vole (*A. agrestis*). This is the short-tailed field mouse, the meadow mouse, and various other names; and, though it is not a true mouse, all the epithets are applicable, as the animal ranges in all these places; and sometimes comes upon a locality in such an overwhelming flood of numbers that, small as it is, the damage which it does would be altogether incredible, were it not known and felt in such a way as to leave no room for scepticism.

It is a burrowing animal, and takes up its winter quarters either in a burrow of its own digging or in the deserted run of the mole. In summer it lives and often nestles in the tall and coarse herbage by the sides of ponds and morasses in meadows; and at this season it is but rarely found upon very dry grounds. The reason why these do not suit it is easily seen: at all times it prefers fleshy and pulpy roots to every other kind of food; and they form its chief subsistence during the summer, though when the grain is matured in the fields it pays them a visit also. The favourite roots are both most abundant and most easily dug out in the soft grounds, and this is the reason why the animal prefers these. The nest is constructed entirely of vegetable fibres, and the number of the young at a litter averages about six. The animals are exceedingly voracious, and so impatient of hunger that they have been known to eat their own species in cases of extremity, though, if they can procure vegetable food, they never touch an animal substance.

The length of the full-grown field-vole is rather more than four inches, exclusive of the tail, which is about an inch and a quarter. The ears are not half an inch long, and the tips of them just appear above the fur. The thumbs on the fore-paws are mere rudimental tubercles, without the slightest vestige of nails. It is found in most of the lowland places of the British islands, and it is not uncommon in the Orkney isles, where the water-vole does not occur; but it is not found in the mountains. It is in fact strictly a champaign animal, frequenting meadows and gardens, and the fields generally according to the seasons. Its depredations in the corn-fields are not very different from those of the field mice, so long as there are grains to be found; but when the animals are in numbers, they are apt to pass to the autumn-sown crops, and completely clear them roots and all. In gardens they are also peculiarly destructive, not only by eating seeds, but by destroying the roots and the stems of valuable plants. They are also particularly destructive in nursery-grounds, where trees are grown in close beds. They conceal themselves in them, and strip the young trees of the bark for some distance above the ground, by which means the tree is as effectually killed as if an American back-woodsman girdled it with his axe.

The royal forests in England have sometimes been attacked by countless thousands of them, the injury done by which to the young trees—to all trees indeed with succulent bark—has been most extensive, and, only that the ravages are directed to a different kind of vegetation, the mischief done puts one more in mind of what is said of the plague of locusts than of any thing else. Singly, these are very feeble creatures; but they show, in a very striking manner, what numbers can accomplish; and this is one among the many practical proofs that we have of the fact, that little foes which make their attacks in large numbers are always the most difficult to deal with.

When the field-voles muster in the full array of their numbers, which they sometimes do both in Britain and on the continent—though in Britain their ravages have hitherto been confined to the southerly parts of the island, and have been most serious in the royal forests—they commit great devastation. On the continent, especially in some parts of Belgium and the north of France, they sweep the lands of the agriculturists with terrible destruction. They first attack the harvest fields, upon which they levy severe contributions, then they betake themselves to the crops that are on the ground, and, burrowing under the surface, remain there till the whole is eaten up. Their next resource is in the woods and copses,

where they gnaw the bark of the trees, which is equally fatal to them, as the communication between the root and the branches is completely broken. The natural enemies of the vales are all on the *qui vive* upon these occasions, just as the natural enemies of the lemmings attend their marches when they descend from the Scandinavian mountains, and pour their destructive numbers over the plains and valleys of Norway and Sweden. The assistance of these, the exertions of the people themselves, the failure of subsistence, and finally the destruction of part of the remainder of those creatures by the cats, ultimately reduce their numbers, and it does not appear that many of them return. In all cases where animals pour in their vast numbers into places where they are not generally so numerous, we may regard their doing so as in some way connected with a wholesome and necessary thinning of their numbers in other places; but the cause of their moving in these multitudes in one season rather than another has not been ascertained.

One year does not appear to be, in all cases, sufficient for effecting the reduction of numbers, which we may suppose is the chief cause of these movements; for in two consecutive years, 1813 and 1814, the New Forest and the Forest of Dean were attacked to a very alarming extent. New plantations had been made in these forests some time before, with a view of replacing the timber that had been cut down, and thus continuing the value of the forest. Such a quantity of plants with succulent bark near the surface of the ground was a rich provision for the mice, which no doubt found the bark of the old oaks and chestnuts rather a dry mess. The mice accordingly mustered to the feast, and began it in their usual style of attacking live plants, that is, by burrowing under the surface and attacking the roots, which in the young trees was of course confined to the bark, though a little further down, where the woody part of the root was softer and sweeter from not being exposed to the air, they ate through that also, though it is fully as probable that the wood was cut through merely from being in the way. They also attacked the bark above the ground, and even scrambled up the trees for it.

The number of trees which they thus destroyed was very great, and the conservators of the forests were thrown into a state of the greatest alarm. Had it been earlier in the history of the country, it is probable that "bell, book, and candle," would have been in requisition, as they were in Canada against the pigeons; but the authorities took human means, that is, they dug numerous pits with overhanging sides, so that once in the vales could not get out, but remained there for the crows to peck at or the keepers to kill. The predatory animals, whether mammalia or birds, which content themselves with "such small deer," as animals weighing about an ounce and a half each, were busy on the ground or in the air; and plying teeth, and bills, and beaks, and claws, with no small zeal and satisfaction. All these means, vigorously as they were applied, were some time in clearing the ground of the little destroyers, and it was much longer of course before the forests recovered from the effects of them.

In many parts of the world there are species bearing some resemblance to the last-mentioned one; and no part of the world appears to abound more in them than the east of Siberia. Of the species there, there is one called the "*economic campagnel*," which, according to the accounts, is a very interesting creature. They excavate burrows, shaped something like an oven, and about a foot in diameter, to which there are numerous entrances, but they are all too narrow for admitting any predatory animal. Near the chief apartment there are magazines of provision. This is collected in the summer, and consists of various plants and roots, which are dried in the open air. The females, which remain in the burrows attending their broods, are said to perform the chief part of their domestic labours. In some years they collect in the spring for the purpose of migrating in a body, which they do to long distances, considering their diminutive size. In their progress they do not hesitate in crossing streams or even lakes, and many of them perish in the water, or are captured by predatory animals. They generally return from these excursions about the middle of autumn; and the natives are said to mourn their departure, and rejoice at their return, in the superstitious belief that they escape from bad weather and come to good.

REDUVIIDÆ. A family, or more properly a sub-family, of hemipterous insects belonging to the section *Heteroptera geocorisa*, and distinguished from the other groups separated from the great Linnæan genus *Cimex*, by the very short, curved, and strong proboscis, with the head narrowed behind the eyes into a distinct neck; the antennæ are also very slender at the tips. This sub-family is extremely numerous, and some of the species are amongst the largest and most singular of hemipterous insects. The majority, however, are chiefly exotic. The body is generally long and the legs slender; in many, however, the fore legs are thickened, and the thighs of these legs armed with spines indicating the carnivorous habits of the insects. In many species the thorax is also furnished with great spines, giving the insects a very formidable appearance. They are considerably variegated in their colours, but many exhibit only uniform obscure tints, with occasional metallic reflexions.

The *Reduviidæ* do not emit that disgusting scent which renders the *Cimicidæ* in general so obnoxious; but, as if to make amends for this want, they are enabled to inflict very severe wounds with their short and strong proboscis. They are found upon flowers, trees, and occasionally in houses; their prey consists of other insects which they can overcome. One of the species has received the name of the masked *Reduvius* (*R. personatus*) from the singular economy of its larva, which has the instinct to envelop itself in a covering of dirt and floating dust, in order to conceal itself the more completely from the insects which it feeds upon, and which are chiefly the common bed-bug. It might perhaps be supposed that this coating of dirt was accidental, and had become attached to the insect in its passage through the obscure places of its abode; but such is not the case, for one of these larvæ being enclosed by itself in a paper box and left for the space of a month, was discovered at the end of this period, not only to have shed its skin, but to have coated itself with its old mantle of dirt which it had carefully picked off its old skin. Stationed, therefore, in some obscure corner, the crafty insect waits patiently for the arrival of a victim, upon which it pounces immediately that it comes within its reach, seizing it with its two fore-legs.

The sub-family, from its great extent, has been divided into numerous genera and sub-genera by

Fabricius, Laporte, Burmeister, &c., the chief of which are *Reduvius*, *Zelus*, *Ploiaria*, *Nabis*, *Petalochirus*, *Holoptilus*, &c. The genus *Reduvius* is distinguished by the elongate-oval form of the body, the moderate length of the legs, the anterior tibiæ are provided with a cushion at the tip, and the antennæ are four-jointed. The type is the *Reduvius personatus*, Linn., which is about two-thirds of an inch long, of a brownish-black colour without spots. It is generally found in houses.

REEVESIA (Lindley). A Chinese plant bearing monadelphous flowers, and belonging to the natural order *Byttneriaceæ*. It thrives in any light rich soil, and may be increased by cuttings,

RENANTHERA (Loureiro) is a splendid genus belonging to the parasitical *Orchidaceæ*. The plant is grown in damp moss in a warm stove, and flowers freely.

RENEALMIA (Dr. Brown). A genus of ornamental perennial herbs, natives of New Holland. The flowers are triandrous, and the genus is arranged among the *Irideæ*. The species, of which there are three already described, are cultivated in the stove, and thrive in turfy-loam and heath-mould.

REPTILE (*Reptilia*). A class of vertebrated animals, and the third in succession in most of the systems, the place being between the birds and fishes. The name "reptile," is derived from the Greek word signifying to crawl or creep; and thus it is not very descriptive of the whole of the order, neither does it express a kind of motion which is peculiar to those animals which the order includes. Among vertebrated animals, indeed, there are not any that can be called creeping animals, except the creeping reptiles; but, when we come to the invertebrated animals, we find very many that crawl or creep. Among reptiles, too, there is to be found every kind of motion which is found among any of the other three orders of vertebrated animals; but it is not performed by means of organs exactly similar, or in exactly the same style. Thus, for instance, many reptiles walk, run, or leap, and some of them with great agility; but their limbs, though they consist of nearly the same number of bones, are not articulated like those of the mammalia. The limbs of a reptile have always something the air of supplemental bones stuck upon the body of it, and not parts of the whole as one harmonious organisation. Some reptiles are capable of performing a sort of flight; but they do it by means of membranes, and not of any organs resembling wings properly so called. Those that swim, and many of them are excellent swimmers, do not perform that motion by any thing resembling fins, but by the flexure of the body or the action of the limbs. Even the creeping or crawling of reptiles is different from that of the invertebrated animals, chiefly *Mollusca* and *Annellidæ*, which perform the same description of motion. In both of these, there is an alternate "holding on," by means either of different portions of one sucker-like foot, or of two such organs, at different parts of the animal; and the real motion is performed by the alternate lengthening and shortening of the body. The possession of a vertebral column prevents any lengthening or shortening of the body in reptiles, and, therefore, those which have no feet, perform these motions by means of flexures of the body, though in many of the species this motion is so rapid that they seem to glide along. In order to produce these, there must be a concentration of muscles on the spine. This, however, though it holds in many of the genera, by no means holds in all the class; for there are three of the four orders into which it is divided, which have but little motion of the dorsal part of the spine, and some which have none at all. In the class of reptiles, therefore, we are unable to lay hold of any general character of the organisation or the mechanical action, which will carry us through the great majority, and thus enable us to see their place and use in the world, before we come to divide and distract our attention with the details.

There are swimming mammalia, and there are mammalia which can perform a sort of flight; but, notwithstanding this, any one who takes a general view of the mammalia as a class, can be at no loss to say that they are the inhabitants of the land or solid parts of the earth's surface. If the examination is continued until it becomes more minute and runs into the differences which appear among the order of the groups and sections, it only requires a corresponding knowledge of the different parts of the land itself, to say where each of these shall find its appropriate habitation; and the few mammalia, in comparison with the whole number, that are inhabitants of the water, are just as easily pointed out, as it is to decide when we see an ape and an antelope, "That climbs a tree by grasping with the hands, and this bounds along over firm surface of the earth."

There are also some birds which have not only got no flying feathers, but which have got the bones of the wings merely rudimental and enclosed within the skin of the body; and there are some others which have the wings more like swimming flaps than like instruments for moving through the air; yet, when we take a general view of the class, we have not the least doubt or hesitation in coming to the conclusion that there are creatures which, upon the whole, are fashioned for making their way through the atmosphere. Even in the case of the wingless and the flap-winged ones, we come nearly to the same conclusion; and upon examining them we feel that, if a little more were added to them, they would quit the earth or the waters and soar aloft. If we go into the details here also, we have no difficulty in inferring the locality from the structure, and pronouncing one to be of slow flight, and another of rapid—that one is a tree bird, another an air bird, a third a ground bird, and a fourth a water bird. It must be admitted that from mere examination of the structure of birds, we cannot so well tie them down to geographical localities, as we can so tie down the mammalia. This we might expect from the nature of the element in which birds move. The air circulates freely round the whole of our planet; and the very same portion of nitrogen which is given out in breathing by a man at London, may, after uniting again with the requisite quantity of oxygen, be breathed by a man at the antipodes, after the lapse of no very great number of mouths, or even of days. Therefore, it is perfectly natural to conclude, that the bird which can ride in the air as in a chariot, should partake something in the discursive power of that chariot; and that the bird which is under the line at one season of the year, should be near the margin of the polar ice at another. But this does not prevent us from easily arriving at the general place which birds occupy in the system of nature, or the particular place of any one genus, family, or other division or sub-division, which has in its different members so many characters in com-

mon, as that we can say they must all follow the same mode of life.

Fishes are less under the control of our observation than either mammalia or birds; but there is this advantage in them, that, when they get out of the reach of our observation, we know where they are, and that is not an unimportant point in our knowledge of them, though it may appear a vague one. Fishes leave their own appropriate element less than either mammalia or birds, though there are a few that can (not fly, but) leap a little way through the air, and others that can crawl a little on the surface of the earth. Both of these are, however, in the metaphorical as well as the literal sense of the words, "fishes out of the water;" and thus they form not the slightest hindrance to our conclusion as to the place which fishes hold in the system of nature. As in the other cases too, if we attend to the differences of structure, we have not much difficulty in coming to an accurate conclusion as to the place and the general style of action in any particular fish. A very cursory look will inform us whether the fish lingers near the shore or drives about discursively over the wide seas. Nor is it more difficult to determine the general depth at which the fish inhabits the water, to pronounce that it is a surface fish, or fish of the midway depth, or one of the bottom.

In each and all of these three classes of animals, therefore, we have something to begin with, which is easily traced, clear and definite, and of ready application at every step of our progress. But when we attempt the study of the reptiles we have no such help. We can of course tell the shape, and the number, form, and arrangement of the several parts; that is to say, if we get hold of the specimen in a condition sufficiently perfect; and there are some few cases in which we can tell whether the land or the water is the habitual residence of the creature. But there are other cases, and they appear to form the majority, in which we cannot decide even this very simple and general question—a question so simple und so general, that, though we could answer it, the answer would be of very little value to us.

Let the reptile in question be an ophidium, and let the question be whether it is a land one or a water one; and without a knowledge of those very details in which the general principle ought to assist us, we can come to no conclusion. Even in those with which we are most familiar, there are puzzles and perplexities of the very same kind. Let any one who has not attended to the habits of the creatures look at a common frog, as it hops lightly along the meadow, and at a common toad, as it drags its apparently useless lumber of legs after it on a dark evening in the middle of summer; and, after he has examined their appearances and their motions, let him say which is the more aquatic of the two, and the chances are, that if he is in the proper condition for needing the general principle, that is, if he knows nothing about the facts of the particular case, then the chance, nay, almost the certainty, is that his decision will be wrong.

Owing to this total want of a general character in keeping with the rest of nature, by the help of which we could arrive at some knowledge of the locality, latitude, and use, we are, as it were, thrown out of the system when we attempt to take a general view of the class of reptiles in reference to the system and working of the rest of nature. They are vertebrated animals, and yet they do not appear to belong to the same combination as the other vertebrata. We can at once point out the general element or locality of a mammiferous animal, a bird, or a fish, but where, upon general principles, is the proper element or locality of a reptile? From inspection of it, we find that, flying excepted, we might with equal propriety point anywhere, and that which is equally at home anywhere may be said to be really at home nowhere.

This negative state, so to name it, in which we are placed with regard to the reptiles, as having light thrown on their characters and uses, from the economy of the rest of nature upon our globe, leaves us absolutely without anything like general or scientific principles in the natural history of them—absolutely without a rational natural history, we may say; for all the knowledge that we have is mere details, as these have been observed in individual instances; and we may add that there are, in the various collections, more specimens of reptiles, of the habits, and, in many instances the mere localities, of which nothing is known, than there are of all the other vertebrated animals taken together.

If we abandon the mechanical structure and the mechanical action, and take to the physiology, we do not materially better our condition as to general knowledge, for there seems to be the very same kind of anomaly here as in the mere structure. Among the whole of the other three vertebrated classes, for instance, there is a production of a certain structure, at the birth or the coming out of the egg, though different parts of this are developed and brought to maturity at different ages of the animal. But if, by accident or design, any member is lopped off, the mutilation continues, and though there may be compensation in other parts of the system, there is never any reproduction of the severed member. But it is not so in the reptiles; for in many of them, a limb, or part of a limb, will sprout again and grow, and come to be useful after it has been completely taken away. In this there is a complete departure from the other vertebrata, and an assimilation to some of the animals that have no skeletons, and nothing that can be called a centre of organisation—to the crustacea for instance, and also to some of those creatures which appear to hold the lowest rank in the scale of animal life, and which may be cut in pieces without being killed, or dried like tinder, without being so far dead as that they cannot be again resuscitated by the application of the requisite supply of moisture and of heat.

Indeed, the reptiles generally are wonderfully at the mercy of the laws of the inanimate part of creation; and though some of them are capable of very powerful momentary action, they are so only when they have due assistance from physical causes external of themselves. The great crushing serpents, which can break the bones of very large animals in their folds—the pythons of the south-east of Asia—and the boas of tropical America—are perfectly helpless if you expose them to the cold of even a mild winter day with us in the open air, or even in a room where there is no fire. When the temperature is reduced below a certain degree, they sink so that they cannot recover, and then of course they die; but, down to a certain degree, the measure of which is a matter of experiment, they may be kept in a dormant state for a great length of time; their

functions, while in that state, may be so totally suspended, that there shall not be the slightest wear or waste of the system, and yet the application of heat shall restore them to the full measure of activity which they enjoy under any circumstances. The enclosing of a common toad in the hole of a tree, by the growth of new wood over the aperture, is a case of which there have been many instances.

In this way the more characteristic of the reptiles afford a remarkable proof of a very curious doctrine—a doctrine which, at first sight, one would be tempted to look upon as a paradox, and yet which, when we come to analyse it, appears to be perfectly consistent with the general law of nature. The principle is this: the less of the activity of life there is in any creature, taken in the average healthy state of that creature, the more difficult is that life to be destroyed. A tortoise has been known not only to live, but to move about, for nearly three weeks after the brain had been totally removed. A salamander, which is a reptile in which the action of life is still more feeble, has been known to live for several months; and the hearts of some serpents have preserved their vitality for nearly two days and two nights after having been taken out of the body.

In fact, it does not appear that any of the functions of reptiles are so purely animal functions as those of the other vertebrata, or even some of the invertebrated ones, in which the action of life is very vigorous, and therefore very easily destroyed. Digestion is one of the most important functions of animals; and in the other vertebrata, the process of digestion appears to sweeten the food in many cases, where it cannot be supposed to be very sweet before it is taken into the stomach. In them the gastric fluid, though a powerful solvent, is anything but a putrifying agent; on the contrary, it is an antiseptic. To enquire into the chemical causes of this, and attempt to ascertain how much of it is owing to the peculiar alkali in this stomachic agent, would be foreign to our purpose. It is certain, however, that not a little depends on this, for there is nothing which deranges the whole system of an animal to a greater extent than an excess of acid in the stomach, which acid neutralises the alkaline property of the gastric juice, which thereby becomes unfit for the performing of its function, and indigestion and derangement of the whole system are the necessary consequences; and, when this derangement is great, the contents of the stomach become offensive, and the food is converted into a poison. Those who have to earn their bread by mechanical labour, in the open air, are very rarely affected in this way; and we may thence infer that, in so far as the mere body is concerned, this is the natural state. With man, as a rational and immortal being, the body, though an important consideration, is not the only one. But in the case of other animals it is quite different. In a state of nature they all perform the labour of finding their food in the open air; and therefore, in the three typical classes, and especially in the mammalia and birds, the contents of that stomach in which the food is turned into chyme are always sweet. So much is this the case, that, in some instances—as in woodcocks and other gut birds—the "trail," that is, the stomach and its contents, is esteemed as the most savoury and delicious morsel of the whole. Very many of the predatory animals, also, endeavour to reach, as soon as possible, the stomach of their prey. All the facts, indeed, tend to show that, in the healthy digestion of mammalia or birds, and even of fishes, there is a correcting of putridity, and not a producing of it.

But, when we come to the class of reptiles, we find the state of things very different; for their digestion appears to be a putrefaction, and it is possessed by the gullet, and probably even by the skin of the interior of the mouth. What connection there may be between this tendency which the digestive fluid in reptiles has to putrify the food, and the actual poison which some of them secrete, as a means of killing their prey, of defence against their enemies, or, as it is in the poison-pores of some of the *Sauria*, for purposes not very well known, it is not easy to say; but we know enough to make us infer that there is some connexion between reptiles and putridity. This is not of course equally conspicuous in all, for the reptiles are a diversified class; and though we cannot infer, *à priori*, from their structures, in what latitudes or in what places any particular one ought to dwell to be in greatest accordance with that harmony which runs so conspicuously through nature, yet we find that their great head-quarters agree with the physiological distinction between them and the other vertebrata in the nature of their digestion; and this, though not a great deal, is some beginning to their history as a portion of nature.

It is a law in the economy of the world, to which we believe there is no exception, that where there is most life there is also most death; and where composition and growth operate with the greatest vigour, there decomposition and corruption, which is but another name for one form or stage of decomposition, are always most vigorously at work. Countries near the tropics, which are shaded by woods, supplied with waters, or otherwise so provided with moisture as that they do not become parched during the rainless season, are of course those in which life and death are most powerfully and constantly at work. We have again and again had occasion to point to the islands south-eastward of Asia, and the countries on the north-east shore of South America, as those which possess this character in the highest degree. Now, it is there that we find the grand muster of the reptiles, in variety of species, in numbers, and in power. Such as inhabit the waters are not of course much affected by the fertility or barrenness of the land. They depend more on the productiveness of the water, and the action of the sun as affecting its temperature, and promoting the hatching of their eggs. It is probable, however, that there is some connexion between the fertility of the land and that of the sea, though the knowledge of this has not yet been reduced to anything like part of a system.

The more powerful of the reptiles, whether those which we call aquatic or not, which are to be met with in those places of continual growth, are in other places less abundant, as they less resemble these in their physical characters. The banks of a large river, the woods near its confluence with the sea, or marshy lands, if in warm latitudes, are all favourite places for the abodes of reptiles. In such places, crocodiles, alligators, and turtles, are found in the waters, vast numbers of toads in the marshes, lizards in the drier places, now in the sun now in the shade; and serpents, coiled up under the bushes, basking in the sun, lying in wait on the trees, or swimming from place to place, are found in countless numbers; and the

size, the strength, and the venom—whatever the creature has to depend upon for its strength and protection—is always in proportion to the general action of nature in the place which it inhabits.

Those which have their habitations in the sea, also, all point to the tropical countries as their head-quarters; and they, as well as the land ones, so far follow the climatal distinction of the two hemispheres, as that they go into higher latitudes in the southern hemisphere than in the northern. As we get into the high latitudes, the numbers, the size, and the power of reptiles, whether of the land, the fresh waters, or the sea, rapidly decrease, till, in the extreme regions near the poles, there are few or none. The northern hemisphere has been examined with the greatest care; and it affords the best field for examination, as there is, in one longitude or another, continuous land all the way from the equator to the polar ice.

From the examination of it, we find, that the sea-reptiles are the first to fail, while the fresh-water ones are among the last. We might be prepared to expect this, from the fact, that very few animals can hybernate in the sea, and none, perhaps, in the deep water. It has been alleged, that some of the surface fishes, as, for instance, the mackerel, sink down into the deep water, and remain dormant there at certain seasons of the year; but the point would be very difficult to establish, and we are not aware of the existence of any sea reptile which hybernates. Even in the warmer seas of Europe, reptiles are few; and in the British seas there do not appear to be any residents, and very few stragglers. In the fresh waters there are none but batrachians; and the land ones are not many, and in the northern parts they are exceedingly rare.

On the continent it is different; for fresh water tortoises are found nearly up to the southern shores of the Baltic, and there are poisonous serpents in Sweden and Norway. This also is what we might be prepared to expect; for, as these are hybernating animals, they do not depend on the average temperature of the year, but on the heat of the summer, or season of their activity; and, though the average temperature is lower in the countries mentioned than it is in Britain, yet the excess of cold is thrown upon the winter, and the summer is considerably warmer. We have a very good illustration of this in many parts of Scotland, where there are snakes in the hills, while not one is ever seen upon the plains between these hills and the sea, though the average of the year is much milder there. The summer, however, is not nearly so warm, at least during the day, as these plains are cooled by the sea breezes, while the heat among the hills is increased by reflection, till, in some places, it is as high as summer tropical ones, and it lasts for a longer portion of the day, from the sun being, for several weeks in the middle of the summer, four or five hours longer above the horizon.

From the way in which they are distributed, we can thus see how the present race of reptiles is affected by the physical character of the climate; and as that confines by far the greater number of them, and all the most powerful ones, to the warm latitudes, we may naturally conclude that these are the only places where they are now required in the economy of wild nature.

In former times it must have been very different, for we have very numerous remains of fossil reptiles in the northern parts of the world, and in England in particular; which proves that, at some former period, they must have been a conspicuous, and therefore an essential part, in the system of animal economy. The fossil reptiles which have been found in various formations, more or less consolidated into stone, are chiefly, if not wholly, either chelonian or saurian. The *Chelonia* are of the forms now inhabiting the waters, some of them apparently of the fresh waters, but the greater part of the sea. Remains of crocodiles are not rare, some of them bearing a resemblance to the existing species, and some not; but of many of the other fossil sauria there are no existing types, neither are there any living members of the order which rival some of them in size.

But, though the reptiles which have the nearest resemblance to these extinct species are now found only in more tropical climates, that proves nothing with regard to the climate of England in former times, nor, which would be more to our present purpose, does it throw any light upon the nature of reptiles. We know, from the almost perfect remains found in the north of Siberia, that there must at one time have been elephants—not an occasional straggler, but in such numbers that the teeth formed a considerable article of trade—so formed as to endure the very extreme of cold, and with bristly hairs interspersed with their fur, capable of shaking off a fall of snow, however heavy. The remains of the other *Pachydermata* which are met with indicate a marshy state of the country; and, as these great fossil reptiles, which, from their situations in the earth, are obviously of much more early date than the extinct mammalia, are all aquatic, we may conclude that the northern parts of the world have been in a progress towards dryness, which, from what we at present observe, is one means of unfitting them for the abodes of reptiles.

This gives us another physiological character of the class, which, though of rather a shadowy nature, is yet of some use in a case where we can found so little upon organisation, and also lets us see the reason of the difficulty we labour under in endeavouring to get a general understanding of the nature of this perplexing class of animals. The reptiles are not peculiarly land animals (including both mammalia and birds under that denomination), neither are they aquatic animals; but they are animals of the boundary between the two, and thus have no breadth of native locality in which we can link them with vegetation, or otherwise bring them within the general laws of the rest of the system as we now observe it. With only one or two exceptions, they all, when in the native state, breathe the free air like land animals, but they do it slowly and imperfectly; and many of them even suspend their animation for a great length of time, or rather, it becomes suspended of its own accord, when the stimulus of heat is sufficiently lowered.

In the production of their young, they vary from a resemblance to the birds to a resemblance to the fishes; and in the last part of the series they resemble both kinds of fishes, in some being oviparous and others ovoviviparous. The very texture of their bodies, bones, membranes, fibres, and all, have something of this intermediate character. The bones contain less phosphate of lime than those of the mammalia and birds, but more than those of the fishes, and gelatine predominates in all the soft tissues and structures of their bodies.

This fact of being intermediate in their motions and also in their principal localities, very naturally leads to the conclusion, that they are also intermediate in their history; that, for example, in respect of any particular place on the surface of the earth, they stand intermediate between the times when the principal character of that place is water, and when it is land. We are generally disposed to regard the ancient account of the *Ultima Thulè*, which was placed in the extreme north, as a mere fable; but really *nec tellus nec mare* is the very kind of country which would suit the great saurian reptiles which are found in the earth; and we may add, that, if the parts with which the bones of some of these creatures were covered, bore any proportion in singularity of structure to the bones themselves, a tolerable foundation is furnished for many of the monsters of antiquity, without much necessity for having recourse to fable. Thus, if the history were complete, which unfortunately it is not, a proper knowledge of the reptiles would throw more light upon the ancient history of the globe than could be obtained from any other animals; because the others indicate a fixed state of things with the surface, either land or water, and the reptiles indicate the transition from the one of these to the other. As they exist, they belong to places of great stimulus and excitement; and we may presume that when they were more general, that state of things was more general also.

The next part of the subject will be the consideration of the particular kind of structure which the reptiles bring to the performance of their duty in nature; or, rather, the kind of structure which enables them, and indeed compels them, to be so obedient to the action of physical causes. In this we shall glance very briefly at the different systems and structures, with the way in which they act or are acted upon; and having done this, we shall give a mere outline of the classification.

In this first part the skeleton is always the portion to begin with. We have remarked that in general the bones contain less salt of lime than those of land animals, but there are differences in this respect. The bones of the small ones are of the same structure throughout, without any cells for containing marrow; but in the larger *Sauria* there are such cells, though comparatively few in number.

The cranium properly so called, or the bony protection of the brain, is very small in all reptiles, which forbids our supposing that the energy is much concentrated in that organ, or that the senses of which the organs obtain their nerves immediately from the brain can be very acute. The vast production of the jaws in some of the species makes the head appear large. There is very often a considerable difference between the young animal and the adult in the form of the head; and one who was not aware of this would be apt to set them down as different species. This is the case, to a very considerable extent, with the crocodiles. When young, their foreheads are rounded in the contour, their muzzles are short and blunt, and the eyes are placed about the middle of the length of the head; but as they increase in size, the roundness of the forehead disappears, the jaws lengthen, the head appears very flat, and the eyes have a backward situation, so that they are three-fourths of the total length of the head from the point of the muzzle. In them, and also in the tortoises, the skull is a sort of flattened cone, with the brain in the posterior or basal part; and in others of the order it is a prism with the edges rounded; but in all the cavity for the brain is simple, and of nearly the same width throughout its length.

The vertebral column varies much in the reptiles, and in some of them there is hardly any distinction of articulated parts; while in others there are some of the most varied and perfect motions in the whole mechanical structure of animals. In the tortoises, crocodiles, and some others that have distinct necks, the number of vertebræ is seven, the same as in the mammalia. The vertebræ of the back vary in different tortoises, being not more than eight in some, and as many as eleven in others; and there are generally three vertebræ in the tail. Those of the tail have considerable motion; and in the neck they have more extent and variety than is to be met with in so short an organ in any other animal; and, besides those that move the joints of the neck, there are other long ones attached to the frame-work farther back, by means of which the creature may be drawn into the horny shell. The vertebræ of the back have not the slightest motion, but are soldered into one piece with the bones which answer to the ribs, and the shield or dorsal portion of the shell. In the crocodiles there are twelve vertebræ in the back, five in the loins, two answering to the sacrum, and thirty-four in the tail; but, except in the tail, the articulations have not much freedom of motion. The frogs have about eight or ten vertebræ, according to the species; but as these form a simple column without any ribs attached, they cannot be distinguished like those of an animal having ribs. The spinal muscles are concentrated upon the neck in the tortoises, upon the tail in most of the *Sauria*, and in the frogs they are few.

The thorax, for it cannot be called the chest in all the species, varies a great deal. In the tortoises the ribs are confined in the shield on the back, and the sternum is blended in the breast-plate. The *Sauria* have the anterior part of the sternum bony to admit of attachment to the clavicles, but it passes into cartilage backwards, and ultimately divides into eight cylindrical cartilages, which brace and strengthen the belly like ropes. The ribs are twelve, but the two nearest adjoining the front, and the two in the rear, are not attached to the sternum. Some of the lizards have the greater part of the ribs joined by cartilaginous arches; the salamanders have them only rudimental, and the frogs, though they have no ribs, have a sternum. Thus, from the crocodiles to the frogs, there is a gradual lessening of the connexion between the dorsal part of the spine and the sternum. The muscles which give motion to the same parts of the body are not very powerful; and in the tortoises and frogs which have no motion of ribs, the abdominal muscles are attached to the breast-plate and the sternum. This enables the frogs to inflate the body by swelling out the skin of the sides.

The cavity in which the head of the humerus, or first bone of the anterior extremity acts is, in the majority of reptiles, with feet formed in two bones—the blade-bone, and what is usually called the clavicle. It is doubtful, however, whether this clavicle, which is a short flat bone extending from the sternum to the shoulder-joint, is not a *coracoid* bone like that which supports the wing-joint of birds from the sternum; and this is rendered the more probable by the turtles having a furcal bone somewhat resembling

that of birds, and being of course the true clavicle. It should seem, therefore, that footed reptiles which have not this furcal bone are really without clavicles. This agrees with the style of their action. We have shown, see art. MAMMALIA, that the possession of a clavicle, though it is favourable to the cross motion of the anterior extremities, is always a drag upon their efficiency in walking, though not necessarily in leaping, as the spring is then taken from the hind legs. Now, while some of the other *Sauria* run with no inconsiderable degree of celerity, the tortoise with its clavicles forming a distinct furcal bone, is one of the slowest of walkers.

This coincidence between the shoulder of a reptile and that of a bird, in the fact of both having coracoid bones, is a very curious matter; the curiosity of it is still further increased when we consider that the tortoises have the shoulder articulated very much like that of a bird, by the support of all the three bones; and these coincidences become still more interesting when we find that they are greatest in those cases where the mode of production in the reptile resembles most nearly that of a bird.

In the shoulder of the turtle, the bone which answers to the scapula or blade-bone, is united by cartilage to the first rudiment of a rib, from which it extends to the shoulder joint. The coracoid extends from the breast-plate to the same; and the third, or furcal bone, extends backwards below the viscera as far back as the abdomen. These bones form an opening for the windpipe and gullet in the same way as in birds; and they may be thus compared to the shoulder of a bird, inside the principal supports of the body, and not outside as the bird has them.

The anterior extremities consist of an arm, a fore-arm, and a hand or paw, as in the mammalia. The arm consists of only one bone, the humerus, as in these. The fore-arm consists of two bones, except in the frogs and toads; and the hand, and also the plane of the principal articulations of the whole number, are varied to suit the purposes which they are intended to serve. In the aquatic tortoises, or turtles, the joints are formed for the motions required in swimming only; and the paw, though internally composed of many bones, is entire externally, so as to be a swimming paw or paddle. In the *Sauria* the hands have a number of divided toes varying from five to one only, variously armed with claws, and capable of most of the motions to which feet with divided toes are applicable; but, in their general appearance, they may be said to be intermediate between the feet of mammalia and those of birds. The feet which they most resemble are those of the marsupial mammalia.

The pelvis, which is the base of insertion for the hind legs, is of considerable size; and the bones of it, contrary to what exists in the mammalia, are moveable on the spinal column, instead of being soldered to it with little or no power of motion. It is this which makes the hind legs appear to be only appendages, and the tail the real continuation of the body; and this appears the more from the thickness of the basal part of the tail in many of the species. But even in the frogs, which have no tails, the hind legs still have the appearance of appendages; and in the best-limbed of the race, there is always a suggestion of the footless reptile. The femur or thigh-bone is curved so as to bend backwards at its upper part and forward at its under, something like the letter *S*. There are two fore bones in the leg in most genera; but in the frogs they are soldered together. The bones of the hind feet are like those of the fore, and, like those, adapted to the peculiar kind of motion which the habit of each requires it to perform. The muscles on the legs of frogs form a sort of calf.

In the positions of rest and style of motion, there are great diversities. Water-turtles stand on the breast-plate as much as on the legs; land tortoises stand on the legs; frogs and toads sit with the axis of the body oblique, and supported anteriorly on the fore legs; and those saurians which approach the nearest to the serpents have the power of coiling themselves up when they are in a state of repose. Turtles shuffle along, but do not walk; tortoises walk slowly; the saurians are walkers, leapers, or climbers, according to the nature of their haunts and their mode of obtaining their food; and none but the dragons can fly, and their apparent organs of flight are mere parachutes, which protract their fall, and not wings that can gain new motion from the air as a fulcrum or starting-point of resistance.

In these few remarks, we have made no allusion to the structure and motions of the serpents or ophidian reptiles, because they have little in common with animals having limbs, and therefore it will conduce to the clearness of our brief view of the class if we take them by themselves. We shall therefore notice the remaining points relative to the others.

Considered with regard to sensation reptiles have even less brain in proportion than they have cranium, and the little they have is very imperfectly developed. They cannot therefore have much of what may be called internal excitement, that is, of originating action with very little impulse from without. But, by wanting this, they are left the more exposed to the influence of external causes. This is what keeps them more to certain latitudes and localities than any other animals; and in respect of the weather in changeable climates, they are excellent weather-gauges in all places where they will live exposed to the weather.

In respect of quantity of brain there are, however, great differences: the brain of a turtle is not supposed to be above a six thousandth part of the whole, while that of a frog is more than a two hundredth part. The frog should, therefore, be an animal of much greater resource, and it may be on this account that it lives in a greater variety of climates.

Though the muscles of reptiles have great irritability, and this continues a long time after death, it does not appear that they have much of what is properly called sensibility; and that their motions and the effects of external impressions on them are much less productive of pleasure or pain than those of mammalia and birds. They have some of the organs of local sense well developed, and others very imperfect.

Of their touch, or feeling, or general muscular sense, it is difficult to judge, because it cannot be separated from the irritation produced by the mere contractibility of the muscles. Sight appears to be their most perfect local sense. The eyes in most are well-formed and ready in use. The turtles, some of the *Sauria*, and the frogs, have the eyes supported by bony plates on the anterior part of the *sclerotic* coat, and this is seldom found in eyes which are not intended for quick and steady vision. The iris of the eye varies in colour, though less than in most of the

other classes, and the prevailing colour is yellow. There is very considerable variety in the form of the pupil. In the crocodiles it closes on a vertical line as in the common cat; in the frogs, and in the geckos among *Sauria*, it is four-cornered, and in the common lizards, the chamelion, and the tortoises, it is round. As in the fishes, the crystalline lens in the whole, or, at least in the greater part, is spherical, by which the animals can see under water, whether their general habit is aquatic or not. Those which have two eyelids closing toward each other, have a third or ventilating one as in birds, and some, as the crocodiles, have a bone in the upper eyelid. In the lizards there are not separate eyelids, but an outer membrane surrounding the whole length, which closes toward the centre by means of a sphincter muscle, much in the same way as the iris closes and contracts the pupil. Thus the eyes of reptiles partake of the structure of those of birds and those of fishes jointly; they have very great power over the apparatus of their eyes; and a few, as, for instance, the chamelion, can look two ways at the same time, but whether it can fully see a separate object with each eye is another matter. Sir Walter Scott was perhaps not aware that he was making a chamelion of Andrew Fairservice, in the novel of Rob Roy, when he represented him as sitting on the sabbath, with one eye intent on the Bible and the other on the bee-hives, equally zealous for the interests of the next world and the present.

Though many reptiles live in dark and gloomy places, and rarely, if at all, come abroad in the day light, yet it does not appear that the eyes are affected by it, because they are well fortified, and there are some which have to bask and sport in the most intense radiance of the tropical sun. In this, as in all other cases, the external action upon them appears to address itself more to their irritability than to their sensation.

It is very doubtful whether any of their other senses are so acute as the sense of sight. As to hearing, there are few or none of them that have external ears except the crocodiles. That alone would not, however, be sufficient to establish the fact of their being dull hearers; for there is no reason why the external integument of an animal should not be an organ of the sense of hearing, as well as the tympanum of an ordinary ear is. But, in general, the internal parts of the ear, although never entirely wanting, are less perfect than in those animals which are known to have the sense of hearing the most perfect. In the turtles the tympanum is under the skin, composed of cartilage, and with but a single bone. The saurian reptiles have nearly the same kind of tympanum; but the bones are more numerous, and there are some additional parts bearing a resemblance to what are supposed to be the organs of hearing in fishes. The frogs and other members of the order to which they belong have the membrane of the tympanum large and on the same plane as the integuments; and if abundance of noise in any animals be a sign of hearing, then the frogs can have no lack of that sense; but the music of their voice is assuredly no argument in favour of their having an ear for music.

The organs of smelling are also not of the most perfect kind; and from the places in which many of the species live, they would at all events require not to have very delicate senses in this way. These organs chiefly open at the termination of the snout, and extend thence to the mouth by cavities lined with membrane, not unlike the olfactory or pituitary membrane in the mammalia. The external openings are furnished with muscles, by means of which they can be contracted or dilated, and the power of motion in the external nostril is rather an argument in favour of some acuteness of smelling. In some too there are bony plates supporting duplicates of the membranes, and thus increasing the quantity of its surface. In all of them however the cavities, and consequently the extent of membranous surface, are small in comparison with those of the mammalia. Yet it is probable that not a few of them depend a good deal upon this sense in the finding of their prey. Many prey during the night, and, climbing trees, eat the eggs and the callow young of the birds which nestle there; and, as many of the birds nestle in holes of which the openings are small, it is difficult to understand how they could be found out, unless by the sense of smelling.

The degree in which they possess the sense of tasting cannot be very great. The tongue varies much in form. In some, as the crocodiles and the tortoises, it is short and fleshy, and furrowed or covered with small papillæ on the upper surface; but it is fastened to the lower jaw both at the sides and the end, and thus incapable of much motion. In some it is very mobile, in others prehensile to a considerable length out of the mouth; the termination is sometimes an elastic cartilaginous fork, and at other times it is toothed. It is, in many instances, of use in seizing the prey; but the extent to which it is an organ of taste is not known. The probability is, however, that there is very little taste in any reptile. Their teeth are in no case instruments of mastication, but of prehension, or they assist in working the prey into the mouth, which prey being in the majority of cases swallowed entire, does not admit of being much enjoyed in the way of tasting.

The system of nutrition is that which next claims our attention. With almost the solitary instance of the green turtle and land tortoise, so much prized by epicures, the reptiles feed upon animal substances, upon animal carrion in a few cases; but in general they kill their own prey, and in many cases swallow it alive.

The nutritive system, considered with reference to the organisation, consists of three parts, prehension, swallowing, and assimilating, including under the latter the various steps of digestion. The mouth is the grand instrument of prehension, and it varies much in the armature which fits it for this purpose; but it cannot be considered as performing any other office than that of simply taking the food and holding it until it is swallowed.

The tortoises have the mouth the most simple. It is without teeth in any of the order. There are jaw-bones, with intermaxillaries in the upper jaw; and these jaws are armed with a horny covering which invests the bone like a hoof, and varies a little in hardness. In some species too the sides of it are nearly even, but in others they are waved so as to have some slight resemblance to teeth. The anterior part of it is sometimes drawn out into the form of something resembling a bill. The upper jaw of the turtle has no motion upon the skull, but offers a firm resistance for the lower one to close against. The lower jaw is articulated on the skull, and has little or

no motion, except opening and shutting; but in some of the species it shuts with great force, and when once shut it is difficult to be opened against the will of the animal. The horny mandibles of the turtles can readily divide substances, some of them even a cable: and therefore the strength of their muscles is thrown upon those that close the jaws, rather than on those that aid in swallowing.

The mouth shuts in the same way in the *Sauria*, but they are furnished with teeth, and the jaws are in general very much produced; and the motions of them contribute both to prehension and swallowing. Among the most formidable mouths in this order are those of the crocodiles, though some of the extinct species show by the remains that they had been animals of most comprehensive gape.

The old belief was, that the jaws of a crocodile shut in the opposite way to those of any other animal, by the upper jaw moving and the lower one being fixed; but the fact is, that both jaws move, and thus the mouth is opened or shut with very great celerity. The lower jaw is not articulated on the skull as in the turtles, but on the upper jaw. That jaw is very long, and the skull, which is small, is lodged in the fork formed by the two maxillaries, and carried with them in any motion they may have. It is this enlargement of the maxillaries, by the way, which changes the round head of the young crocodile to the flat head of the old one. This long upper jaw can be elevated or depressed by the motion of the whole vertebræ of the neck, and partially by those of the back also, so that the face of it in which the teeth are may be brought to the perpendicular, or even to incline a little backwards. This has the same appearance, and also produces the same effect, as if the upper jaw had a motion on the skull, and it offers a firm resistance to the lower jaw in closing the mouth, which could not be obtained if the upper jaw had a motion on the skull. Indeed if both jaws so moved, the bite of the animal would be feeble and unsteady. The lower jaw is articulated on the upper one, and opens from it and shuts against it in the same manner as if the upper did not change its position. The advantage which the animal draws from this is the ability of biting upwards, or with the line of the closed mouth at right angles to the surface of the water. Its prey is often on the surface, and thus it can lie in wait with the snout above the surface, and thus make a more certain capture. Its teeth are formidable, but they are not capable of dividing a substance, and therefore, as the mouth does not dilate beyond the measure of the jaws, the animals are said to bury their larger prey until it becomes tender enough to shake to pieces.

The other saurian reptiles have much less power in the bite than the crocodile tribe, but some of them have teeth in the palate which aid in the operation of swallowing. The tongue of the chamelion is one of the most curious prehensile instruments in the whole class of reptiles. It is nearly cylindrical, and about the thickness of a goose-quill, rather thicker at the point than in the basal part. When in a state of repose, it is drawn into a sheath in the posterior part of the mouth; but when used, it is projected with great celerity to the length of five or six inches, and at the same time the distal portion becomes covered with a viscid secretion. It seldom fails in killing and attaching the insects at which it is directed, and then it is withdrawn, and by its contraction assists in swallowing the prey.

The entrance to the gullet is simple in reptiles, and the gullet itself is wider in proportion than it is in animals which can masticate, or even bruise the food with the mouth. In many it is beset with papillæ, having their points directed downwards, and in most there are longitudinal folds, which by spreading to receive the food, and closing after it, facilitate its passage into the stomach.

The stomach in reptiles varies very considerably in shape, and sometimes it is doubled back in a curve, but is in all cases a simple stomach; and though the intestinal canal varies in form in the several members of the order, it may in all cases be said to be without cæcal appendages. The progress of digestion, like that of most of the functions of these animals, appears to be but slow; and the action of the gastric juice is chiefly confined to the stomach, the solvent power of the gullet, and whole internal membrane from the mouth down to the stomach in which the first stage of assimilation is completed, being confined to the ophidian reptiles, the notice of which we shall take by itself for the reason already stated.

But though the process of digestion appears to go but slowly on in the generality of reptiles, there are many of them which are exceedingly voracious when they do eat. In most cases the food consists of worms, insects, mollusca, and other small animals, though some take larger prey. The turtles live on some species of sea-weed, which grow only in the warmer latitudes; and is, from their feeding upon it, called turtle-weed, or turtle-grass; and the land tortoises eat the succulent leaves of plants, being particularly fond of lettuce, though their meals of it are taken at long intervals. Some of the species gorge themselves to the throat, and part of the prey which they have seized, but have not room to swallow, occasionally escapes unhurt from their mouths, and regains the place of its natural enjoyment.

Notwithstanding the voracity of some of these creatures under particular circumstances, their abstinence under others is equally wonderful, if not more so; and this is increased by the fact that long abstinence in them is not attended with the same "falling off in flesh," which is a concomitant of scanty or poor though regular fare in animals of more rapid circulation, and more energetic vital powers. Hybernation is not necessary to this; for turtles and tortoises, alive the while, have existed a year, or even a year and a half, without taking any food; and the turtles which are brought from the West Indies to "banker out the wits" of the ventricular devotees in England, keep their flesh as well by simply tying up the mouth as if they had the free range of their own favourite weed in the sunny latitudes of the Atlantic. Nor is the power of living without food, and, singular to say, increasing in size under this privation, by any means confined to the turtle, or to the reptiles of warm climates. The common newt of our own country will live without food for a month or two; the chamelion and the salamander for more than half a year; that singular creature, the proteus, for two or three years; and the common toad for a period, the length of which has not yet been determined.

The part of the subject which next demands a little of our attention is what may be regarded as the most essential part of the vital system of reptiles, namely, their circulation, and, closely connected with that, their respiration, or the extent to which they require the circulating blood to be purified and renovated by

the access of atmospheric air to it, as it passes through the capillary vessels of the lungs. These must evidently be taken together, because, if the one of them is by any means stopped, the other stops along with it, or at least immediately after.

These two functions, or rather the compound function of which they are the two most essential parts, may be regarded as the indices of the quantity of life —the rapidity of habitual action in the animal, though not of the momentary efforts that it may be capable of making at long intervals. They are purely animal operations, carried on in opposition to physical causes from without, and not in any way by the influence of such causes; and therefore, the more vigorous that the circulation and respiration of any animal are, the better is the animal able to bear the variations of climate and the vicissitudes of the weather. The fact that reptiles are, in the great bulk both of their species and their numbers, confined to the warm lands and seas, and to those places of the lands which have the highest temperature in their atmosphere, might be taken as conclusive evidence that in them the circulation and the breathing must be both very feeble, otherwise they would not leave the animals so much at the mercy of the elements.

Besides the difference in the active parts, the heart and the lungs, there are other evidences in the whole reptile class. First, the whole quantity of the blood is much smaller than in mammalia, or than in birds, though in the majority of these it is less than in the majority of the mammalia; from which we would infer that the voice and the sagacity of animals are in proportion to their quantities of blood. The muscular fibres of all reptiles are white, and they bleed little or none when cut into, if the larger vessels are avoided. They consist more of elastic membrane, composed chiefly of gelatine; and it may perhaps be presumed that this substance is more under the control of what we may call the electric influence than fibrin, which is a product of blood. Secondly, the change which the blood of reptiles undergoes in passing through the lungs is much less than in mammalia and birds. In these there is a very marked difference between the bright red arterial blood, which is sent over all parts of the body for their nourishment and repair, and the dark red venous blood, which comes back to be renovated in the lungs; but if we examine the blood from these two parts of the system in a reptile, we can hardly tell the venous from the arterial either by the colour or by any other tint. It should seem indeed that there is some intercourse between the solid part of a reptile and its blood, independently of its circulation; for when the animal continues for a long time in a lethargic state, without activity or food, the blood in all parts of the system becomes paler in the colour, as if that portion of it upon which the colouring matter depends were taken up by absorption. Toads, which have been long shut up in the holes of walls, or have been "grown in" in trees, are said to have little or no red colour in their blood. This would lead us to conclude that the system of the blood, which is the controlling system in mammalia and birds, is a controlled system in reptiles; and as the nervous system is always in accordance with the system of the blood, that must be a controlled system in reptiles as well as the other is.

The form and structure of the heart vary a great deal in the different orders of reptiles. In some there is a rudimental appearance of a double heart, though there is always some internal communication by means of which the systematic and the pulmonary circulations are more or less blended together, so that a greater or smaller portion of the blood, which has been returned to the heart by the systematic veins, can be returned directly by the systematic arteries, without having passed through the lungs. Whether the communications between the cavities are capable of being contracted or expanded, so as to vary the portion of circulation through the lungs, has not been very clearly ascertained; but it is highly probable that these internal communications in the heart contract when the animal is greatly wasted, and expand as it relapses into a state of inaction. This does not of course admit of direct experiment, but it is at least highly probable. Most of the animals that have the double circulation perfect and vigorous are ready for action on the instant; but there is always an effort of preparation required by a reptile; and it is highly probable that this preparation is not confined to the external demonstrations, but that a part, and that the most essential part, goes on within; that in fact it contracts these natural passages of the heart, and, for the occasion, approximates to the character, and thereby acquires a portion, though a momentary one, of an animal with a perfect double circulation. In this again we can learn the indefinite and shadowy place of the reptile in nature, not of the earth or the air on the one hand or of the water on the other, but of the boundary between both. Some reptiles have the heart far less perfect than this, and they are not capable of even momentary displays of energy, but pass their time in an unbroken dulness and repose. It may not be amiss to name the differences in the three orders, leaving out the serpents, as we have done in the other parts.

In the *Chelonia* the heart is broad, and it is nearly semicircular in the turtles, and of a square form in the tortoises; in both there are two auricles, one systematic and the other pulmonary, but they open into one ventricle; this ventricle is divided into two parts by a partition, but there is an opening in this partition which, as we have said, probably varies in capacity.

In the *Sauria* the heart has also two auricles, and as many of these reptiles are active, and most of them can be worked into energy upon occasion, we might expect that the heart should be more complex than it is among the *Chelonia*. The crocodiles are hence the most typical, the most powerful, and the most celebrated of this order, and therefore we shall confine our limits to the heart as it appears in them. It is evidently formed for vigorous action, although that action may be momentary; and the ground upon which we come to this conclusion is very certain—namely, the great strength of the organ, and the power of the muscular fibres with which it is supplied. The auricles are much smaller in proportion than in the heart of the *Chelonia*, but they are far thicker and more muscular in the walls. The ventricle is also very strong, and of an oval form; it is divided into three compartments, which communicate with each other by numerous orifices, all apparently capable of expansion and contraction. The right compartment sends the blood to the hind part of the body, and partly, also through the orifices, into the middle part; the left part sends it towards the fore part of the body, and also in part to the middle compartment, which is the pulmonary portion of the ventricle, and

smaller than either of the other two; it is this left compartment which receives the blood back again from the pulmonary veins; there is thus a very complicated circulation in the crocodile—that toward the anterior part of the body approximating the circulation of the mammalia, and that toward the posterior part being more completely the circulation of a reptile; we may therefore suppose that the fore part of the crocodile is more constantly in readiness for action than that of any other reptile, and this is confirmed by the power and energy with which the animal uses the jaws instantly, and from a previous state of perfect stillness and repose. As the hind part of the animal does not take much share in this ready energy, it follows the general law of reptiles. The motion of the animal is but slow, and whether in the water or on the land it never takes its prey by chase, but always by lying in wait, and in most cases in the water only. The *Sauria*, which live mostly on the land, and are nimble-footed, have not this circulation in the two ends of their bodies; but the examination of the greater part of them has been so imperfectly made, that it is not easy to trace, in a satisfactory manner, the relation between the circulation and the activity of the animals. This is much to be regretted, and it were earnestly to be desired that able and unhypothesis-bitten physiologists would direct their best attention to the working of the system in reptiles; for, from the peculiar way in which they are situated on the confines, as between class and class, it is highly probable that they would help us more to a rational understanding of the highly interesting but very serious subject of animal life, than any of those classes which have their locality fixed and definite.

In the frogs and other batrachian reptiles the circulation is very simple. The heart in these consists of only two cavities, one auricle and one ventricle; it does not therefore appear that they are capable of working themselves up to any degree of energy at all comparable with that of those orders which have the heart of more complicated structure; and as they have the aquatic structure, or breathe by means of gills, in the early stage of their being, they appear to retain a portion of this character through life; and hence many of them which are upon the land occasionally, in the warm season, take up their winter abode and pass into the dormant state in the water.

The other branch of this division of the subject is the breathing apparatus. In those reptiles that live and breathe in the water when young, and also in the very few and obscure species which retain this power of breathing along with that of breathing in the air, and which are therefore the only true amphibia in the animal kingdom, the gills resemble those of fishes in their structure; they consist of a number of filaments around which the water can play, and this appears to be the only form of an apparatus by means of which an animal can breathe air through the residuum of water. Between these and the gills of fish there is, however, a very remarkable difference in the adaptation; the bone fishes have lids and flaps by means of which they can work their gills; and even the cartilaginous fishes that have fixed gills, have them in sacs or cavities, which have the power of alternately expanding to receive the water, and contracting to reject it after it has done its office. The gills of the reptiles, whether young or mature, have, on the other hand, no accompanying apparatus by means of which the animal can work them. They are placed on the sides of the neck without any apparatus or covering whatever, and then the animal cannot work them by any effort on its part; hence those reptiles which retain them through life are among the most dull of all known animals, and are among the very lowest types of the vertebrated form.

The lungs of reptiles resemble those of the other vertebrated animals in their general structure—that is to say, they are composed of cells into which air may be admitted, and from which it may be again expelled; but in respect of structure, and of the means of working that structure, they are far inferior to those of the mammalia and the birds. They are in general larger in their whole volume, and extend farther down into the abdominal cavity, but they are lesser in their texture; their cells are much larger; they do not, bulk for bulk, expose nearly so much surface to the air; they are much less elastic in their own structure, and the apparatus for working them are exceedingly imperfect. In the tortoise they are of uniform structure, but the cells are large and few, and the walls or partitions between them comparatively loose and flaccid. In the *Sauria* the lungs, which are in two lobes, one on each side of the heart, there is a sort of double division, or rather division and subdivision, into cells—first they are divided into polygons by large partitions, and then into cells by smaller ones; but in most cases also these cells have not much elasticity in their walls, and the smaller ones are much larger than the cells in the lungs of mammalia. The lungs of the *Batrachia* resemble those of the *Sauria*, but they are still more simple, consisting of fewer cells; and they are not developed until the metamorphosis in which the gills are lost or absorbed, these lungs float loosely in the cavity, and, as already hinted, they are in all cases much less elastic than the lungs of other animals. The air can thus much more easily distend them, and thus the animals can inhale a large quantity, or rather passively receive it. In consequence of this, as well as of the less need they have for air, the breathing in reptiles is very slow, and particularly so when they sleep. It appears indeed that, in very many of them, the transition from sleep to perfect dormancy is short and easy. The common turtle will live for four or five weeks, though the mouth and nostrils are both effectually closed. Reptiles will also live much longer than the other vertebrata in the same quantity of atmospheric air, but they will not live in air which is wholly deprived of its oxygen. In what may be called the voluntary taking in of air, which the reptiles, from their capability of suspending their respiration, necessarily possess in a higher degree than those animals which cannot suspend it long, they do not draw it in by the action of the chest and diaphragm like the mammalia; they *drink* it, that is, they take it into the mouth and gulp it down by the action of the throat, much in the same way as a carnivorous animal gulps down water. The chelonians make way for it by raising the shield at the back part, and depressing the breast-plate at the same; the first being accomplished by the mere relaxation of the muscles at that part, and the last by the contraction of the same. In short, the two plates work something in the same manner as the boards of a common pair of bellows, only they work slowly and to a very limited extent. The respiration in the *Sauria* is performed by the action of the ribs, the abdominal muscles, and the tendinous continuations of

the sternum, jointly; and in the *Batrachia*, which have no ribs, the abdominal muscles and the integuments perform the same office. The *Chelonia* do not appear to have any other way of taking air into the lungs than by forcibly swallowing it, because they have no part in which the mere pressure of the atmosphere can make a cavity for itself, and therefore they are really the animals which should be called *engoulevents*, or "wind-swallowers," the name which the French give to the goat-suckers, which are capable of getting all the wind they want without any effort in the swallowing of it.

The voice and the temperature of animals both depend on the respiration, though the voice is modified by the larynx. In reptiles that organ is simple, without any epiglottis, though with various ligaments and muscles to the glottis; and in some, the males of the bull-frogs especially, there are membranous bags and cheek-pouches, that serve further to modify the sound. The loudness of the voice depends on the force with which the animal can expel the air; and as the crocodiles can do this with far more force than any of the others, they roar or bellow loudly, and often in the most tremendous key. The *Chelonia* have no such power of respiration, and thus their sounds are only hissing and sighing, and these not very often repeated. Some of the land *Sauria* utter a sort of siffling whistle; while a few, as, for instance, the common green lizard, have little or no voice of any kind.

As to the heat of the animals, it cannot be great, because the heat is in proportion to the action of the system only. Most of them, however, keep their temperature a little above the average of the atmosphere in which they live. They are all very soon affected by cold, but many of them can bear a pretty high temperature: not that there is any salamander, which, like the fabled reptile of the ancients, can live in the fire, and there only; but there are aquatic reptiles in some springs of pretty high temperature. This endurance of heat is not universal, however; for the common frog cannot live in water so warm as the blood of a healthy human body. The change of temperature which takes place during the paroxysms of excessive activity, in those which can be powerfully excited, has not been examined; and yet it is a point the settling of which would be of much use in clearing up the doctrine of animal heat, about which there are still many things not quite satisfactory, notwithstanding all the theories that have been prepared, and all the words that have been written about it.

Closely connected with the vital system in reptiles is their power of passive endurance, and that of reproducing lost members. The first of these is of no inconsiderable value in throwing light on the relation between the laws of dead matter and the laws of animal life; and it is not a little satisfactory that the peculiarities of reptiles in this way extend to chemical action as well as to the action of mere temperature. Analogy would lead us to conclude that this ought to be the case; but a conclusion from analogy is always more satisfactory when we can substantiate it by direct evidence.

We must not understand that it is in its yielding to the general laws of nature, that an animal suffers injury, disease, or death, from those laws, but exactly the reverse. For, if an animal could be so formed as instantly, and without effort or resistance, to obey all those laws in all their changes, they could have no injurious effect upon it. The only instances which we have, even of inanimate matter, as in perfect obedience to these laws, is in the celestial bodies; and as there is no resistance to the law there, there is no casualty. The sun is not an atom exhausted by its shining, neither is the planet fatigued by its career in its orbit; and could there be any such perfect obedience in terrestrial nature, the thing or being possessed of it, or yielding it, would be totally exempted from death and dissolution. This cannot, however, be the case; because the law of gravitation to the earth always comes in, claiming and forcibly taking a portion of this obedience; and therefore the obedience to no other law, whether of matter as such, or of life, can be perfect. Perfect exemption from these laws has of course the same element of permanence in it as perfect obedience to them; and this is the reason why the immortality of the mind of man is so clear in itself, and in such beautiful harmony with the whole system of nature.

Life is, in its very essence, an opposing of the common laws of matter, whether mechanical or chemical; because the action of life consists in taking a certain quantity of matter from the common stock, and applying it for a longer or a shorter time to the purposes of the animal. It follows from this, by very obvious and even necessary consequence, that the more stubbornly the animal keeps the uniform tenor of its own economy, the more sturdily must it have to battle with the changes which take place in physical nature. We have a remarkable instance of this in the human body, which, as it is adapted to the greatest number of purposes, we ought perhaps to consider as the very *chef-d'œuvre* of animated matter. But, though the human body can endure a greater range of temperature than the bodies of most animals, there is no question that it does so with a hard struggle, and in all probability it could not do so were it not supported and buoyed up by mental resource. It is incalculable to what an extent the mental hope sustains the corporeal frailty; for we find that, even under the most favourable physical circumstances, if hope becomes extinct, the extinction of life follows close upon it; and if the body will not die, the agony of the mind makes it lay violent hands upon itself. Yet, notwithstanding all this, and all the resources which the mental sagacity of man open up for him, he is more subject to disease than any other animal. Not only this; for man is exceedingly liable to be injured by the chemical laws of nature, and is much more easily deranged or poisoned than any other animal of the same size.

The other animals have none of this mental hope to buoy them up, and therefore they stand upon less advantageous ground, with reference to the changes of physical nature, than man does. It may be thought that their exemption from mental fear is an adequate compensation, but it is not; for, though there are a few timid individuals of the human race who go about mourning and apprehending all the days of their lives, even when they are in the fullest enjoyment of the bounty of Heaven, and grumbling is of course the blackest and most criminal of all ingratitude; yet they are the very few, and not the many, the casual exception, and not the habitual rule. So that, upon the fair and philosophic principle, the irrational animals are in much worse condition for battling with the laws of physical nature than man

is. It is true that each species of animal has fewer of those laws to battle with than man has, and that it is suited to the circumstances of its locality much better than so universal a creature as man can be suited; but, notwithstanding this, the animal has a disadvantage under changes which man does not, and cannot feel.

In consequence of this, ready obedience to the physical change is always of great advantage to the animal; and this is very clearly shown in the reptiles. Their gelatinous tissues much more readily expand under the action of heat than the more elastic tissues of animals of more energetic systems. The tissue of the lungs has already been mentioned as having but little elasticity, and the same may be said of all those other tissues, for the general character of the animal runs through the whole; and there is not a fibre or vessel in the whole of the working structure which is not sheathed with this tissue. The elasticity resists in proportion to its energy, and herein lies the whole difference of constitutional adaptation between the reptile and the animal of more active system. The elasticity resists both expansion and contraction, and also the irritability of the muscular fibre as such, while the more superior tissue of the reptile at once gives way to any of them.

This variableness of the elasticity of the tissue in different animals is one of the most important points in the whole range of animal physiology; and yet, strange to say, it is one which the professional writers upon physiology have almost entirely overlooked.

It will be observed, too, that this elasticity, though it must be regarded as a product of the peculiar life of the animal, because each animal has it different, according to the nature of its race, yet still it is in itself a property of matter, and not a function of life. If the expression be allowed, and it seems a very allowable one, this same elasticity of the membranous tissue is the anvil upon which the energy of the active principle in the animal hammers out the characters of its various actions; and it would be just as vain to expect that vigorous action could be produced with a readily-yielding tissue, as that a workman could hammer steel into shape upon an anvil of lead. It is the struggle between the principle of action in the animal, and the resistance of the tissue, which is the real cause both of the greater heat of the animal and the greater rapidity of its circulation. The flaccid and yielding membrane will not "show front" to the circulating fluid any more than it will to anything else, and therefore the fluid moves coldly on. So, also, the dull and passive vessel will not contract on the contained fluid and urge it onward, and therefore it lags and loiters.

Applying the general principle to the reptile: it is not thrown into a fever by the ardour of the warmest climate, because the coats of the vessels above give way to the expansion of their contents. On the other hand, the vessel yields to the contracting influence of cold, and contracts so as to stop the circulation, and bring on a dormant state, without almost any resistance, or, at all events, with so little that the system of the creature is little injured by it. It passes into a state of complete repose with very little unpleasant feeling, and no injury to the system; and therefore, as soon as the cause which sent it into this repose has ceased to act, it returns to such activity as may be natural to it at once, and without having sustained any injury, or undergone any diminution of substance, how long soever the time of inaction may have been. Nay, though it must be admitted that the point here is not so evident to the judgment of "slow-going men," who have but little of the anvil whereupon to hammer their own metal into a weldable condition, is not altogether so clear; it is probable that this very yielding nature of the tissue may enable those reptiles which have the power of momentary effort—of putting on the steam, as one would say—to bring themselves up to the high pitches of excitement under which they always perform their greater efforts. We find that the greater part, if not the whole of them, bring themselves up to this by the inflation or distention of various parts of their bodies, which makes it appear that the tissue must be worked to a great extent before it is able to offer the necessary resistance.

Upon the very same principle, the reproduction of members which have been taken off may be explained. We know that, even in the human subject, a reduced action of the system is absolutely necessary to the speedy cure of wounds or cutaneous lacerations, however slight. If a wounded person, or any one who has a diseased part of the skin, is in very full blood or vigorous action, and especially if under the influence of any unnatural (and in that case not only unnecessary, but injurious) stimuli, is reduced by medicine, or any other cause that lowers the tone of the system, the healing of the wound or the sore is sure to begin, and is perfected in no very long period of time. But if, while afflicted by such a wound or such a sore, the high tone of the system shall be kept up, and especially if it shall be increased by the incautious use of anything of a stimulating nature, then the merest scratch may become an ill-conditioned sore, and that which, in a more quiet state of the system, would have healed without much difficulty, may be turned into gangrenes that will ultimately occasion death.

It really does appear, therefore, that this doctrine of not working the system too hard is one of the most important in the whole of that science which has for its object the promotion of health and long life in animals, whether rational or irrational; and the more energetic, and therefore the more valuable the animal is, the more necessary it is to attend to these particulars. In the case of every animal, and of course of man among the rest, there is a point beyond which heat or cold, or any other kind of physical action, cannot be borne. It is true that there is no absolute place for this point even in the case of the same species, nor do we in very many cases know why some individuals have more power of endurance either way than others; but this does not in the least invalidate the general principle.

The reason of the difficulty of healing a wound or a sore, under strong excitement of the system, is, that the increased and turbulent circulation, restrained by the resistance of the parts which are yet sound, is thrown upon the weak or lacerated part, and destroys the healing action which, in a more moderate and healthy state of things, would be successfully going on there.

We can, without much difficulty, apply this to the case of reptiles, so as to see why they should have that power of reproducing a lopped member which is denied to animals of more vigorous system and more rapid circulation. There is, however, a preliminary

point to which it is necessary to attend, as it helps to throw light upon the more obscure one. If the body is wounded by an instrument, or injured by any virus which is not the production of a vertebrated animal, and we may say not of the mammalia, to which, as a class, the human body belongs, then the wound closes; and though it leaves a scar, more or less conspicuous according to the nature of the wound and the mode of treatment in the curative process, yet there is no absolute diminution of substance; but, on the contrary, the seam of the scar often stands higher than the rest, as if there had been an accession of new substance produced by the injury. But, on the other hand, if a virus, originating in an animal of the same genus, or even the same class, inoculates the body, so as to occasion an inflamed and suppurative sore, there is always a certain destruction of substance, the loss of which is never again supplied. The simplest case to which we can refer is that of a scrofulous ulcer, such as very often breaks out on the lower jaw of persons who inherit that very unpleasant malady, but who, in consequence of the very fact of inheriting it, appear to have the system more excitable, and in a state of more constant excitement than those in whom the body is sound and free from all hereditary taint. This local outbreak of scrofulous affection may be simple, or it may be severe; but, whether it be the one or the other, if it comes to a head and breaks, there is a pit or indication of the destruction of substance left, which is never obliterated or filled up, but which remains with the individual for life. The only other instance which we shall mention is one of foreign inoculation from an animal of the same class, though from one of a very different genus and order, namely, vaccination, originally produced by the matter of a particular disease on the udder and teats of the cow, though now transferred from one human being to another. I this takes effect, the scar which is left in the arm, the usual place to which the virus is applied, the bottom of the scar is always honey-combed, as if portions of the substance had been eaten away by the virus; and if this appearance does not remain after the place has been completely healed, there, to a certainty, the vaccination has not taken effect.

Now, it follows, as proof of one and the same general law, that if the body of an animal, when inoculated with a virus which occasions an unusual action of the system, prevents that restoration of a small quantity of local matter which would have been restored to the full if the action of the body had been in its usual state; much more must a system of circulation, which is naturally very slow, admit of the reproduction of a member which could not be reproduced with a system of greater activity. Therefore we are to attribute this curious reproductive power in reptiles to their slow circulation as the immediate cause; though, carrying the matter a little farther, this again resolves itself into the readily-yielding nature of the tissue, and the gelatinous nature of the whole soft parts of the body.

These reproductions of parts have been seen in natural cases, and they have been brought about, or rather, scope has been given for the bringing of them about, by some of the most scientific and careful enquirers into the animal economy, such as Spallanzani, Bonnet, and Blumenbach. The experiments were made on the nimble lizard and the water-newt, and they were performed both on the limbs and the tail. Very soon after the separation of the part there is an effusion of blood, though a very slight one, as might be expected from the comparatively small quantity of blood, and the closeness of the circulation in these animals. The wound soon heals without any external application, or even the protecting of it from the action of the air, which does not appear to retard the healing process in these animals of slow circulation. Soon after the healing, the new member begins to sprout, and grows to the proper form and size in a longer or a shorter time, according to the nature of the animal, though, for a considerable time, the new member looks much more delicate than those which the animal possessed from the beginning. This power of reproduction is not confined to what is called the extremities, as, for instance, the tail and the limbs, for it extends also to the most delicate and nicely-formed of the organs of sense. Blumenbach dissected out the eye of a water-newt, which was, in due time, replaced by a new eye as perfect in all its parts as that which had been removed.

The external coverings of reptiles are also worthy of attention, as they are peculiar, and differ not from those of any other of the vertebrated animals. This, as in other vertebrated animals, consists of three parts: an *epidermis*, or cuticle, or scurf-skin; a *dermis*, or cutis, or true skin: and a *rete mucosum*, or mucous tissue.

The two more internal of these do not differ very much from the same integuments in the other vertebrated animals, excepting perhaps in some of the *Batrachia*, as for instance the frog and the toad, in which the cutis is attached to the parts underneath at only a few points, and loose like a sack at all other places. This is not, however, peculiar to this batrachian reptile; for we find instances of it in other classes of animals, as for instance in the gannet among birds (see the article GANNET in this work). The object of this general detaching of the skin from the parts under it, except at a few points, which serve as ties or anchorings to keep it from shifting from its proper place, appears to be that the skin may admit of inflation by the introduction of air, without disturbing the economy or action of the other and more essential parts of the animal.

The epidermis, or cuticle, is much more varied in its appearance and appendages; and these are among the means used for distinguishing them. The horny productions of this part, to which the names of scales or shells are given, are productions from the exterior of the epidermis, just in the same manner as the hair and fur of mammalia, and the feathers of birds. None of them, however, are true shells, or even crusts, such as occur in the shelled mollusca and the crustacea; for they consist of consolidated animal matter, without any salts of lime; and they are always external of the epidermis, and not within it, as are the shells of the mollusca. Of these the most remarkable are the horny coverings of the *Chelonia*, which are known as "tortoise-shell," "turtle-shell," and other names, according to their quality, which depends upon the species by which they are produced. Though we say that these productions are "horny," as distinguished from bones and shells, both of which have the carbonate or the phosphate of lime, or both, in their composition, we must not confound them with the form which is found in the horns, hoofs, and claws of the mammalia, and in the

beaks and claws of birds, or in the nasal armature of the rhinoceros. All these are of a substance very nearly of the same nature as hair or feathers, and always of a fibrous texture, capable of being divided longitudinally into threads or fibres. All the appendages to the mammalia, and generally also to the birds, are much more easily split longitudinally than they are divisible in the cross direction. This is perhaps more strikingly the case in the nasal horns of the rhinoceri, than in any others; but it holds in all of them that can be considered as the products of an epidermis capable of producing hair or feathers under other circumstances. The same character holds in the plates of baleen, with which the mouths of the whalebone whales are armed—all clearly showing that, if the general habit of the class of animals is to produce a detached fibrous covering, that covering when it comes in solid portions will follow the same general law. It must not be supposed that the broad antlers of the hinds of deer are an exception to this, for they are really not horn, though they are called "horns:" they are bone, the produce, not of the epidermis of the heads of the animals, but of the bones of the same.

There is not the slightest tendency to the production of hair, wool, or any other fibrous matter in the epidermis of any of the reptiles; and, therefore, the appendages to their skins, whether they be great and strong plates, as in the *Chelonia*, or scales of various sizes, as in the different genera of the *Sauria*, are never of a fibrous structure. They have various degrees of hardness and tenacity; but they will break nearly equally in all directions, and they are not subject to those markings by the application of heat which apply to true horn. This, besides its beauty, is one of the recommendations of tortoise-shell as a material in some of the ornamental arts.

But it must be admitted that even in the *Chelonia* the solid plates are produced rather from the cutis, than from the cuticle; for although the body within them is invested in a very perceptible cuticle, there is also another fine membrane without; so that, if the expression may be admitted, the shield and breastplate of these animals are produced between the folds of a sort of double epidermis. If the matter, which we call the shell, is very strong and compact, as it is in the greater part both of the land tortoises and the sea turtles, then the membrane over it is very thin, and apt to be obliterated; but, if what we call the shell is of a weaker consistency, then it is covered with a tough and strong leathery envelope; and it is not a little worthy of remark, that the turtles which have this soft and pliable shell and leathery covering are by far the most active and ferocious of the whole order.

In most of the *Sauria* there is the same complication of the integument. There is one epidermis investing the true skin; upon this there are scales or horny tubercles of some kind or other, and over these again there is a second epidermis. The crocodiles and some others have broad horny plates, and others have the scales distributed in bands, variously disposed on the different species. The *Batrachia*, in general, have the skin soft, and without any horny or scaly appendages; and although the old and foolish fable has it that there is a hard substance in the envelopes of the head of the toad, which has great medicinal virtues, the saying, like many others of the same sort, is totally without foundation.

In the *Sauria* there are often very powerful muscles immediately under the skin which can produce considerable motion in that, while they show the close connexion which it has with the parts underneath. In the *Chelonia*, both the shield on the back and the breastplate on the under part, consist of a number of pieces, which contribute much to the strength of the whole. These, in some cases, touch at their edges, and, in others, they overlap. The shield or upper defence is the more perfect of the two. It consists of a separate row of plates or separate pieces, more or less firmly attached to each other, which form the middle or central part, along the mesial line of the vertebræ. Immediately in contact with these at the sides there are others, which with them make up the disc of the shield; and external of these there are still others which compose the margin, and approach the sides of the breastplate. This shield on the back of these reptiles is united to the breastplate on the under part only at the middle of the sides; and separate at the fore and hind parts, for the action of the head and fore paws at the former, and for that of the tail and hind paws at the latter.

It does not appear that, under any circumstances, the *Chelonia* ever change the coverings of their bodies; but the *Sauria* and *Batrachia* do, especially when they are in the young state. In them, however, the old skin is not cast at once, as it is in the *Ophidia*, of which we shall speak in another place; for it comes off gradually in patches, and the animals are not so much weakened by the operation as those are which moult the entire covering at once.

The mode of reproduction in animals, and the number of their young, are points of great importance both in understanding their own physiology, and in tracing their connexion with the rest of nature. Reptiles of all orders are in two sexes, without hermaphrodites. All the *Chelonia*, *Sauria*, and *Batrachia*, with the exception of the salamanders in the latter group, are oviparous; and the number of their eggs in a season may much exceed those of birds. They do not, however, pay much attention to the eggs after they are extruded; and, therefore, both eggs and young fall a prey to many enemies. The eggs of the *Chelonia* and *Sauria* resemble the eggs of birds, only there is much less lime in the shell, and the white is gelatine, not albumen, so that the eggs do not boil hard. The eggs of the turtles are much esteemed as food, and those of the crocodiles are said to be nutritious; but they have a musky smell. All reptiles which are produced from eggs with a firm covering come out of the shell in the same form which they are to preserve during their lives; and it does not appear there is the same limit to their subsequent growth as is found among mammalia and birds. The *Batrachia* undergo a metamorphosis, and some of them have curious modes of bringing the eggs to maturity, an account of which will be found on looking back to the article Frog, in this work.

We have already casually alluded to the readiness with which all reptiles yield to a reduction of temperature, and pass into the hybernating or dormant state. The readiness with which they pass into this state, under comparatively little reduction of temperature, is a great advantage to them in the way of preservation. The effect of reduced temperature, equally affecting all its body, and accompanied by abstinence from food, is to produce a tendency to the dormant or hybernating state in every animal; only

the longer that the animal can resist, it receives the greater injury from the change of state, and, consequently, has the less chance of awakening to life; in as far as evidence on such a subject can be collected, we believe it may be said that the first symptom of a fatal nature, which occurs to those who perish in the snow, or are recovered when they have nearly perished, is a heavy sleepiness, from which they become at last quite unable to keep themselves awake. If only a small portion of the body is exposed to this extremity of cold, while the rest of it is kept comparatively warm, then the action on that part becomes a topical disease, which ends in the destruction of the part. This resistance in the whole or part of the body is clearly owing to the natural elasticity of the membranous tissue, which cannot, without long and severe action of the cold, be made to contract the vessels, so as to stop the circulation. In reptiles the necessary vascular constriction is produced by a very slight degree of cold; and thus they are not in the least injured by it. Several of the mammalia also hybernate, of which the bats are, perhaps, the most remarkable instance; for in cold countries they disappear for nearly as long a period of the year as reptiles do in temperate ones.

When there is little or no difference of seasons all the year round, there is no necessity for the hybernation of reptiles; but whenever there begins to be a perceptible difference, hybernation is sure to occur. In North America the reptiles hybernate as far to the southward as the shore of the gulf of Mexico, though some part at least of the vegetation there is of a tropical character.

Each species seeks a peculiar retreat in which to pass the season of temporary death. The aquatic *Chelonia* bury themselves in the mud; and the land ones in the earth, the crocodiles bury themselves in the sand or other banks; and the *Batrachia* hide themselves in holes, or seek the mud under water. The progress of this is gentle and gradual; but the state itself, however, in the severe weather, very complete. Nothing will rouse them but the application of heat; and that application must be gradual, otherwise the consequences are injurious, if not fatal. While they are in the depth of their hybernation, the suspension of all the animal powers is as total, though of course not so final, as if they were dead. No mechanical action and none of the ordinary chemical actions have any effect upon them. They may be torn, cut to pieces, burnt with acids, or acted upon in various other ways, without showing, by motion or in any other way, that they have the least feeling of what is done to them. Whether, by unequal exposure to the cold, which many of them must experience, particular members of their bodies are liable to suffer, as certain parts of the human body do when they are frost-bitten, has not been very clearly ascertained; but it is probable, and may be at least one of the uses of that reproduction of parts with which they are endowed. We believe that a seasonal state of dormancy takes place in all or in most reptiles, whatever be the temperature of the country in which they are found, and that it is, in all cases, a total repose, not attended with the slightest diminution of the weight or impairing of the strength of the animal. When the proper action of external nature comes round they again gradually awaken, and resume all their functions as if nothing had been the matter, but rather as if they were refreshed by a sound and long-continued sleep. As this seasonal repose, which reptiles enjoy, is complete rest to the whole of their system, whereas the sleep of other animals is rest to the system of sensation only, and not to the vital system, the reptile has the advantage of the other animals, and awakens much in the same condition as a creature actually new.

What we have stated are the leading facts in the structure and more general habits and action of the three orders to which our consideration has been directed. Though they vary much from each other, and cannot be said to follow any one class and precede another, in anything like a regular chain of being, yet they follow the general type of the quadruped, or animal with four limbs, to whatever purpose those limbs may be applied, until it appears to merge in the type of the fish, in which class the form is gradually obliterated.

Having done this, we shall now very briefly notice the remaining order, the *Ophidia*, or snakes and serpents, which do not properly range with the others in the structure of their bodies, although they clearly belong to the class of reptiles. They stand in the same anomalous relation to the general class of reptiles as the marsupial animals do to the common mammalia, only the anomaly in these is in the mode of reproduction, while in the serpents it is in the general structure of the body. There is another circumstance worthy of notice before we proceed to the outlines of the structure; and that is, that most of the serpents, which retain within the integuments slight rudiments of extremities, chiefly of anterior ones, the mode of production is simply oviparous, like that of the *Sauria*, while in the poisonous serpents it is ovoviviparous, as it is in the case of the salamander among the batrachian reptiles; but there are none of the *Ophidia* which have the same mode of reproduction as the more typical *Batrachia*, the common frog, for instance.

To detail the general form of a serpent would be superfluous. It consists of a head, a body, and a tail in one lengthened bone without any extremities, though there are sometimes membranes to the head or neck, which admit of being inflated at the pleasure of the animal, which inflations appear to answer a purpose in the economy of the animals having them, to which we shall have occasion to revert.

The skeleton is simple in them, consisting chiefly of the skull, the spinal column, and the bones of the head. The skull is small, as in the other reptiles, and the brain is also small and very imperfectly developed, so that the idea of a serpent of any kind being the emblem of wisdom or cunning is without foundation in the nature of the animal. The mouth is the chief organ for taking the food in all serpents; and it may, in every case, be considered as a prehensile instrument, and not a killing or wounding one. The bite of a serpent, considered merely as a mechanical operation, cannot be regarded as very formidable, even in the case of the largest and most powerful of the order, though the action of the poison-fangs, which is a mere puncture and not a bite, not necessarily drawing blood, is often of the most deadly character, and it is at all times painful and dangerous, especially if the animal upon which it is inflicted has a diseased habit of body.

The mouth being thus a seizing and swallowing mouth, and not in any respect a mechanically wound-

ing or masticating one, is of course constructed in all its parts for the work which it performs, and being so, tends to disqualify it for performing the opposite kind of work. The under jaw, as in birds, is made up of two maxillary bones; and these are not articulated upon the bones of the head as in the mammalia, or on the upper jaw as in the crocodile, but upon an intermediate bone on each side, resembling the os quadratum in birds, both in situation and in use. The union of the upper jaw with the cranium, though not an articulation, is very loose in all the species; and, in some of those that swallow large prey, it has nearly all the flexibility of a joint; and, as the tendinous or ligamentary connexion is flexible every way, even this jaw is capable of twisting motions. This flexibility at the junction of the upper jaw with the cranium may be considered as serving fully as much in removing the skull and its contents out of the way of any very large prey which the animal may have to swallow, as in merely widening the gape, for which the organisation of the jaws themselves is abundantly sufficient. In the most remarkable of the swallowing serpents, the great python of south-eastern Asia and its isles, the mastoid extends backwards very considerably in rear of the articulation of the head with the neck, and to such a distance that there is twice as much length behind the orbit of the eye as there is between that and the intermaxillary bone at the point of the muzzle. To the under side of the extremity of the mastoid, the os quadratum, or trunk bone (*caisse*), is articulated, the articulation being on the same part in the orbit, when the jaws are in a state of repose. In this state the os quadratum stands in a perpendicular direction, and the lower jaw is articulated to its under extremity. The bone is not so long in proportion in the python as in some other serpents, but it is, and indeed all the bones of the mouth and jaws are, very strong. Each jaw may thus be said to be articulated upon one extremity of this connecting bone, so that while the lower one opens forward or downward upon it, the upper one moves forward and upward. The opening of the mouth is therefore extended to the full measure of both jaws, together with the two connecting bones, which furnishes a gape of very large dimensions. About one-half of this vast circumference is margined with very powerful conical teeth, considerably bent backwards and a little inwards, but with the short points a little round, so that they the more readily take hold of any substance. In the lower jaw there is only one row of these teeth, but in the upper there are teeth on various parts. There are four small ones on the intermaxillary bone; fourteen in each side, in the external row in the maxillary, and three small ones in the anterior part within these, as a second row. Then there are six on each of the palatal bones, and eight on each of the pterygoids, forming a continuation which reaches very nearly to the opening of the gullet, which opening can be extended to the full width opened by the circle of bones in the mouth, when brought to a plane, which is of course the position in which they form the most ample circumference. There are thus altogether one hundred and four teeth in the upper jaw, and there are thirty-six in the lower, making in all one hundred and forty teeth, and teeth of a very formidable character in the way in which they are intended to act, in the mouth of this mighty monarch of the pestilent swamps of the oriental isles. Of its other power, that of crushing very strong animals in its folds, we shall speak afterwards.

In those serpents which kill by poisoning, the mechanical armature of the mouth is of a less formidable character, though in them also the gape is of large dimensions for the size of the animal. The rattlesnake will serve as an illustration of these. The mastoid is much smaller than in the python, and the articulation of the os quadratum is not farther back than that of the head. That bone is long and slender, and in a state of repose inclines backward at its lower extremity. The under jaw is longer than the upper, and considerably bent, with the concavity upwards. The palatal and pterygoid bones of the upper jaw are bent in the contrary direction.

The only teeth which appear fully developed in the upper maxillary bones are the poison-fangs, one on each side near the anterior part of the bone; but there are others behind them, at least in some cases, which could take the place of those in the event of their being broken or lost; these are hollow, with openings near the points, from which the poison is discharged. When the animal is in a state of repose these deadly weapons are concealed in folds of the integument. They are not, however, folded down by an articulation on the maxillary, for they are firmly set in that bone, and indeed could not act so well were they jointed at their roots. The short maxillaries in which they are inserted have a motion on the transverses; and two muscles, which have their origin on the other bones of the jaw a considerable way backwards, are inserted into the upper part of the maxillary, so that when they contract they turn the bone by pulling the upper part of it, and the advance which this causes elevates the poison teeth, or fangs as they are called. The same muscles pass one on each side of the poison bags, and compress them at the same time that they elevate the fangs. The pulling back of the upper part of the head of the bone also shortens the poison duct, and thus enables it to give way, by an enlarged diameter, to the passage of the virus. Thus these serpents always infuse their poison into any wound which they make with their fangs, as the very same muscular apparatus works both the fang and the poison. The transversal bones, which are very long in these animals, have a bend upwards, so that they are out of the way of the poison apparatus: and the bend downwards of the palatal bone at the middle part conduces to the same purpose, by preventing any thing against which the roof of the mouth may press from interrupting the flow of the poison. The increased depth necessary in the anterior part of the maxillary, for allowing the fangs to be lowered and raised, gives more apparent size to the muzzle in the poisonous serpents than is possessed by those which are not poisonous. The swallowing teeth of these serpents are few and of small size, as compared with those of the species which have no poisoning apparatus. They in general consist of a single row of small teeth on each side of the lower jaw toward the front, and another row on each of the palatal bones; but there are none on the intermaxillaries or the pterygoids; and, with the exception of the poison fangs, the mouth is not a formidable one, either in the strength of its bones, or the number, size, and character of the teeth with which it is armed.

A question has sometimes been raised as to the use of these poison-fangs in the economy of the ser-

pents which have them, whether they are to be considered as principally intended for killing the prey on which the animals feed, or for defences against their enemies. Some have thought that they are principally of a defensive character, but this is contrary to the general analogy of nature, and also to the appearances of the particular case. Poisonous serpents are all, without exception, carnivorous; and, according to the accounts, which, though they may be exaggerated in many points, are surely not wholly fictitious, their prey is much more alarmed at their appearance than the prey of other serpents more powerfully armed in the way of teeth, and also of greater activity. But it is a pretty general law of nature that no carnivorous animal is furnished with any organs, the primary use of which is that of defences, or even weapons of war: talon, teeth, or fang, whatever the weapon may be, its leading use is always of a predatory character, and the grand purpose which it serves is invariably the feeding of the animals. No doubt such animals do use their weapons in warfare, both on the defensive and in the offensive; but this is a secondary use of them, not essential in the economy of the animals, and not resorted to for any occasion, unless it is absolutely necessary. The animals which have defences that are not of essential use, or of any use to them in their feeding, are animals which are preyed upon, and not preyers. In most of them too their weapons are used more against their own species than against enemies. The males of almost all the horned animals fight with each other in the rutting season; and in the elephant the tusks are not even the grand means of vanquishing an enemy. Making a lurch on the enemy, shaking him off by the action of the subcutaneous muscles, and trampling him to death after his fall, are the chief modes of defence with the elephant.

But if animals which, both from their nature and their haunts, are very much exposed to enemies, have not defences absolutely for their protection, why should we suppose that these should be given to rattlesnakes and other poisonous serpents? From their haunts and their habits, they are among the animals that have the least chance of annoyance from any enemy save man. The greater part of their time is spent in the fastnesses of bushes, brakes, and other covers, where enemies are not very likely to reach them; it being understood that birds, and not mammalia, are the principal enemies of the serpent tribe. The idea that the deadly fangs of these animals are defences must therefore be abandoned, and they must be considered as conducing to the more humble purpose of enabling them to eat their dinners, which are few and far between.

It must not be supposed that this is a piece of merely gratuitous criticism on a subject of no great importance in itself, for really it involves the subject of a very mischievous tendency in the study of natural history. The error lies in this, that there are really "weapons of war," created purposely in nature; and this being once admitted, it follows, of course, that war is a part, and a necessary part, of creation, and that, as such, it is not only unavoidable, but natural. Now, no doctrine can be more false or more mischievous than this. For there are no evils in nature; and war is not only an evil, but the very worst of evils; and therefore war is not a part of the law of nature; it is a direct breach of that law. No animal but man engages in war as a trade, though animals do fight; and man engages in it only in consequence of having broken the law of nature (as given to him), and become wicked.

The use of weapons against their own species, which we find in various animals, though it does not in any way conduce to the feeding of the individual, as the use of the weapons of predatory animals always does in their natural and original exercise, must not be supposed to conduce nothing to the advantage of the species. It is the males of such animals that are pugnacious; and it will be found that the very pugnacious ones are invariably polygamic. The purposes of it seems to be the preserving of the race in the very best condition as to the size, strength, and vigour of the successive generations. We know that, in the case of hybrid animals, the form, the size, and the strength, follow after the male parent; and the breeders of domestic animals know this to be the fact, and rest upon it with practical advantage. It is by proper attention to the males that the breeds of our domestic animals have been so much improved since breeding became a science. On the other hand, where no attention has been paid to the good properties of the males, the breed has become stationary, and in many cases degenerated. The pugnacity in wild nature, in consequence of which the more powerful male drives off all the more feeble ones, appears to answer, in wild nature, merely the same purpose as the skill and attention of the breeder answers in art. Such wrong notions of the use of organs, as that which we have been endeavouring to expose, tend greatly to spoil the useful information which we can so copiously obtain from the rational study of animated nature.

The poison is very much of the consistence of a solution of gum, to which substance it bears a resemblance in its general properties; but whether the poisonous nature of it is owing to the presence of a poisoning ingredient, or arises from the mere composition of the entire substance, it is not easy to say, though we know that there are some chemical compounds which are quite harmless when the several ingredients are in one proportion to each other, and deadly poisons when that proportion is different. The virulence of their action, however, is not destroyed by their being dried, which is a proof that the deadly part is diluted in order that it may flow more easily along the duct and the fang. It might therefore be used to poison weapons, in the same way that compound poisons are used by the inhabitants of warm countries. In the vegetable poisons it is now generally understood that the deadly part is an alkali, and it is possible, but not hitherto fully established, that the same may be the case with the animal poisons.

Whether the coincidence is accidental or not we pretend not to say; but it is a coincidence worthy of remark, that the places of the world in which the inhabitants are most in the habit of poisoning their weapons both for the chase and for war, are also those in which the poison of serpents is the most deadly, and the vegetable poisons the most numerous and virulent. The rich and warm parts of tropical America, and the oriental isles, are the remarkable places for all the three; and we believe there are few places containing naturally a very poisonous reptile in which a poisonous plant may not also be found.

Poisonous serpents vary in their deadliness with

the species, the condition of the animal at the time of its infusing the poison, and also with the part of the body upon which the wound is inflicted. If the poison is introduced into a vessel of any considerable size, death, even in a large animal, very speedily ensues, especially if the reptile is in a very healthy and vigorous condition, and has not been using its fangs for some time previous. A puncture in a part where there is no large vessel is not so speedily mortal, but it is attended with far greater pain and suffering to the unhappy victim. Even if there is a recovery from an inoculation of this kind, very unpleasant symptoms are felt for a considerable time after the accident.

As the consequences of these inoculations are often of the most distressing kind, and valuable lives are often perilled by them in a moment when such a casualty is the least apprehended, remedies for them have always been highly desirable, and many have been proposed. Such as are always at hand, and can be promptly and easily applied, are of course the most valuable; because the poison gets so soon diffused over the system, so as to defy not only all local but all general means of relief, that the utmost expedition is necessary. It has been proposed to cut down upon the part to a greater depth than the fangs have entered, and to cut freely. Then instantly upon the incision being made, to apply the mouth and suck out the natural fluids and the poison together. In preparing to do this it is much more valuable to divide the veins and other returning vessels than those which carry the fluids from the centre of the system, because it is by the former that the poison most speedily reaches the vital parts and affects the whole system. The sucking may be performed without any danger, if no part of the interior of the mouth is wounded, for these animal poisons are perfectly harmless when applied to the unbroken integuments. If there were no sore or broken skin upon the hands, we might wash them in the poison of the most deadly serpent with as much safety as they could be washed in water. Another topical means of preventing the poison from getting into the system is to bind the part so firmly with a ligature as to cut off all connexion between it and the body. Of course this can be adopted only when the bitten part is one to which a ligature can be applied, and unless the application is instantly made it has but little chance of success. In extreme cases, however, it is desirable that every remedy which has the slightest chance of success should be applied. Ammonia has also been recommended both externally and internally; in the latter case to bear up the system against the feelings of horror and prostration which the poison produces. Caustic potass has also been recommended as a topical application; and many vegetable substances have been recommended as specifics. But there is some doubt as to the efficacy of any or of all of those, as the precise mode in which the poison acts upon the system, is not known. The subject is, however, one of very great interest, and information respecting it, obtained from experiments skilfully made and faithfully reported, is very much wanted—the more so that, in the vulgar opinion, the subject has been invested with horrors which certainly do not belong to it, bad as it is in itself; and there are probably many who die of the bites of serpents from the mere force of the belief that no one who is so bitten can recover.

The next part of the structural character of serpents which draws our attention is their mechanical action, whether considered as merely conducing to locomotion, or as one means of securing and overcoming their prey. The first thing to be considered in this is the very peculiar structure of the vertebral column, which, in its articulation, and in the mode in which the ribs are attached to it, is different from that of any other animal.

There is a resemblance in the species of all, but the most perfect form is found in the great crushing serpents, which kill their prey by compressing it in their folds. The articulation of the head with the body is by means of a single tubercle, but this tubercle has three distinct articulating surfaces like an irregular pulley, and therefore, though it has a very free lateral motion; it has but little in any other direction. The posterior extremity of each of the vertebræ is formed into a rounded head, from which springs the main body of the vertebra, increasing in diameter, and terminating in a shallow cavity, which receives the round head of the one preceding it. From the neck of the round head of such vertebræ as have ribs attached to them, there spring two lateral processes, one on each side, which curve outwards and a little downwards and increase in diameter as they proceed, each ending with a double tubercle placed longitudinally; and to this the cavity of the rib is applied. Upon the dorsal aspects of the vertebræ there are also short spinous processes which afford points of origin and insertion to the dorsal muscles. The ribs are awl-shaped and tapering to points, and very strong and elastic for the quantity of matter they contain. They do not meet each other on the under part of the body, neither are they in any way united to a sternum, for there is none. Each pair, for there is a pair on each vertebra, are united at their points to the two extremities of one of the *scuta* or shields on the under part of the body; and as the ribs are articulated by cavities on the tubercles of the lateral processes, and are furnished with a curious array of five differently shaped sets of muscles, they admit of a very great deal of motion. The first set of these intersected muscles pass obliquely from one rib to the next. The second pass over two ribs, and unite the external ones of each four in a direction nearly parallel to the spine. The third set also pass over two ribs, and unite the external ones of four, but they pass very obliquely from near the articulation of the one to near the point of the other. The fourth set pass over one rib, and unite the first and last of these in nearly the same direction as the second set. The fifth set unite rib and rib in a direction parallel to the spine, they are very numerous, and extend between rib and rib something in the same manner as the rounds of a ladder.

These intercostal muscles alone form a very complicated apparatus, and are capable of producing more motions than it would be very easy to count. When to these we add the muscles which are inserted upon the spine itself and its dorsal processes, we are constrained to admit that there is not in the whole of animal nature, wonderful as many of the structures are, any piece of mechanism superior, and few equal, to that of the spine and the ribs of a serpent, with their apparel of muscles. The bones too are articulated in such a manner as to give the fullest latitude of action to this very complicated but very beautiful mechanism.

Viper

Rattle Snake

Crocodile

The number of processes to which ribs are articulated vary in the different genera. In some they are as many as two hundred, or even more, and as far as they extend may be considered as the body of the reptile. The vertebræ of the tail are without processes for the ribs, as there are of course no ribs there. The processes on the dorsal aspect of that member are also more simple and more uniform in their shape than those on the dorsal aspect of the body. They are little else than simple tubercles in all the species, while those on the back are at some distance apart in the crushing serpents, and nearer to each other in the poisoning ones. The ribs may be considered as a sort of legs to the reptile, and the plates or shields on the belly as feet; but before we can explain the action of them, we must say something of the covering of the body.

The power of action in the muscles of those animals is as wonderful as their structure. They appear to have to bring themselves up to a certain degree of excitement before they can act with their full vigour; but when they have done this, their starting into vigorous action is without parallel among animals. When one of the more powerful crushing serpents is stimulated by hunger and the sight of prey jointly, its attack is more like a discharge of electricity than any thing else. It does indeed take some time in working itself up to the necessary pitch of excitement; but the instant that it has done this the victim is awakened in its folds in such a way that one can hardly tell how it is done, even though standing close by. The gripe of the folds is also tremendous; for it has the power of tightening them by crawling along the skin by the action of the ventral plates, and as, in doing this it has as many points of holding as there are plates, it pulls and tightens as a rope would do if drawn by a powerful engine; indeed it does more than this, for it draws in every part of its length at the same instant. A dead substance which is thickly set with barbs will work onward in a wonderful manner. One of the barbed beards of barley will very soon get from the waist to the shoulder of one who is working at that species of grain; and the operation of felting, in the making of hats or otherwise, and the milling of woollen cloths, are other instances. These are, however, only dead matter, urged on by mechanical force; while the creeping motion by which the serpent strangles its prey, and even crushes the bones, is a living power which operates at every point where it touches, and there is really nothing in the mechanics of dead matter that can be brought in illustration of it. The power of what seems to be but a small serpent is very great in this way, and can crush to death an animal, around which it appears nothing but a rope of moderate thickness. It does not fasten indiscriminately, especially if the prey is large, but concentrates its coils at that place where their gripe is the most effective for its purpose. It is probable that the exertion of griping the prey to death in the folds, conduces to the secretion of that slimy matter which so much facilitates the swallowing of an animal many times the diameter of the swallower. But we have already mentioned the extent to which the gape can be dilated; and there is hardly any limit to the dilatability of the gullet.

It has sometimes been said that these crushing serpents break the bones of their prey by straining it against a tree; but it is doubtful whether it would not lose much more than it gained by such a means of assistance. It is in its coiling round and round the body of the prey, and performing the tightening motion by means of the scales, that the vast crushing power of this animal consists; and if it were to be coiled round any thing else along with the prey, it is easy to understand that its force would thereby be interrupted in the continuity of its action, and consequently lessened in its effect. In the case of small prey, this terrible crushing power is not put in requisition, the gape is quite enough to make them find their way to the gullet; and though it is any thing but a pleasing sight, it is certainly a curious one, to see one of these serpents making a mouth for the devouring of a fowl or rabbit, or any other little animal.

The reverse of this operation is also a powerful one; though it is momentary, and does not partake of the curious creeping into close folds, which is the grand part of the crushing. The reversal of the twine round is the other motion, in which the whole muscles are brought into play, and it is practised by many serpents whether they crush their prey, poison it with the fangs, or simply swallow it. Generally speaking, the body is coiled up in circular folds on the surface of the ground, with the tail at the circumference, and the head at the centre, and elevated above the coils when the animal is alarmed or excited. It does not at once start from the coil, but opens its mouth, glares with its eyes, sends out its pestilent breath, beats the ground with its tail, and makes a noise with its rattle if it happens to have one. After it has worked itself into a sufficient degree of excitement, and there is reason to believe that in doing this both the heat and the quantity of breathing are brought up to more than the usual pitch, it makes its spring as if it were an arrow shot with great force from the bow of its own folds. In this it is careful not to throw away its effect, which is a considerable one; and as it appears instinctively to judge with accuracy both of the direction and the distance, it seldom misses. Of course it depends on the character of the species, in what manner it acts after it has sprung. If it is a crushing serpent, it twines; if it is a poisonous one, it uses the fangs; and if it is merely a swallowing one, it darts open-mouthed upon the prey, and gulps it down upon the spot. Serpents of this last description generally prey upon smaller animals in proportion to their own size than the others do; and it is also highly probable that the poisoning serpents swallow their small prey without making any use of the poison-fangs.

It now remains to notice the progressive motions of the serpents on their ordinary march, and when they are not under any extraordinary excitement; but in order to do this we must previously notice the covering of the body.

The skin of serpents consists chiefly of two parts—*dermis*, or skin properly so called, and the *epidermis*, or cuticle. The dermis is without any callous surface, is of considerable thickness and great strength; firmly connected to the tissue of muscular fibres underneath, and never cast. This skin is very gelatinous; and, when properly tanned, that of the larger ones makes remarkably thick, tough, and durable and excellent leather, only the surface of it has a curious appearance from the impressions of the scales. The epidermis is cast every season. The appendages to this skin consist entirely of scales. There are two

distinctions as to these scaly appendages, which are accompanied with differences both in the characters of the animals and the styles of their locomotion. Those which have the same kind of scales upon the upper and the under part of the body, may all be considered as quite harmless; and, unless to the very small prey on which they feed, they are among the most innocent and gentle of all living creatures. In those the *ossa-quadrata* are articulated immediately upon the cranium, without the intervention of mastoid bones; and the upper maxillaries are united to the cranium and the intermaxillaries, so that the width of their gape is limited. Their ribs also do not in any way act as legs, so that their progressive motion is performed by flexures of the body. They are quick and gliding in their motions, and can in general move with either end foremost. They advance into higher latitudes than the others. They are not in fact true serpents, but snakes; and they ought not to share any part of the suspicion which attaches to the others. The hard coverings of their bodies are true scales. Some of them have a third eyelid like the *Sauria*, and slight rudimental traces of scapulars and clavicles, though not even a vestige of anterior extremities.

The true scales upon all serpents are placed lengthways, and pointed or rounded at their posterior extremities, in which they differ from the scuta or shields which are on the under part of the true serpents. These are placed crossways on the belly, and attached at the ends to the two ribs, which are articulated on the same vertebra, as already noticed. They are continued on the under side of the tail, sometimes only in one row, and sometimes in two; and in all the species that have them, these shields may be considered as answering the purposes of a sort of feet. When these serpents move at their full speed, they do it by forming the body into successive arches, the scales behind the arch holding on till the extending of the arch advances the fore part of the body. In their slower marches they literally creep along with hardly any flexure, and it is this which forms their characteristic style of marching. One of the actions of the muscles attached to the ribs depresses the anterior part of the shield and raises the posterior, so that it takes a hold on the ground. By this means, also, the anterior edge of each shield can get on below the posterior one in advance of it, by which means another muscular action is enabled to shorten the distance between shield and shield, over a considerable portion of the under side of the animal. The more that the distance is shortened, the more the posterior edges of the shields are raised, and they take the firmer hold of the surface over which the animal moves. Thus, by holding on with the hind part while the fore part is advanced, this curious method of walking by means of ribs and shields, instead of legs and feet, is carried on with great ease, and much more rapidly than one who had not seen it would be apt to suppose. When the fore part of the body is to be advanced, the oblique intercostal muscles pull the ends of the shields upwards; and when the length of the under part is to be contracted in order to bring up the rear of the animal, the muscles, which extend parallel to the axis of the spine, draw the ribs together. The celerity with which this creeping motion is performed is much more considerable than those who are in the habit of associating locomotion on the earth with feet only would be ready to believe; and it affords a proof of a very general and very delightful principle in the working of nature, namely, that it is of very little consequence what form of organ is provided for any particular purpose; for, be the organ what it may, the labour is always sure to be done in the best manner, and with the minimum of exertion on the part of the animal.

The whole of the *Ophidia* can swim, although some take the water more readily than others; and there are several that live habitually in it. There is, however, no ophidian reptile that is furnished with gills, and entitled, as so furnished, to be called an aquatic animal. Their mode of swimming is by flexures of the body, which are chiefly performed in the vertical plane, or in the cross direction to those of the eel; and, as they have no fins of any kind, this is an advantage to them, as it enables them to ascend and descend by the flexures of the body alone, which they could not do if the flexures were lateral, unless they were possessed of lateral fins to serve them as means of support.

Considered in its mechanical structure, the alimentary apparatus of all the *Ophidia* is very simple; and the process of digestion depends upon the solvent power of the gastric juice, and very little on the action of the vessels. The gullet and stomach, in the serpents of large gape especially, have far more capacity of distension than those of any other animals, the wide-mouthed fishes not excepted. The stomach is little else than an enlargement of the gullet; and both have a solvent power. This is necessary, if, as it is *said*, the great crawling serpents swallow a deer, all to the horns, which continue sticking out from the sides of the gape, until the solution of the body has proceeded so far that they drop off.

The organs of circulation and breathing are also simple. The heart has two auricles and one ventricle, and only a portion of that which returns from the systematic circulation, is sent to the lungs. These lungs consist of a single sac, having large cells on its walls, and being situated in the cavity of the abdomen. The windpipe and the larynx are membranous; and thus the animals have no voice but hissing, which is produced by the passage of the expired air through the opening of the larynx, without any action of the membranes of that organ. The hiss accompanies excitement, and corroborates what we have said of the increase of respiration being necessary to work up the system of the animal to its full heat. In their production some are oviparous, and some ovoviviparous; those which have the former habit are more prolific, and consist of most of the harmless serpents; and those which have the last are less prolific, and belong chiefly to the true serpents.

Ophidia are all creatures of wild nature, for which there does not appear to be much place or use after man begins to cultivate extensively. They accordingly disappear before the progress of improvement, the dangerous ones first, and the others afterwards. Many of the savage tribes eat their flesh, which is said to be wholesome and nutritious; and there was a time when feeding upon the flesh of vipers was considered as one of the best means of preserving and increasing female beauty. It is said that, when man began to eat turtle in those parts of the world, women ceased to eat vipers; but whether this did or did not arise from their despairing of carrying on the war successfully with the luxuries of

the table, the story does not inform us, and the point is of too grave and deep a nature for our philosophy.

The classification of reptiles need not occupy us long. The four orders of *Chelonia*, *Sauria*, *Ophidia*, and *Batrachia*, into which it is usually divided, are tolerably well defined in their general characters, though the *Ophidia* certainly break the gradation, which is tolerably regular in the other three.

Of *Chelonia* there are two sub-orders, *Testudina* and *Chelonia*. The first of these is very numerous both in species and in individuals, and they are much more widely distributed over the surface of the globe. They inhabit the land and the fresh water, both in rivers and lakes; but there are none of them in the sea. They are the animals which are properly called tortoises.

There are usually reckoned four distinct genera of *Testudina*. 1. *Testudo*. With the shield hemispherical, solid, and covered with plates nearly of the consistence of horn, but not fibrous. The feet club-shaped, with five toes on the fore-feet, and four on the hind ones; the latter blunt, and all the toes fitted for digging. They are all inhabitants of the land; they inhabit chiefly the warmer parts of the world. There are about twenty known species, which are formed into several sub-sections, on account of differences in the form of the shield and breastplate. 2. *Emys*. With five sharp claws on all the feet, and the toes webbed, so as to fit them for swimming. The shell hard, the head retractile, and the last plates of the shield capable of shutting down upon the posterior margin of the breastplate. There are at least forty different species of them, inhabiting the water or its margins, and burrowing in the mud in the season of dormancy. They are called mud-tortoises, and some of them box-tortoises, from the power they have of closing the shells against each other anteriorly, posteriorly, or both. 3. *Chelys*. The shield cased with horny plates, the toes webbed and five or four in number, and the neck contractile. There are about fifteen species, some of them inhabiting the southern parts of the eastern continent, especially Africa and New Holland, and the others the tropical parts of America. 4. *Trionys*. The feet pectinated, and in general only with three toes armed with sharp claws. The shell with a membranous covering, ending in a flexible edge. Found in the fresh waters, chiefly those of tropical or warm latitudes. The known species are about ten in number. Some of the animals of this sub-order have shells useful for various purposes in the arts, and the animals themselves are occasionally kept as curiosities; but they are of comparatively little value. Some of them are animals of very fierce and predatory dispositions.

The *Chelonia* properly so called are more interesting and more useful animals, though the species are fewer in number. They are all inhabitants of the sea, and the flesh of some and the shells of others are of considerable value. For a notice of them, and some hints respecting the former sub-order, see the article Chelonia in this work.

The order *Sauria* are still more numerous, and some of them are animals of considerable interest, though more on account of their strength and ferocity than of their value to man, which is very limited. There are five families of them—crocodiles, lizards, iguanas, geckos, camelions, and scinks. The crocodiles are chiefly inhabitants of the water, especially of the larger rivers, and they are found only in the warm latitudes. They are the most formidable of all the saurian reptiles, though their power is in the water, rather than upon the land. All the rest are slurred over, in ordinary language, under the common name of lizards, which, however, ought to be restricted to a few only out of the number. They are land animals, and some of them are tree animals, climbing and jumping about with much ability. The flesh of some of the species is much esteemed as food; and some of the smaller ones are of a little use in clearing habitations from insects. Altogether they are an inoffensive race; but many of them are hideous in their forms, and furnished with crests and elatable or inflatable membranes, which add to their rude and coarse appearance.

The Ophidia, which literally means serpent-shaped reptiles, have been noticed apart from the others in a previous part of this article. There are, strictly speaking, only two families of them; but one of the families admits of considerable subdivision, besides the genera of which the several sections of it are composed. Snakes and true serpents are the grand divisions or families. The genera of which their family is composed are not very numerous, and they are all harmless in their dispositions, though some of them are guilty of plundering the nests of birds, and doing other depredations in wild nature. The true serpents consist of many more genera than the snakes, and there are many more varieties among them. Some have the power of going at nearly the same speed with either end foremost; some simply swallow their prey, and others crush it to death in their folds, while there are a very few that are said to live chiefly upon succulent matter, and they are the only animals in the order that do so. Others again are armed with poison-fangs, though they form the minority of the section of true serpents in species, and are not proportionally so numerous in individuals as those which have no poisoning apparatus. Of the poisonous ones, some have no teeth in the upper jaw-bones properly so called, except the poison-fangs; but they have these fangs more completely developed than the others; they have also all the parts and workings of the poisoning apparatus more complete; and, in as far as the infusing of venom into the punctured wounds made by the fangs is concerned, they are the most destructive and deadly of all the serpent race. Their fangs are so formed that the covering of very few animals is proof against their puncture; but fortunately for the rest of the living world, they are animals of very retired habits, and seldom make an attack unless they are alarmed. The rattlesnake and the viper may be considered as the two typical forms of them; but under the type of the viper there are many varieties, some of the small ones of which are highly dangerous, especially in the warm countries where vegetable and animal poisons of all kinds are the most deadly. The poisonous serpents which have other teeth in the upper maxillary bones, besides the poison-fangs, though not perhaps quite so deadly in their venom as those which have the fangs only, are perhaps more dangerous, because, from there being several teeth on the same part of the jaw with the fangs, which move along with that in the same manner as the fangs do, one is in danger of not supposing that they are poisonous. All the teeth which are on this part of the jaw are understood to partake of the nature of fangs, and to

be ready to perform the same office, in the event of any casualty happening to them. Generally the real fangs are the ones most in advance, though this is not always or necessarily the case. The fang is, however, always the largest one, or, if there are two fully developed ones in the same side of the jaw, the probability is that they are both capable of instilling poison into the punctures which they make. Of this subdivision of the waters—not of the fresh water only or chiefly, but rather of the sea—the land ones, some of which grow to the length of seven or eight feet, have been confounded with the crushing serpents, which are not poisonous; and indeed there are many points in the history of both which have not yet been cleared up in a very satisfactory manner. The naked serpents are perhaps the most singular of the whole order. They are, in some respects, more like worms than serpents, and they spend no small portion of their time deeply buried in the mud and slime of the marshes, but still they are vertebrated animals, and true serpents.

Of the *Batrachia*, the frogs, after which the order is named, are by far the most numerous, and the most widely distributed. But, as we have already given some notice of them in the article Frog, we need not add any more in this place. The other members of this order do not admit of being classed into any group more comprehensive than genera; and of some of these there is only a single species, and that species both local and rare in its locality.

We must now close this very brief and very important notice of the class of reptiles. If our limits had admitted, we could easily have made it longer; but there are so many parts of it upon which we have no correct information, and indeed no information at all, that a greater number of words would not have afforded a corresponding increase of information. Yet the reptiles are in themselves a very singular department of living nature; and, although none of them are inviting animals, and some are very repulsive, yet they occupy a place which renders the knowledge of them of great importance in obtaining a proper understanding of the other parts of the system, as they stand intermediate between the mammalia and birds on the one hand, and the fishes on the other; and also between the past and the present in the history of the globe and its inhabitants.

RESEDA (Linnæus.) A genus of annual, biennial, and perennial herbs and undershrubs, belonging to the natural order to which the genus gives a title, viz. :—

RESEDACEÆ. A natural order, containing a single genus, but of which there are twenty-three species. They are mostly worthless weeds, found in Europe and North Africa. They differ from the order *Cruciferæ* in the capsules being unilocular, and the stamens indefinite, as well as in the seeds being destitute of an umbilical cord. Except the *R. odorata* (mignonette), for its delightful fragrance, and the *R. luteola*, the dyer's wood or weed, cultivated for yielding a yellow dye, none of the other species are worth notice except to botanists. They are increased from seeds.

RESTIACEÆ. A natural order, containing nine genera and twenty-nine species of "rigid inelegant, often leafless plants, with the habit of *Cyperaceæ*, or true *Junceæ*." They are weeds of the southern hemisphere, and uncultivated.

RHAGIONIDÆ (Leach; Leptides, Macquart). A family of dipterous insects, belonging to the division *Brachocera* of Macquart, having the wings slightly extended during repose, and not resting upon each other, with several complete cells. The antennæ are short, with the third joint mallet-shaped, with a terminal seta; the palpi are filiform, or conical and external, the proboscis generally exposed; the anterior trochanters elongated, and the tarsi with three pulvilli.

This family is but of moderate extent, the species being of a moderate size. They are often met with upon the trunks of trees and on flowers, and occasionally are to be observed sucking the juices of other small insects which they have captured. The genera are *Rhagio*, *Leptis*, *Chrysopilus*, *Spania*, *Clinocera*, and *Atherix*. The typical genus, *Rhagio*, is distinguished by having the palpi generally lying upon the proboscis, the third joint short and conical, and the style of the antennæ terminal. There are several British species, the type being the *Rhagio scolopaceus*, a common species, half an inch long, with the thorax black, the abdomen buff colour, with a row of black spots. This insect is well known to fishermen under the name of the down-hill fly, the insect being always observed, immediately upon settling upon the trunk of trees, to fix itself head downwards. The habits of one of the insects of this family, the larva of which feeds upon ants, is detailed under the article Leptis.

RHAGIUM (Fabricius). A genus of coleopterous insects, belonging to the family *Lepturidæ*, having the antennæ not more than half the length of the body, and the terminal joint of the palpi large and triangular; head large, nearly square; and the thorax with a lateral spine. They are handsome insects, of moderate size, which frequent flowers, especially those of the white-thorn. Types, *Leptura inquisitor*, *bifaciatum*, &c.

RHAMNACEÆ. A natural order, chiefly shrubs and trees, containing eighteen genera and above one hundred and seventy-one species. They have simple alternate, rarely opposite, leaves, and small, free deciduous stipules, which are sometimes wanting. The inflorescense is either axillary or terminal, and seldom solitary; the calyx free, or adherent to the germen, without sepals; the petals stand on the throat of the calyx; the stamens are definite, opposite the petals, if present, and alternate with the clefts of the calyx; the germen is free, or more or less adherent to the calyx, and immersed in the fleshy disc, and two or four-celled; the styles are equal to the carpels, and the stigmas are simple.

In this order we find the buckthorn, Christ's-thorn, zizyphus, the jujube, &c. Many of the species are medicinal, or useful as dyes; and the *Zizyphus lotus* yields a fine African fruit. The fruit of the *Z. vulgaris* and *Z. jujuba* are favourite desserts in Italy and Spain, either fresh or dried, as a sweetmeat; and a pleasant pectoral lozenge is made of them by the French pharmacians.

The leaves of *Ceanothus Americanus* form the New Jersey tea, and are used in some parts of America instead of the Chinese leaf.

All the genera are easily propagated, and thrive in loamy moor-earth.

RHAPONTICA (Decandolle). A genus of hardy perennial herbs, mostly natives of Switzerland. They belong to *Compositæ*, and were formerly called *Centaurea* by Linnæus. They are increased by division, and do well in the common soil.

Rhinoceros.

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RHEUM (Linnæus). A highly-valued genus of fleshy-rooted herbs, all of which are medicinal, and almost all of which are cultivated. The genus belongs to *Polygonaceæ*.

The cultivated rhubarb is in every garden, and much more an object of the kitchen-gardener than ever it was by the medical herbalist. It is now one of our most favourite and useful vegetables, answering the purpose of all kinds of baking or boiling fruit, and at the most acceptable seasons, viz., throughout the winter and spring months.

Many new varieties have been raised from seed prized for the immense size of their leaf-stalks, the part used in cookery. No plant is easier of cultivation, and no one forced with less trouble. A new sort, called the Goliah, is now very generally cultivated. The roots prepared for medical purposes are chiefly imported from Turkey.

RHEXIA (Linnæus). A genus of handsome herbaceous plants, natives of America, and belonging to the fine order *Melastomaceæ*. Whether potted or in the open ground, they only succeed in peat-earth.

RHINANTHUS. A genus of annual plants, natives of Europe, belonging to the natural order *Scrophularineæ*. Two of them are British, where they are called "yellow-rattle;" very common in every damp meadow.

RHINOCEROS (*Rhinoceros*). A genus of pachydermatous mammalia, and one of the most singular of the whole race—singular as many of the rest are. Though all the characters and most of the habits of this genus of animals are very peculiar, yet the "horn on the nose," on account of which the name is given, and is merely the expression in Greek, is certainly the most extraordinary part. It is a true horn, and indeed more completely a horn than any other appendage to which this name is given, as it contains no sort of bone, and has no immediate connection with the bones of the animal. When we say "horn," in the case of these animals, we are to be understood as speaking of the substance only; for most of the existing ones, as well as of those which are now met with only in a fossil state, and generally, if not exclusively, in places where none of the living animals are met with, have two horns, generally a large one and a smaller one, not placed laterally, but in the rear of it, so that the centres of the bases of both are on the mesial line and on the nose; whereas the horns of the other animals are on the forehead, connected with the bones of the cranium, and in part composed of prolongations of these.

The nasal bones of the rhinoceros are strongly formed and vaulted, and otherwise fortified for supporting the base of the horn, but there is no immediate connexion. The horn is altogether a production of the skin, as is the case with all the heavy substances formed on the mammalia, on what part soever of the body they may appear. No part of the body in the mammalia appears to be capable of secreting horny matter but the skin, and the skin does not appear to be capable of secreting any other kind of permanent matter. There are particular glandulous pores or follicles for the secretion of this matter, and, according as these are situated, so is the distribution of the matter produced; and according to their size and distribution it is fur or hair, or bristles, or horny appendages of some kind or other. Various circumstances affect its production in the same animal. If it is transported from a cold climate to a warm one, the pores producing the hair or fur become abortive in part, and the coat gets thinner; and if the change of climate is made the other way, the opposite results are produced. The quills on the porcupines, and the spines on the hedgehogs and some other animals, appear to be of the nature of single hairs, each produced by one follicle, and not by the agglutination of several into one mass, for they are not liable to split longitudinally.

The bristles of the hog, on the other hand, do appear to be the production of several pores; for, though they are compactly soldered together at their basal parts, they are easily split at the points, and generally partially so split in a state of nature. Nails, claws, and all the true horns, including that of the rhinoceros among the rest, are always produced from numerous pores or follicles; and, though the substance of the epidermis appears to proceed toward them, as we can trace by the descent of a temporary hurt on the back of the thumb or finger, passing along the nail as a white spot; yet, if the follicles are destroyed, they are not again produced; or, if they are injured, the production of them is deformed. If a nail, horn, or a hoof, is entirely torn off, together with the roots, as we call them in ordinary language, it never again grows. In nails and claws, and also in hoofs, the growth appears to be constant; but in many horns it is annual, the different years appearing as separate rings on the basal part of the horn, which can sometimes be separated from each other without much difficulty.

The horn of the rhinoceros grows on a disc, which appears to be very closely set with pores, the fibres from which come into contact as soon as they issue from their pores, and thus they are closely soldered together, as is the case in all the horny appendages. We cannot say that these productions of horn are absolutely without life, but they have in themselves very little sensibility, unless they have a near and immediate connexion with the bones, and in that case the sensibility appears to reside chiefly in the periosteum. The horn of the rhinoceros, originating as it does in the skin only, has none of this sensibility. The form of the disc of skin to which it is attached, and the fact of its attachment equally to all the parts of that disc, give it a strength of base which no other horn possesses; and its fibrous structure throughout makes it secure against fracture by any cross strain. The circumstance of its being placed over the bones of the nose, too, completely prevents any concussion of the brain, even from the most violent use of it; and its central position admits of its being made use of with the whole power of the animal. It is thus one of the most formidable weapons of defence in the whole animal kingdom, and one which can be used with the least pain or injury of any kind. It may also be worn down to the very stump without inconvenience to its owner; and one in the gardens of the Zoological Society of London, at the Regent's Park, had the horn worn down to a mere stump by habitually using it against the timbers of its den. This formidable weapon is, however, a defence merely, that is only to be used against the enemies of the animal, or sometimes, perhaps, in tearing its way through branches, and other obstructions, in the tangled places which it frequents; for the rhinoceros is strictly a vegetable feeder, and not furnished with any apparatus for biting.

The characters of the teeth are not so constant as they are in many genera; but the cheek-teeth, which are the ones that determine the nature of the food, are much the same in all the species. None of them have any canine teeth, and the incisors vary in number and size, and are sometimes wanting, at least in the adult animal. The incisive teeth, when complete, are four in each jaw, two larger and two smaller, and sometimes the one of these, sometimes the other, are placed in the intermediate part. The cheek-teeth, in each side of each jaw, are seven in number, with transverse ridges on their crowns, and those in the middle part of the jaw are usually the largest. The alimentary canal answers to the coarse vegetation upon which the animals feed. The stomach is simple, and of very ample dimensions; the cœcum is also very ample, and the intestinal canal is long. Great size in these parts is indeed one of the characters in which all the *Pachydermata* agree the most; and though there are differences among them, we necessarily conclude that they are fitted for subsisting on a coarser vegetation than the *Ruminantia;* while their progressive history assigns their general distribution over both cold and warm latitudes to an earlier period. The same difference may be stated, with a few exceptions, of the *Rodentia*, and also of the whole of the *Quadrumana;* and these are the only other orders of mammalia which are decidedly vegetable in their feeding.

In their general appearance they are strong and massive, but dull and unwieldy animals, though they are more compact and indicative of strength, in proportion to their size, than the elephants. Their aspect cannot be said to be absolutely ferocious, but the form, and especially the motion, of the upper lip, gives them a snarling appearance. This lip is produced considerably beyond the nostrils, and also beyond the lower lip; it is pointed, and so far prehensile as considerably to assist the animal in feeding. The motion of the point is accompanied by another motion of the middle part, which displays the teeth, deepens some furrows near the gape, and gives a forbidding aspect. It seems best adapted for feeding on substances at or above the height of the axis of its body; but, though the animal is not very rare in some localities, very little is known of the details of its action in wild nature, as it cannot be approached either with ease or safety.

The legs are short and thick, sometimes approaching the character of those of the elephant, and indicating that the animal must be much on its legs—as indeed all animals are which subsist upon very coarse food. The terminations of the feet are, however, very different from those of the elephant. Each has three toes, though very imperfectly developed externally of the membranes. The middle one is largest; the two lateral ones are nearly of equal size; and all the three are furnished with short flat and blunt hoofs. The head and neck are rather short; the ears of moderate size, and pointed, bearing a slight resemblance in shape to those of the bison. The eyes are very small and lateral, so that the animal cannot see well immediately in front. The tail is of moderate length, or rather small, round toward the root, and flattened in the sides toward the extremity. The skin is of immense thickness and strength, much gathered into folds in some of the species, and for the most part destitute of hair, at least in the species now living. When there are a few hairs on the tail, they are usually found on the upper and under edges of the flattened part, and there are generally a few hairs on the margins of the ears. The female has two mammæ seated in the groin; but the mode of gestation, and the other particulars of the production of the young, or the duration of life, are little known. It is pretty well established, however, that in the Indian species the time of gestation is nine months, and that the young, of which there are never more than one at a time, begin to have the appearance of the horn when nine months old; and it is supposed that the others follow the same law.

The bones of the animals are remarkably dense and compact, equal, as it is said, to those of the fore leg and paw in the lion; and Mr. Burchell, who had many opportunities of observing the animals in Southern Africa, mentions that a pewter bullet was flattened by striking against them. The cervical vertebræ have the number which is common to all the mammalia, namely, seven. The vertebræ of the back are nineteen in number, the ones at the shoulder with large spinous processes. The lumbar vertebræ are three, the sacral ones four, and those in the tail twenty-two. There are nine true ribs and four false ones on each side.

The skin of the rhinoceros is "cudgel-proof" at all times, and hardly penetrable by a leaden bullet, unless urged on by a strong charge of powder. When dried and prepared, it is exceedingly hard and tough, and can be penetrated with difficulty by any ordinary instrument. The flesh is much esteemed, at least by the natives of some of the countries which the animals inhabit.

Though there are considerable differences of size among the living species of the genus, they are all large animals, and powerful in proportion to their size; but some of the extinct ones appear to have been much smaller, and others of them still larger. As existing, they are all natives of the eastern continent, and of the most tropical parts of it; and none have hitherto been found in the fossil state in America. We must not be too hasty in inferring from this, however, that none of the genus ever existed in America, for the portions of the soil of that vast continent that have been explored amount to so trifling a portion of the whole, that they do not warrant us in saying positively what is not there. The analogy would, however, lead us to conclude that there never has been any, as there are none living in the tropical parts. On the eastern continent they appear to have been at one time distributed over every latitude, for they have been met with in various parts of Siberia; and, as is the case with the extinct elephant of the north, one at least has been thawed out of the polar ice, in that part of the world, in such a state of complete preservation, as to show that it had been adapted to the rigour of a cold climate, as it was pretty thickly covered with hair.

As now existing, the rhinoceros may be considered as the most aquatic of all the *Pachydermata*, excepting the hippopotamus, and the ones which, next to it, feed upon the rankest and coarsest vegetation. They do not, like the hippopotami, spend the greater part of their time in the water; but they resort frequently to it, not only to drink, but especially to wallow in the mire, which they do something in the same manner as hogs. They do not, however, at any time range the forests at a distance from the water, as is done by the elephants; and though they have a

little tendency to be gregarious, they do not assemble in such herds as these. We believe, that neither the lion and the tiger on the one hand, as predatory animals, nor the elephant on the other, are fond of invading the territory of the rhinoceros. The claws and teeth of the former, could make but little impression on the thick skin of the animal; and its vigilance is so great, that it is not easily taken by surprise. The sight is, as we have said, not very penetrating, and there would be no great scope for its exercise, either in the finding of food, or the discovering of danger, in the slimy jungles which the animal inhabits. But the hearing and scent are very acute; the first being chiefly the one which gives the alarm when danger approaches—though the scent also is said to be useful in this way; and the scent being the grand means of finding out the favourite food. What is usually called the sense of touch cannot be very acute in the general surface of an animal which has so very thick a skin as the rhinoceros; but the prehensile part of the upper lip appears to have that sense in a considerable degree. The animal is also by no means deficient in the sense of tasting; for those that have been kept in a state of confinement have shown much fondness for sweet-tasted food, especially for sugar.

From the peculiar places in which the living rhinoceri are found, and their partiality for water, we are enabled to draw some conclusions with regard to what must have been the general condition of the earth at the time when they were more generally distributed over it. This, it must be borne in mind, has no reference to difference of temperature, taken upon the average, and referable to the influence of the sun upon the earth as the grand cause of the difference of seasons. It has no reference whatever to any variation in the orbit of the earth, in the inclination of the axis of rotation to the plane of that orbit taken on the transverse or principal diameter, or to anything else of an astronomical nature, whatever that may be supposed to have been. It is not the great astronomical principles of the solar system that regulate the nature of the earth's productions, whether vegetable or animal; it is the condition of the earth itself, and chiefly its condition with regard to humidity, which, extending over a large surface, tends more to equalise the temperature of the different seasons, than to fix their average degree. That a tropical climate was not required in the high latitudes, in order that the animals might resemble those now found only in tropical climates, is shown by the fact, that both the elephant and the rhinoceros of the north were really animals adapted for a cold climate.

The inference from this, respecting the state of the higher latitudes of the eastern continent, when they were inhabited by those animals up to the very shores of the Northern Ocean, is easily drawn. They must have been, in great part, covered with marshes; and the vegetable remains of the same period that are found in some of the accumulations, show that a more vigorous marsh vegetation must have grown in such places, than there can possibly grow at the present day. If we attend to the remains which are found still deeper in the earth, and which, we may, therefore, suppose have been deposited there at a period still more early, we find the remains of plants which have evidently grown in moist places, and perhaps in the water, and which have rivalled in their magnitudes the tallest pines that grow upon the comparatively dry surface of the same regions at the present day, but which do not extend into such high latitudes as these tall children of the marsh must have done. Along with these last, we find the remains of creatures which must have been of giant bulk when in the living state; some of which, from the structure of their skeletons, must have lived in the waters only, and others alternately in the water and air probably, without any indications in other skeletons that they ever could have walked or even crawled on the surface of the earth. All these have been vertebrated animals, or animals with an internal spine or back-bone, supporting the cranium and jaws at the anterior extremity, and drawn out into a long tail at the opposite one. The cranium in them all is of very small size as compared with the whole skeleton, which indicates that they must have been animals of very limited resources, and of little general energy. The jaws, on the other hand, are produced to a length which, compared even with those of the crocodiles of our day, appear absolutely monstrous and deformed. These jaws are furnished with teeth having no resemblance to the teeth of the mammalia, and no distinction of kinds in the different parts of the mouth. They are simply prehensile teeth, and not adapted either for killing and tearing, or for any kind of mastication or bruising of the food. The teeth to which they have the greatest resemblance, are those of the larger saurian reptiles, which are either absolutely inhabitants of the water, or found immediately on its banks.

It is of course impossible for us to refer these strange animals to any one class of the system of vertebrated animals as at present existing on the earth, not only on account of the dissimilarity of their organisation to that of anything which we now see alive; but from the total dissimilarity of the whole vegetable and animal kingdoms, and of course of the appearance and state of the whole face of terrestrial nature. But the class which they resemble the most, in so far as can be determined from the remains, is that of the reptiles. Vast powers of endurance, for long and almost indefinite periods of time, and violent momentary action, when aroused to it by the proper stimulus, are the leading characters of the great reptiles of the present age of the world. But these are known to us only as inhabiting warm climates; and therefore we can establish no proper analogy with them, without falling into the same error into which the earlier speculators upon such subjects were led, in considering the northern elephant. They had made up their minds as to the degree of average temperature necessary for an elephant; and having settled this part of the matter, they came to the natural but not very philosophical conclusion, that in the earlier stages of its history, the tropical parts of the world must have had a tropical climate. In good time, however, there appeared sufficient evidence for the refutation of this; for first the northern rhinoceros, and then the northern elephant, were found in a state of sufficient preservation for shewing that both were animals fitted for enduring the very rigours of a polar climate. And, in order to make the demonstration that they did actually live in such a climate complete, they were found preserved in ice in which they must have been frozen up in a very recent state, and kept from the decomposing influence

of the atmosphere for one knows not how many thousands of years; so that there cannot be a doubt that the principle which is established by actual observation in their case, was equally true in the case of every other remain, whether of more or of less ancient date, which has been found or shall be found in the same latitudes; and the fact must be held as perfectly established, that the average climate of every zone in the world, as depending on the influence of the sun, was the same in the very remotest times as it is now.

To suppose otherwise, though perhaps not an unnatural supposition in the days of ignorance, was calculated to originate and confirm a very pernicious and inveterate error on the subject of Nature's grand system, the universe—or, taking it within the limits to which we can apply weight and measure, the solar system. The vulgar opinion is that we are the important part of this system; and that all the rest has been made and is conducted specially for us;—that there is not an event which takes place in the economy of our globe, or a character displayed, or an action done by the highest or the humblest individual of the human race, without "the stars in their courses" having a hand in it. They who once swallow this, need, of course be under no apprehensions of choking by the very largest mass of nonsense that imagination can picture; and they would do only due honours to their *gull*-ability, if they were to label themselves; "Nonsense swallowed here in the largest possible quantities;" in the active performance of which, they might play the vulture, and undo part of the mischief which they and their forefathers in folly have done. Now when we come to consider that the sun contains considerably more than three hundred thousand times as much matter as our earth, and that Jupiter, which is so remote from us as to have but very little influence even in the matter of gravitation, more than three hundred times, it seems very absurd to suppose that any of these bodies should have the least influence in the topical changes which go on upon the surface, or in the interior of our little globe; and that they should take cognisance of our doings as low down as

Cutting corns and letting blood,

really appears to be the acmé of absurdity. It is worse than this, for it takes away our attention from the real causes, and then cuts us off from all possibility of obtaining that knowledge which would really be useful to us. That the action of the sun upon the earth as the dispenser of light and heat is, in itself, a constant quantity, dependent solely upon the unalterable laws of the solar system, and capable of being estimated for every latitude with perfect mathematical accuracy; and that it is the same, and has been and will remain the same, in all years and ages, is a principle which we must take along with us if we wish to turn what we observe of seasons and plans to the proper account. In addition to this, the sun exerts its gravitating influence; and the moon does the same, and also cheers us by the variableness of its borrowed light. But, in addition to this, these bodies do nothing. All the rest is the effect of terrestrial causes; and it is in these causes that we are to seek our explanations as to why any one region is fitted for one kind of plants and animals at one period of history, and for another kind at another period. There is something humbler than this in philosophy, but of more immediate practical use; it is this kind of study which leads us to the proper means of so working the soil to the solar influence, as to be able to obtain the most abundant and permanent return from the land; to adopt, in short, such a mode of culture as shall enable us to feed ourselves without impoverishing our fields. It may not be either possible or desirable to cultivate the northern lands back to the state in which they were when they were tenanted by the rhinoceros; but the covering of the surface with green leaves during the time of the sun's greatest ardour, has produced many wonderful effects in different places of our own island; and the invariable result has been, that in proportion as cultivation has reduced the heat of the summer, the intensity and duration of the winter have been diminished; so that an approximation has been made to permanent cultivation—keeping the earth in a state of producing something useful all the year over. This is an incalculable advantage; for the long winter used to exhaust the whole of the year's stock in the days of our fathers; and the summer, notwithstanding all its heat, was a season of sorrow; during which, famine came in to destroy a people who had no food, in the most heart-rending manner. Then the rains of the autumn came with terrible violence, scourging the fields and floating away much of the produce; and the transition from burning heat to cold damp was so violent, that the season of plenty was also a season of death.

These are only a very few of the simpler points of that knowledge to which the proper study of the rhinoceros leads, as an easy and necessary matter; and we may apply, in the same manner, the history of any other animal, which now appears only as a fragment in a few peculiar localities, but which the remains found in the earth prove to have been at one time more generally distributed. We shall now notice the species of rhinoceros, in as few words as possible.

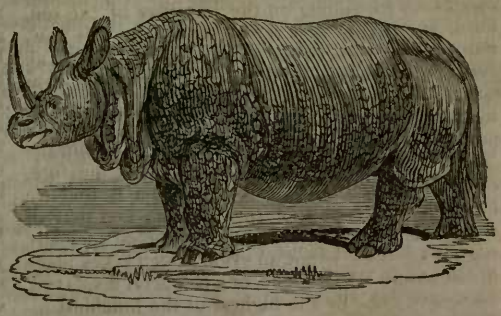
Indian Rhinoceros, (*R. Indicus*). The old name of this the first rhinoceros known to naturalists, was *Unicornus*, or one-horned; but the discovery of another with only one horn, and yet with specific differences sufficiently marked, rendered this name no longer descriptive as a specific one. This powerful animal is not distributed over the breadth of continental India, but confined to the marshy jungles in the lower valleys of the great rivers, especially the Ganges, and its affluent the Burhampootra. The country there has a peculiar character among even Indian countries. The rains come with both monsoons, the north-east as well as the south-west, and they come in very great quantity; so that, for the greater part of the year every where, and the whole of it in many places, the country is a swamp; a swamp which remains under the shade of that most luxuriant vegetation which it produces, despite the great heat of the sun. This is the grand residence of the rhinoceros; and it points out what must have been the character of vegetation in those places from which the rhinoceros has vanished, when that animal was alive in them.

The characters of this one are:—a single horn on the nose; the skin is marked with deep furrows or plaits behind the shoulders and the thighs; and there are also deep folds under the throat. The skin is indeed folded and furrowed in many places, as if it were too large for the owner. The hairs on the skin are hard and smooth; but they are so few, as scarcely to make any appearance, excepting a few on the tail and the margins of the ears. The head

is short and triangular ; but the nasal bones are well developed, and form a strong vault, on the summit of which the base of the horn rests. The eyes are very small ; and there are two strong incisive teeth in each jaw. When in health, the skin of the animal is blackish grey, with a slight tinge of violet. When full grown, it attains the length of eight or nine feet ; but it does not stand much more than half the height of the elephant. It is a strong and powerful animal and easily excited, in which state it is equally bold and persevering in its attacks. What the natural enemies of the rhinoceros may be, it is not easy to say ; though its proneness to make the attack, which has no reference whatever to the finding of its food, would lead us to suppose that this pugnacious instinct has not been given to it in vain.

In consequence of its boldness and strength, the hunting of the rhinoceros is one of the most splendid and hazardous of the wild sports of the East. It is to be sought for in the jungles, and is often found in parties of about half a dozen, led on by the biggest of the whole, as is the case with the herds of elephants. In the tall vegetation of the Indian jungle, the sportsmen cannot hunt for this animal unless they are mounted on elephants ; and they find it necessary to go in bands, so that while some of the elephants are receiving the charge of the rhinoceros, the others may take aim and wound them. A single one is said, in the first instance, to seek safety in a retreat into a closer part of the jungle ; but, if again roused, it advances to the attack. Its object appears to be to get at the elephant on the side ; and passing the horn in below it, to wound it in the belly, or fairly rip it open. The elephant is also said not to attempt using the tusks, which would not, of course, be able to toss so weighty an animal. What may be done in a state of nature we have no means of knowing, for nobody has recorded, and probably nobody ever saw, a battle between a rhinoceros and an elephant in wild nature, nor probably between a rhinoceros and any other creature. But in cases of hunting, the elephant does not appear to have any means of warding off the attack ; but wheels round, and receives it on the hinder part of the body, on which the horn has not much effect in the way of laceration ; but the impetus of the animal is such, that it hurls the elephant to the earth ; and this it will continue to do again and again for some time. It is not unlikely that the elephant, if free in wild nature, would continue to receive these attacks till its opponent were exhausted, and then have recourse to its own mode of warfare with advantage ; but this is merely matter of conjecture, upon which there appears to be no means of getting real information.

As far as can be judged from the few specimens which have been kept in menageries in Europe, the rhinoceros does not appear to be in any way ferocious; though its efforts to break down its prison-house and obtain its freedom are often repeated. In such places the elephant and the rhinoceros are shown to very great disadvantage, on account of the smallness of the dens or cages in which they are pent up. This is considered necessary to the safety of the spectators, and it also suits well with the economy of those who pay the expenses of the spectacle. Truly, however, an animal pent up in a crib which barely enables it to turn round, is but a miserable sight,—a little better than a stuffed skin we grant, but only a little better. If we are to see the animal in such a way as to have any idea of what it is in a state of nature, we must give it free scope for the performance of its natural action ; and thus all that we can know of a living rhinoceros, kept as these animals are usually kept, amounts to little more than an artificial knowledge of them.



Pretty circumstantial details are given, by M. F. Cuvier, of one which was kept in the royal menagerie at Paris. It was but a young animal, yet of considerable size, measuring about eight feet in length, and standing five feet and a half in height. From the shortness of the legs, and the compact massive form of the body, this must have been an animal of great weight and power ; and if it had been allowed space enough in which to acquire its momentum, its den would have required to be of great strength. Its general deportment was mild and gentle ; it knew its keeper, was not wholly unobservant of persons and things around it, had no reluctance to be fed, and obeyed a few very simple commands—upon receiving food after each act of obedience. No particular attention appears, however, to have been paid to the calling out of its instincts in any way that could be considered as even preparatory to domestication ; and its efforts to get out of the prison-house were so violent and incessant, that many liberties were not taken with it. The skin was, as has been stated of the genus, nearly naked of hair. It was marked with tubercles, and of the same dark purplish grey that we have mentioned, only in the depths of the folds it was flesh-coloured. This skin had to be wetted with water every day, otherwise it was apt to chap and crack. The irregularities of the skin on the head, and the external surface of the legs, were formed into elongated ridges, and gave these parts the appearance of being furrowed. These furrowed parts are naturally the ones which have to undergo the severest fatigue when the animal is finding its food or making its way among the close vegetation of the jungle.

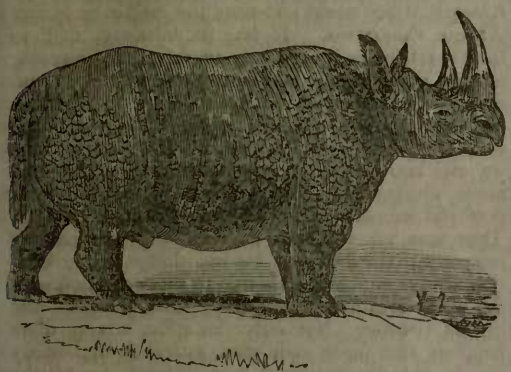
Rhinoceros of Java (*R. Sondiacus*). This is another species with only one horn, and was first discovered, or at all events described, by the French naturalists Diard and Duvancel, when they, in part at least, explored that island of natural wonders. It is smaller, at least in the specimens that have been seen, than the Indian species. The length, from the membrane of the tail to the ears, is six feet ; and from the ears to the extremity of the upper lip, about two feet more ; but as the animal carries the head something in the manner that the hog does, with the axis nearly horizontal, the whole eight feet may be said to be included in the continuous length. The tail is

only about a foot in length ; and the legs, though very stout, are short, the total height, when standing, not being more than four feet. The horn is situated about the middle part of the line occupied by the two horns in the species named with these, which is, perhaps, a very little higher upon the nose than that of the Indian species. The horn always appears to be much used by the animal in some operation or other ; for it is ground or rubbed down, and is sometimes reduced to little more than an inch in length, and much rounded, so that it cannot be very powerful as a weapon. In the young animal, there are four incisive teeth in the upper jaw, two upon each intermaxillary bone, and the whole standing close to each other. These appear, however, to be merely milk teeth ; for they are shed early, and replaced by only two, which however are of much greater size. These milk incisors are cylindrical in their forms and blunt on the crowns ; but the teeth which come after them are broad and flat, but too blunt in the edges for being considered as chisel-shaped, or for cutting any substance clean off, though they cut with considerable force against the long incisors of the lower jaw, or rather form a grand point of support for those to rub against. Though all the teeth in this, as well as in the other species of rhinoceros, are blunt, yet they must be powerful gnawing teeth, as the size and weight of the nasal bones and the horn afford a powerful resistance ; and thus the whole force of the lower jaw can be exerted on the substance which the animal breaks in pieces. The skin of this species is very much plaited behind the shoulders, under the neck, and on the outsides of the legs. The folds on the shoulders surround the whole body, those on the legs extend the whole length of these members, and the folds on the neck hang like collars on the under part. Besides these folds, the skin is roughened by prominent tubercles, for the most part in the shape of regular pentagons, well defined. These do not, however, in the least approach to the nature of scales ; they consist merely of accumulations of the epidermis ; and the only hairs that are found upon the body of the animal arise from slight depressions in the centres of their pentangular tubercles. The hairs are of a black colour, and short and stiff; and they are very few in number, excepting on the borders of the ears and the edges of the flattened part of the tail. The accumulation of tubercles on the skin of this animal, is a singular character among the class to which it belongs, though there are traces of marking on the skins of some of the other *Pachydermata*—even on those of the common hog, as may be seen in those parts of saddles which are made of the prepared skin of that animal. Though this species has latterly been met with only in Java, it is highly probable that it may exist in the other islands of the Sunda group ; but it does not appear to exist in any part of the continent of Asia. It must, however, be borne in mind, that the part of the continent nearest to these islands, namely, the Malay peninsula, has been but little explored, as the treacherous character of the inhabitants renders the exploring of it a matter of no small risk.

The two species which have been noticed are the only one-horned rhinoceri which are now to be found in the living state ; and the greater part, if not the whole, of those which are found fossil in the colder latitudes, appear to have had two horns ; so that the one-horned species appear to have been, in all ages of the world, confined to the localities in which they are now found. The two-horned ones, in farther proof of their having been once more generally distributed, and in their nature better adapted to climates of different temperatures, or at all events more obedient to those natural causes which adapt them to these, are found both in the eastern isles and in Africa. There is one difference between these animals which is worthy of notice, as showing the particular quality of the two-horned ones, upon which their adaptation to climate seems in a great measure to depend. The skin is more free from plaits and tubercles, and more plentifully covered with hair, than on those which inhabit the most equatorial climates. There is, therefore, in the skin of these species a much greater disposition to form hairy matter, and not mere accumulations of cuticle, than there is in the other. The heat of tropical climates, even where they are most under the influence of the sun, and have less need of protection from cold than in higher latitudes, has a tendency to form hairs on the body. We believe we may also add that, although they love moist places, and are fond of bathing themselves and wallowing in the mud, yet the application of water to their skins is not so absolutely necessary as it is to the skins of the single-horned ones, which produce epidermis rather than hair or any other substance of a horny consistency. They are thus driven to the water by the action of the hot sun upon their bodies ; and the action of the cold also tends to champ and harden their epidermis much more than it does that of the others. In the two-horned ones, again, there is a power in the skin, upon which the cold seems to act, though to what degree, in the species now living, we have no correct means of ascertaining ; we know, however, that in all cases where such a power exists, it is always in so far under the influence of climate, and changeable with changes of that. The sheep bears little or no wool in India ; and the dog is almost naked in tropical climates, well clothed in the middle latitudes, and coated with very thick fur in the polar ones—even if the variety is the same, for all dogs are of the same species. It may be said that these are animals which accompany man, or are carried by him, over all the regionsof the world ; and that they are especially fitted for this by the readiness with which climate modifies them into an agreement with its leading characters. So far we admit this ; but the admission is one of degree only, and not of kind. There is no *general* property in the skin of any animal covered with hair or fur, which does not also belong to every other which produces the same substance, however different may be the quantity and quality ; and if the property exists, it is always in so far under the controul of climate, though of course in a less degree when it is in itself weaker. We have instances of this in some of the other *Pachydermata*, which are generally distributed over climates of different characters. Of these, the most familiar is the common hog ; and any one who visits the places may see that the hogs of the warm and dry parts of the south of England are almost naked, while those of the north of Scotland, especially in the cold and upland districts, are quite shaggy. Hogs' bristles are imported in large quantities from Russia, but no such article is to be found among the imports from India or Central Africa. These circumstances will suffice to show why the remains of the two-horned rhinoceros should be found in the cold latitudes, and not those of the one-horned ; and also that there is no need of having recourse to

any supposed difference of temperature as depending on the action of the sun, between the present time and that at which the rhinoceros was a common inhabitant of Europe and the north of Asia; for the change from being very humid to being very dry is quite sufficient to explain the circumstances. This principle would lead to many other conclusions respecting the removal of an animal from one climate to another, and the means of applying art so as to facilitate its adaptation to the change; but we have not room, neither is this the proper place for entering upon the subject, interesting though it be. We shall therefore proceed to notice the living species of two-horned rhinoceri.

African Rhinoceros (*R. Africanus*). This is unquestionably the typical animal of the two-horned species; and it is the largest and most powerful, and apparently the most numerous, of the whole. It ranges the whole of the African continent from the Cape of Good Hope to the upper part of the valley of the Nile; and although the size and colour vary in some of the localities, or at least in some individuals, it is probably the same specific animal throughout the whole extent of its range.



It is probable that this species was known to the ancients, though the two-horned rhinoceros first discovered by modern naturalists appears to be the one which is now called the Sumatran rhinoceros. Pausanias mentions, under the name of the Ethiopian bull, an animal which agrees better with the characters of the African rhinoceros than with those of any other animal with which we are acquainted. What gives greater appearance of truth to this, is the fact that the profile of a two-horned rhinoceros is found on some medals struck by order of the emperor Domitian; and there are hints in various ancient writers, respecting this animal, as distinct from the rhinoceros of India. Farther, we can draw no conclusion respecting the animals which the ancients may have met with in Northern Africa, than those which we now find in the places that the ancients visited. For many extensive tracts of that country which were humid in ancient times are now dry; and many which were covered with rich pastures are now desert. Accordingly, many animals, both herbivorous and predatory, have disappeared; and there can be no doubt that, in proportion as the country became dry, the rhinoceros would be among the very first to depart; and that, as the desert continues to increase, the pasture of these animals will be narrowed in the same proportion.

This animal, at least in the adult state, has no incisive teeth, and even the intermaxillary bones appear to be wanting. Some, however, are mentioned of smaller size, and with two incisors in each jaw; but it is probable that these, though the observers have considered them as distinct species, are only young animals which have not shed their milk teeth. This is rendered the more probable by the circumstance of those species which have two incisors in each jaw when adult, having four milk teeth in each of the same; and it is also to be borne in mind that a milk tooth is an appendage of the gum rather than of the bone; and that, therefore, the existence of such teeth is not incompatible with the absence of intermaxillary bones.

The skin of this species is smooth and without folds, though there are more lines traceable on those parts where the folds are upon the others; and Bruce (we believe) mentions that some, at least of those in the interior of Abyssinia, have decided folds on the skin, and the anterior or longer horn much compressed laterally. The base of the anterior horn is placed farther towards the extremity of the nose than that of the single horn; the flexible and prehensile part of the upper lip begins nearly at it; and the arch of the nasal horns brings it nearly on the same plane with the eyes. This anterior horn is conical and sharp-pointed, about two feet in length, and curving slightly backwards for the whole of its length. The second horn is situated a little above this one, and over the eyes, with its base in a sort of depression of the frontal line. This one is nearly straight, and not above half the length of the first one; but it stands on a base of equal dimensions, and is therefore the stronger instrument of the two, though not the more formidable in appearance.

It is considerably larger than the Indian rhinoceros, being found as long as twelve feet, or even more. One measured by Mr. Burchell was eleven feet two inches along the mesial line, and eight feet four inches in the circumference of the body. The tail was compressed laterally toward the distal extremity, and measured one foot eight inches. These are probably the proportions of the animal in all the varieties of its size; but there are many of larger dimensions than those that have been named. Burchell states, upon the authority of the natives of southern Africa, that there is another species found in the interior different from that which is met with nearer the sea, being much larger in its dimensions, and feeding on grass; whereas the one commonly observed nearer the coast feeds on the leaves and tender twigs of trees. This is not impossible; but it is quite as philosophical to suppose that the enlarged size may be the result of richer pastures than the animal meets with near the sea; and this is rendered the more likely from its being known that the size of the Indian rhinoceros depends a good deal upon the nature of its pasture. As to the one living upon coarser food than the other, that proves nothing as to difference of species; for every grazing animal lives upon the finest and most succulent food that it can procure; and we have evidence not only that the Indian rhinoceros prefers succulent vegetables to those which are hard and coarse, but that it prefers sugar to these. The vast size which this animal of the interior of southern Africa is said to attain, and especially the largeness of the head and the breadth of the prehensile lip, certainly are differences; but the substantial characters are so much the same, that we

should hesitate much before admitting that there are more than one species of rhinoceros in Africa.

But whether there is only one species, or more than one, the rhinoceros seems to be much more at home in Africa than in India. In the latter country it is not found in the interior, even where the banks of the rivers are marshy; and nearer to the sea it is not found but in the jungles, or their close vicinity. The African appears to be much more a ranging animal, and though it resorts to the water several times in the course of the day, it moves over the dry places in the intervals, and feeds on the branches of the trees, especially some of the species of acacia. This ranging habit demands a little more resource, and when an animal requires that, it is always given. The lion of southern Africa, especially at some distance into the interior, where his pastures are abundantly supplied from the time that he is a cub, and all his powers are, in consequence, fully developed, is certainly a much more formidable animal against very large prey than the tiger of the Indian jungles. He is not so little, or so capable of making his way in a tangled cover as the tiger; but tangled cover is not the character of the country in which the lion is most in his place. The lion is not a sea-side animal, or an animal of the low and swampy places by the banks of the great rivers. The plains, where there are alternations of pasture and bush, are the places where he is most in his element; and though he sometimes lies in wait in the bush, he more frequently prowls along the plains, and steals within the reach at which he can capture his prey, under cover of the night rather than of the herbage.

It is probable that under such circumstances, the lion, which makes a prize of the Cape buffalo and the giraffe, may, in the absence of other prey, and when excited by the joint influence of the heat of the season and hunger, attack the rhinoceros itself; and, should he once fairly seat himself on its back, he might be able to ride and gnaw it till it fell, and then of course it would be his prey the same as though it were a weaker animal. That this may be the case is rendered more probable by the hide of the African rhinoceros, though still a tough and compact one, not being nearly so much so as that of the rhinoceros of India. This, of course, enables the animal to be more fleet in its motions; and along with this fleetness there appears to be an increased acuteness of the senses. Perhaps it may be as well to hear Mr. Burchell for a little upon this point, as he had excellent opportunities of studying the manners of the African rhinoceros, and improved those opportunities well. "Their smell (sense of smelling) is so keen," says Mr. B., "and nice that they can know, even at a great distance, whether any man be coming towards them: on the first suspicion of this they take to flight. Therefore it is only by approaching them against the wind, or from the leeward, that the hunter can ever expect to get within musket-shot. Yet, in doing this, he must move silently and cautiously, so as not to make the least noise in the bushes as he passes through them; otherwise their hearing (the hearing of the rhinoceri, not the bushes) is so exceedingly quick, that they would instantly take alarm, and move far away to some more undisturbed spot. But the dangerous part of the business is, that when they are thus disturbed, they sometimes become furious, and take it into their head to pursue their enemy; and then, if they once get sight of the hunter, it is difficult for him to escape, unless he possess a degree of coolness and presence of mind, which in such a case is not always to be found. Yet, if he will quietly wait till the enraged animal make a run at him, and will then spring suddenly to one side to let it pass, he may gain time enough to reload his gun before the rhinoceros get sight of him again, which fortunately it does slowly and with difficulty. The knowledge of this imperfection of sight, which is occasioned perhaps by the excessive smallness of the aperture of the eye (its greatest length being only one inch) in proportion to the bulk of the animal, encourages the hunter to advance without taking much pains to conceal himself; and by attending to the usual precautions just mentioned, he may safely approach within musket-shot."

The arts of the hunter would not, however, avail him much, were it not for the musket; and we want a good account of the manner in which the aborigines deal with this powerful animal, when they have not the use of fire-arms. The poisoned arrow and the hassagnay bring down the strength of the lion; but the arrow would need to be aimed by no ordinary archer, and discharged from a bow of no ordinary strength, which could penetrate the mail even of the African rhinoceros. It may be, however, that, as the skin, thick as it is, is very sensitive, the poisoning of it by a puncture of no very great depth may be sufficient to overcome even this animal. It is a curious fact that, let the people of a country be as low in the scale of civilisation and as destitute of anything which we call knowledge as they possibly can, they are never without the means of conquering the most powerful animal that is to be found in their country. Thus man, taken merely as man, and without any reference to the degree of his knowledge and civilisation, always establishes his title to that dominion over the other creatures which was at first given to him by his Creator. Not only this; but it very often happens that those rude men, with their apparently simple weapons, are much more efficient against the powerful animals, than civilised men are with those of a superior construction. In India, as in southern Africa, the hunt of the tiger or the lion is seldom undertaken without the natives being of the party; and in all parts of America, when the hunt is attended with great difficulty and danger, the Indian is always, by way of eminence, the hunter. This seems at first sight a curious fact, but it is a fact; and the reason of it is not of very difficult explanation. The mind of the savage is concentrated upon a few operations; and for this reason he does them better than they can be done by a civilised man, whose attention is divided among a great multiplicity of subjects. Besides this, the civilised man goes to the hunting of those animals with very little knowledge of them compared with that of the savage, who has been trained from his infancy in the manner in which he is to deal with them; and it would be absurd to suppose that civilisation should enable a man to do that which he does not know; and especially to do it better than one who knows it well.

Sumatran Rhinoceros (*R. Sumatrensis*). This is a smaller species than the two-horned rhinoceros of Africa, even if we admit that there is in that quarter of the world a larger and a smaller species. It appears, like the African one, to be more an animal of the interior of the country than the Indian species, or that of Java; for, although the accounts mention

that the natives of the coast and those of the interior call it by different names, yet the animal seems to be the same. The coast name is the general one for the rhinoceros in the language of several Eastern nations, especially the Malays; and the name in the interior is probably that used by the African negroes, of whom there are still remnants in most of the larger islands to the south-east of Asia, even where the Malays are in possession of all the coasts. If a traveller were to come from a far country where no such animal as a cow were known, and see a cow, and hear its name in England, in the Lowlands of Scotland, and the Scotch Highlands, he would be very apt to conclude that there were three species of the animal, as well as three names; and we may expect to find much the same mistake made by travellers who visit such countries as Sumatra.

The Sumatran rhinoceros, in the specimens that have been seen by Europeans, is only between five and six feet in length, and between three and four in its greatest height. It is of course a much less formidable animal than most of the other species. Its skin is without the decided folds which mark the single-horned ones, and also the wrinkles which more or less pucker the skin of the African species. The skin altogether is softer and thinner than that of the others, and it is much more abundantly supplied with hair. We might suppose this from the thinness of the skin; and the two circumstances taken in conjunction would lead us to conclude that this species should be obedient to climate; yet it does not appear to occur except in Sumatra, which is one of the most tropical islands on the surface of our globe, being intersected by the equator in very nearly the middle of its latitudes.

The colour of this animal is dark brown, by which it can be at once distinguished from the other rhinoceri of the East, although it had not two nasal horns, the one of which is sometimes not very conspicuous, especially in the young and the females. Although there are some hairs on the body, there are none on the flat sides of the tail; but the upper and under edges have them tolerably thick. In the young state there are four incisors in each jaw, but two of them are lost as the animal approaches the maturity of its growth. In this part of the mouth, therefore, it resembles the other eastern species, and differs from the African, though in the smoothness of the skin and the two horns it more resembles the African. The first horn is moderately large, although by no means so formidable an instrument as that of the African; but the second one is always very small, and often little more than rudimental. In the females the first horn is also only a small one. Of the manners of this species little or nothing is known; but as the cheek teeth are the same in structure as in all the others, it is natural to conclude that the mode of feeding and the food are exactly the same.

Fossil Rhinoceri. The preceding notices contain all the existing species of those curious animals that have hitherto been made out, at least with so much certainty as to entitle them to notice in a short popular list; so that it remains only to take a very slight glance at those which have once inhabited the earth, but the whole of which are now entombed under its surface. As we have already alluded in a general way to these, and to the probable state of the temperate and cold latitudes, when these were inhabited by them, our present observations will be very few.

Rhinoceros with partitioned nostrils (*R. tichorhinus*). This is the largest of all the fossil species, and appears to have been the most plentiful, and the one which inhabited farthest to the north. Its remains have been found in many parts of Europe, and particularly in France, though perhaps that is owing to the greater attention which has been paid to the fossil remains of animals in that country. They have also been met with in Siberia; and this is a species of which a preserved specimen, nearly entire, was found in the ice, in the extreme north of that country, in the year 1771. The flesh, the skin, and the hair, were all in such preservation as to afford a perfect knowledge of what the animal had been when in the living state, and the hair was in such abundance and of such a nature as to show that the animal was able to bear the cold of the severest winter.

This extinct species has a considerable resemblance to the living one now found in Africa; but still, independently of its adaptation to a different climate, which of itself would perhaps not be distinction enough, there are other and more essential characters which show it to have been a distinct species. The bones of the head are much more elongated than in the African one; and, from the size of the discs on the bones which supported their bases, the horns, especially the second one, appear to have been larger. They appear also to have been more actively or powerfully employed, for the nasal bone is supported by a vertical septum or partition, which is not found in any of the living species. Like the African species, this is without intermaxillary bones, and of course could have had no incisive teeth in the upper jaw when of mature age. From the character of its bones, this must have been a large and powerful animal, equally capable of performing severe labour and defending itself against enemies, as for enduring the rigours of the northern winter.

Rhinoceros with simple nostrils (*R. leptorhinus*). This has been altogether a more slender and less powerful animal, and it has not inhabited so far to the north. The south of Europe appears to have been its principal habitat, as the bones have been chiefly found in Italy. From the discs on the bones of the head, it must have had two horns; but there is no partition to strengthen the nasal bone, and the bones altogether are much more slender in proportion to their length than those of the preceding species. From its southern habitat there is not the slightest chance that any more perfect remains of it will be found than simply the bones. As is the case with the former species, this one is without intermaxillary bones, and consequently must have had no incisor teeth

Fragments of another species have been found in some of the collections of fossil bones in Germany, which appears to have been of considerable size, and to have been possessed of intermaxillary bones. Having them, it has certainly been different from any of the two preceding ones; but very few particulars are known respecting it.

Small Rhinoceros (*R. minutus*). The remains of this species have been found in France, and from them it does not appear to have been larger than a common hog. It appears to have been a very ancient species, for the bones have been found at the depth of eighty feet below the present surface of the ground, mingled with those of crocodiles and tortoises. Its incisor teeth appear to have very much resembled those of the rhinoceros of Java.

RHIPICERA (Latreille). An interesting genus of coleopterous insects from Brazil and New Holland, belonging to the family *Cebrionidæ*, distinguished by the beautiful antennæ of the males, which are composed of from twenty to forty joints, each being furnished with a long and pilose branch, together forming an elegant flabellated appearance. The antennæ of the females are only slightly serrated, and are composed of fewer joints than in the other sex. The body is of an elongate-ovate form, the thorax short and convex, and the legs of moderate size. There are six or eight species.

RHIPIDURA—Fan-tail. A genus of birds, belonging to Cuvier's dentirostral family of *Passeres*, and nearly allied to the fly-catchers in their general habits. They are natives of Australia, a country which is as peculiar in many of its birds, as in its other productions. Their general characters are as follows: the bill short, depressed, wide at the base, and compressed toward the tip; the upper mandible keeled and crooked in the culmen, and notched toward the tip. The nostrils basal, oval, and nearly covered with hairs and feathers. The gape provided with numerous bristles, which are rather longer than the mandibles. The wings are of mean length, something resembling those of the fly-catchers, but more rounded, and therefore it is concluded that the birds are not capable of the same rate and extent of forward flight. The tail is long, rounded at its termination, capable of being spread out like a fan, and therefore well adapted for assisting the birds in rapid ascent and descent. The feet are of mean length, slender, and with the tarsi smooth. There are several species, but very little is known of their habits.

R. flabelliforme. This is the fan-tailed fly-catcher of Latham, and a bird which is by no means rare in the country inland from Sydney, between that place and the ascent of the Blue Mountains. It frequents the woods and bushes, in which it hunts for insects, darting upwards and downwards, rather than performing long flights. Its general colour is blackish fawn; with a spot behind the eye, the throat, the tips of the coverts, and the ends of the shafts of the tail-feathers, white; and the belly rust-coloured.

R. malacilloides is black, with the quills yellowish brown, and a spot behind the eye; the middle of the breast and abdomen white.

R. rubrifrons is blackish fawn, with the back, the forehead, a streak over the eye, the base of the tail, and the lower part of the belly, red; the neck black; the throat and breast white, spotted with black; and the quills fawn, with white tips.

RHIPIPTERA (Latreille; Rhipidoptera, Lamarck). Names proposed by these authors for the order of insects previously described by Mr. Kirby under the name of Strepsiptera, which see.

RHIPIPHORUS (Bosc). A curious genus of coleopterous insects, belonging to the family Mordellidæ, which see for its characters, and an account of its parasitical habits.

RHIPODENDRON (Willdenow). A genus of African succulent plants, nearly related to the genus *Aloe*, and from which it has been separated. It belongs to *Hemerocallideæ*. They are managed in every respect like other succulents, that is, planted in light lime-rubbish soil, and allowed but little water.

RHIPSALIS (Gærtner). A genus of succulent undershrubs, natives of South America and India. The flowers are icosandrous, and belong to *Cactæ* or *Opuntiaceæ*. The species are all cultivated like other succulents.

RHIZOBOLEÆ. A natural order containing only one genus, namely, *Caryocar*, of which there are three species. The genus is remarkable for bearing the butter or suwarrow nuts. These have a rich oily flavour, and are used as a desert. The fruit of *C. glabrum* is eatable, and the nuts of *C. amygdaliferum* taste like almonds. *C. butyrosum* is the butter nut, and which are sometimes met with in our fruiterers' shops. The species are large trees, natives of Guiana, and cultivated in our stoves.

RHIZOPHOREÆ. A natural order containing only two genera, and of each a single species as yet discovered. The genera are *Rhizophora* and *Carallia*. The *R. mangle* is the mangrove of Madagascar. They are arborescent, and are remarkable for growing upon the shores of the sea and rivers. The seeds have the singular property of germinating while enclosed within the capsule and adhering to the parent, and pushing forth a long fusiform radicle, which lengthens till it reaches the soil, where it takes root, and forms a new individual.

RHODIOLA (Linnæus). A genus of two species of alpine plants, natives of Britain and Siberia. The flowers are dicœcious, and the genus belongs to *Crassulaceæ*. In gardens the species are planted in light soil, and usually placed on lapidiums or rock-work.

RHODODENDRON (Linnæus). A genus of shrubs and trees which, from the beauty of their evergreen foliage, and highly splendid character of their flowers, attract the admiration of every beholder. The magnificence of the European and American species is only exceeded by the grandeur of the arborescent species from Nepal. Of these last we have now two or three species, and several splendid varieties procured by intermixture of the pollen of the trees of Nepal and shrubs of America and Europe.

The *Rhododendrons* are placed by Linnæus in his tenth class *Decandria*, and they belong to the proteus-like natural order *Ericeæ*. They are all propagated by seeds or layers, and all thrive in leaf mould, moor-earth, and sand.

RHODORA (Linnæus). A genus containing only as yet one species, viz., *R. Canadensis*. It is a pretty early flowering shrub, and mostly before the leaves appear. It belongs to the *Ericeæ*, and is treated like what are called American plants, namely, in heath-mould borders, though they are often potted for decorating the greenhouse in early spring.

RHOPALA (Dr. Brown). A genus of South American trees, bearing tetrandrous flowers, and belonging to the natural order *Proteaceæ*.

RHUBARB. See Rheum.

RHUS (Tournefort). An extensive genus of deciduous trees and evergreen shrubs, found in every quarter of the globe. The flowers are pentandrous, and the genus belongs to *Terebinthaceæ*. They are chiefly hardy plants, and the greenhouse species are easy of management.

RHYNCHÆA. A genus of *Echassiers* or stilt-birds, belonging to the longirostral or long-billed family, and nearly allied to the snipes. They have indeed been classed with these and also with the rails by some authors, though they appear to have characters of their own sufficient for entitling them to be regarded as a distinct genus.

They are all natives of warm climates—of China,

of India, of Southern Africa, and the isles to the east of that continent, and there is one at least a native of South America. They have the general air and gait of the snipes; but they differ much from them in their plumage, the colours of which are much more brilliant. In this respect, one remarkable character of them is the occillated spots which mark the quills and the tail-feathers; the bill is also different in its structure. The generic characters may be stated as follow: the bill longer than the head, enlarged at the tip, much compressed, hooked at the tip; the mandibles of equal length and very slightly covered; the upper mandible furrowed for the whole of its length, and the lower only toward its extremity; the nasal grooves continued for half the length of the bill, and the nostrils linear and open; the feet of mean length, the tarsus longer than the middle front toe; the toes four in number; three to the front, totally divided from each other for the whole of their length, and one to the rear articulated higher upon the tarsus than the front ones; the wings of ample dimensions; the first, second, and third quills nearly of the same length with each other, and larger than any of the rest.

R. Capensis, the Cape snipe of some authors, is a bird about ten inches in length. The upper parts are of a bluish-grey colour waved with black; there are five bands on the head, one reddish, two grey, and two white; there is a broad band of black on the upper part of the breast; the belly is white; the coverts of the wings are ash, the lateral ones marked with four eye-spots of yellow, and the bill and feet brown. This species is subject to considerable differences of colour at different ages; and it has accordingly been figured and described as two if not as three species; the mature bird being *Capensis* of authors, the young *Variegata*, and the intermediate stage being recognised as another variety if not species.

R. Sinensis. This, as the name imports, is a native of China. It is a smaller bird than the African one, being only nine inches in length; and it is also richer in the colouring; the upper parts are brown, spotted and streaked with red, bluish, and black; the head is streaked with black and white; the neck is mottled with grey, and whitish; the under parts are white, with a large gorget of black upon the breast; the bill and feet are black. The present species is a very pretty bird.

R. Indica is of the same dimensions as the Cape one, namely, ten inches in length. The upper parts are greyish-brown, without any wavings, lines, or spots of another colour; the head is white, slightly clouded with greyish-ash on the crown, and having two streaks of grey on the sides; the neck and breast are white, spotted with grey; the greater coverts of the wings are crossed by bands of black; the throat and belly are white, and the bill and feet black.

R. Madagascarensis is nine inches in length, and although some have considered it the same as the first-mentioned species, or, at all events, called it by the same specific name *Capensis*, it appears to be distinct. The upper parts are varied with black and grey, with some red on the coverts of the wings; there is a double streak, one part black and the other white, over the eye, and another of the same colours on the neck; the coverts and quills are brown rayed with black, and having upon them four eye-spots of red, with black margins; the under parts are white, and the bill and feet black; various writers upon birds, and Temminck among the rest, who is usually correct to the very minutiæ of species, are of opinion that all of those which we have noticed are one and the same bird in different states of its plumage; and certainly the differences which we observe among them are not greater than those which occur in the same species among birds with which we are better acquainted. Altogether, indeed, they are birds of whose nature and habits we know very little. From the countries which they inhabit, we might be led to conclude that, at some seasons at least, they can feed upon pastures much more dry than those that are usually resorted to by the snipes; but information is wanted before any certain conclusion can be arrived at respecting them.

RHYNCHÆNUS (Fabricius). An extensive genus of coleopterous insects, belonging to the section *Tetramera* and family *Curculionidæ*, having the antennæ strongly elbowed, and ten, eleven, or twelve-jointed, the three last forming a club; the rostrum long and deflexed, with the antennæ inserted near the middle; the body of an oval or rounded form, and the legs long, the tibiæ generally having a curved terminal hook. The genus has been greatly subdivided by Schonherr and other recent authors.

RHYNCHITES (Herbst). A beautiful genus of coleopterous insects, belonging to the section *Tetramera*, family *Curculionidæ*, and sub-family *Attelabides*, in the article upon which we have given the characters and figured the genus; and in the article CURCULIONIDÆ, we have given an account of the destructive habits of the *Rhynchites Bacchus*.

RHYNCOPHORA (Latreille). A sub-section of coleopterous insects, distinguished by having the head anteriorly produced into a snout or muzzle, with the mouth placed at its extremity. This sub-section corresponds with the Linnæan genus *Bruchus*, *Attelabus*, and *Curculiæ*; of the arrangement of which we have already given a sketch in the article CURCULIONIDÆ.

RHYNSCHOSIA (Loureira). A genus of North American and tropical plants, mostly climbers, and belonging to *Leguminosæ*. This genus was called *Glycine* by De Candolle and other botanists; but Loureira's name has been generally adopted. The greenhouse species thrive in sand and moor-earth, and are propagated by cuttings.

RHYPHUS (Latreille). A genus of dipterous insects belonging to the family *Tipulidæ*, having the antennæ short, sixteen-jointed; the proboscis advanced, cylindric, and rather shorter than the head; the ocelli three in number, and of equal size; the legs of unequal size, the posterior being the largest. There are two or three species which frequent the windows of our apartments, distinguished by their spotted wings. The larvæ, according to Reaumer, frequent cow-dung.

RIBES (Linnæus). A genus of shrubs found in many places of the northern hemisphere, of which the various species of the currant and gooseberry are familiarly known. The flowers are pentandrous, and the genus gives a title to a natural order, viz. *Grossularieæ*. There are several varieties of the common useful currant, and those of the gooseberry are innumerable. Both the currant and gooseberry are wholesome and useful fruits, and are applied to many economical purposes. The old varieties are perpetuated by cuttings, and new varieties are obtained from seed. The best currants are the Dutch white

and red. The black is highly esteemed by the confectioner; and one of the best gooseberries is the Warrington red.

RICE is the *Oryza sativa* of Linnæus, a tropical aquatic cereal, extensively cultivated, and of the greatest importance to the inhabitants of those warm countries where it succeeds.

RICHARDIA (Kunth). A genus of plants nearly related to *Dracontium*, and formerly called *Calla æthiopica*. It belongs to the natural order *Aroideæ*, and is a common plant in every greenhouse.

RICINUS (Linnæus). A genus of shrubs and annual herbs, natives of the tropics. The flowers are monœcious, and the genus belongs to *Euphorbiaceæ*. The *R. communis* is commonly called palmo-christi, from the hand-like form of the leaves. It is from the seeds of this plant the castor oil is expressed, and for which the plant is cultivated in the West Indies. In this country, the palmo-christi is treated as a tender annual, and planted as an ornament in the flower-border.

RICINUS (De Geer; Nirmus, Hermann). A genus of bird-lice. See the article Nirmidæ.

RIEDLEIA (Ventenat). A genus of tropical undershrubs, formerly called *Melochia*. The species have monadelphous flowers, and belong to *Byttneriaceæ*. They grow freely in our stoves, and are easily propagated by cuttings.

RIPOGONUM (Forster). A genus of Australian climbers, bearing white flowers, and belonging to the natural order *Smilaceæ*. They are greenhouse plants, and are propagated by division or or by cuttings.

ROBINIA (Linnæus). A fine genus of trees and shrubs, almost all natives of America. The flowers are papilionaceous, and the genus is associated with the *Leguminosæ*. The *R. pseudacacia* is an elegant ornamental tree, producing very durable timber, and is the celebrated locust-tree of the United States, of which so much was written by the late Mr. Cobbett. The *R. hispida*, *R. rosea*, and *R. viscosa*, are all fine flowering plants. Most of the species ripen seeds from which they are raised, or the more choice sorts may be grafted on the common *R. pseudacacia*.

ROCAMBOLE is the *Allium ophioscorodon* of G. Don, a culinary species of onion, now but rarely cultivated. A peculiarity of its manner of growth is that of its seeds vegetating before they drop from the capsule. *Rocambole* is in no respect superior to the common onion.

ROCKET. This is the vulgar name of a genus belonging to *Cruciferæ*, called, by Tournefort, *Eruca sativa*. A majority of the species are cultivated in various parts of the continent as greens, and the double varieties are admitted into flower-gardens. The *Hesperis matronalis* of Linnæus, a favourite border flower, is also called Dame's Rocket.

ROCK ROSE is the *Cistus purpureus* of Tournefort. The genus *Cistus* contains many species, all natives of Europe, and favourite plants in our shrubberies.

ROELLA (Linnæus). A genus of under-shrubs and annuals, natives of the Cape of Good Hope. The flowers are pentandrous and are arranged among the *Campanulaceæ*. The species are pretty, and easily managed in the greenhouse.

ROLLER (*Coracius—Galgulus*). A genus of conirostral birds, in Cuvier's great order *Passeres*, omnivorous in their feeding, as most of the conirostral family are, and arranged by Cuvier as intermediate between the more coloured and woodland members of the ocean tribe, and the birds of paradise. They are generally speaking handsome in their forms, and gay in their plumage, generally with more or less of metallic lustre. But they have a suspicious and magpye-like look, which almost convinces us that they cannot be altogether honest. Yet, notwithstanding this, the purity and the brightness of their colours entitle them to rank among the most beautiful of birds. They have, however, little to recommend them but the beauty of their colours; for their voices are harsh and disagreeable, and their manners are gloomy rather than lively.

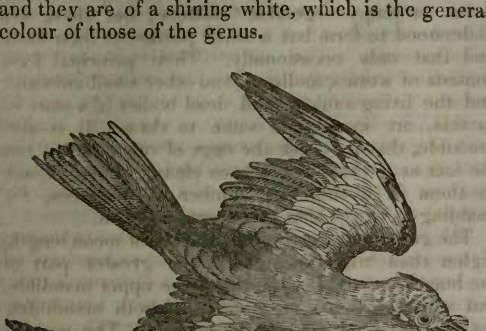
They are all natives of the eastern continent, where they inhabit the depths of the forests, so that little opportunity of studying their manners can be obtained. They probably can subsist upon farinaceous or pulpy vegetable matters; but these are understood to form but a small portion of their food, and that only occasionally. Their principal food consists of worms, mollusca, and other small animals; and the living subject, and dead bodies in a state of carrion, are nearly the same to them. It is also probable, that they eat the eggs of other birds; but the fact as to this has not been clearly brought home to them in a sufficient number of instances, for enabling us to say that it is a general habit.

The generic characters are: the bill of mean length, higher than broad, straight in the greater part of the length, covered at the tip of the upper mandible, and with the tomia, or margins of both mandibles, sharp, hard, and adapted for cutting. The nostrils are basal and lateral, half covered by a membrane furnished with stiff bristles, like feathers. The tarsus shorter than the middle front toe; the toes four, three to the front and one to the rear, all completely free to their articulations,—so that the foot is either a walking foot, or a hopping one, aided by the wings, as the particular action which the bird has to perform may require. The wings are rather pointed, the first quill is shorter than the second, which is the largest in the wing. The tail is generally speaking long, capable of spreading, and composed of firm feathers. The whole plumage indeed is firm and compact, and not liable to be injured by the motions of the bird among the thick branches in the woods. There are a good many species in the genus; but they have been increased much beyond the proper number, by including tarragons, pyes, and other birds, some of which do not belong to the same family, in the natural arrangement.

European Roller (*C. garrula*). Though this bird is called European, and appears in the south and east parts in considerable numbers, it is doubtful whether it is permanent for the year in any part of Europe. They appear to be summer migrants from Africa; for they appear in considerable numbers in Malta in the spring on their passage northward, and again in autumn on their way southward. They of course breed in those parts of Europe which they frequent; and thus they are natives, although they do not continue all the year round. They occasionally, but very rarely, make their appearance in Britain, though only as single individuals, which appear to have strayed out of the line of their ordinary migration. But still they keep so much in the cover of the thick woods, that a stray bird may occasionally breed in Britain without being observed. On the continent

they range farther to the north, for numbers of them cross the Baltic. They are, however, much more rare in the west of the continent, being rarely found in France farther north than Strasburg, and rarely, if ever in Holland, even as stragglers.

The length of the common roller is about thirteen inches, and it is a firm and compact bird in proportion to its length. The upper parts are of a brownish-fawn colour; the top of the head and upper part of the neck blue with green reflections; the lesser coverts of the wings bright violet-blue; the quills waved with blue, dull green, and fawn colour; the middle tail-feathers greenish-grey, and aquamarine green on the under sides; those next them dull green, and the external ones, which are a little longer than the rest, are of this same colour; the under parts of the body are aquamarine blue; and the bill and feet are reddish-yellow. The eggs vary from four to seven, and they are of a shining white, which is the general colour of those of the genus.



Abyssinian Roller (*C. Abyssinica*) is a larger species than the one which visits Europe, measuring sixteen or seventeen inches in length. The back is orange-brown; the forehead, a streak over the eyes, and the chin, are white; the top of the head, the neck, the middle and greater coverts of the wings, and all the under parts of the body, are sea-green; the lesser wing-coverts and the scapulars are bright azure; the quills are rich blue, with the lips and margins of the inner webs black; the middle tail-feathers are greenish-black, the next ones blue at the basal part, and sea-green at the terminal, and the external ones, which are considerably longer than the rest, are sea-green at their bases, then crossed by a band of blue and black in the remaining portion towards the tips; the bill is black with the exception of the base of the lower mandible, which is white; and the feet are reddish. The female is smaller, has the lateral feathers of the tail less produced, and all the colours duller. The young have the upper part mottled with green and reddish, and the front, throat, breast, and flanks reddish. This is a very handsome bird; but it is subject to some variations of colour, and very little is known of its habits.

Bengal Roller (*C. Bengalensis*), is perhaps not very accurately named after Bengal, as some of the authorities state that it is also found in Southern Africa. The upper parts are violet-green, with the lower part of the back and the rump clouded with green and blue. The larger coverts of the wings are sea-green, the middle ones are clouded with green and blue, and the lesser and also the upper tail-coverts, are light blue; the quills are variegated with deep blue, sea-green, and black; the middle tail-feathers are blackish-green; and the others are deep blue at their bases, and black toward the tips and in the outer margins; the cheeks and lower neck are violet streaked with white; the throat is reddish, the breast russet, and the under parts sea-green; the bill is black and the feet grey; the length about thirteen inches. The female is rather smaller than the male, and has the front and the under part of the body reddish-white. The young have the anterior part of the head and the ear-coverts white; and the top of the head and upper part of the neck reddish-violet; the breast and belly are of the same ground colour, but they are streaked longitudinally with white; the upper parts are olive-green clouded with red; the coverts of the wings violet-red; the bill brown; and the feet red. There are some doubts about the bird being a native of Southern Africa, though it is thus stated by some authorities. It is rare indeed that the same species of animal, be it what it may, occurs in both these countries; and there have been so many instances of productions of India and the oriental isles being purchased at the Cape as African, that we require very strong evidence, in fact that of the very party who met with them alive in the wild state, before we can be secure against this kind of imposition. It is true that India and Africa are more abundant in birds of the genus than any other parts of the world; but, except in this instance, if it really be an exception, all the species of the one locality are different from those of the other.

Blue-billed Roller (*C. cyanogaster*). This is an African species measuring about fourteen inches in length. The upper parts are olive-brown; the head, neck, and breast reddish, clouded with green; the rump and wing-coverts are blue; the quills green at the base, then blue and afterwards black at the tips; the tail-feathers are green; the neck and breast greenish-red; the under parts blue; and the bill black, and feet grey.

Green Roller (*C. viridis*). This is an Indian species about a foot in length. It is sea-green in the general plumage; but has the forehead and throat reddish-white, and the rump and tail-coverts bluish-green; the bill is black and the feet reddish.

Temminck's Roller (*C. Temminckii*) is an Indian species, about the same dimensions as the last-mentioned, but different in the colours. The upper parts are green; the top of the head, the nape, and the crest, are aquamarine blue; the neck, rump, coverts, throat, and all the under parts are bright shining blue; the bill is black, and the feet are reddish-brown.

There are several other species of roller, some natives of India, some of Africa, and some of Australia; but, excepting in size and colour, they do not differ from those which have been already noticed. Indeed, though the rollers are unquestionably very beautiful birds, there are very few genera which have got a shorter, or even so short, a story to tell. Excepting in their mere external appearance, and the countries which they inhabit, any one of them may be an index to the whole race.

ROSACEÆ. A natural order, embracing the greater part of the Linnæan class *Icosandria*, and a very conspicuous order of Jussieu's sub-class *Caly-*

ciflorœ. This order contains forty-six genera, and not less than seven hundred and eighty-three species. Whether the genera be trees, shrubs, or herbs, there is a similitude in the character of their flowers which is obviously striking; and the single rose being a type so well known, facilitates the identification of the various genera. Among the trees there are the *Amygdalus*, *Prunus*, *Persica*, *Cerasus*, and *Eriobotrya*, which are also fruit bearers; among the shrubs, besides the type, there are the *Cratægus*, *Photinia*, *Cotoneaster*, and *Cydonia*; and among herbs we have the useful strawberry, the *Potentilla*, *Geum*, and *Tormentilla*.

Rosaceæ is divided into eight tribes, viz., *Chrysobalaneæ*, *Amygdaleæ*, *Spiraceæ*, *Neuradeæ*, *Dryadeæ*, *Sanguisorbeæ*, *Roseæ*, and *Pomaceæ*. The *Amygdaleæ* is distinguished from the other *Rosaceæ*, because it is remarkable for containing plants which, notwithstanding they all bear eatable fruits, furnish from their leaves, their blossoms, and even from their seeds, one of the most subtile and powerful vegetable poisons known. The deleterious principle, separated by modern chemistry and named prussic acid, although so poisonous in a concentrated form, rarely exists in such proportion to the sugar, mucilage, and other innocuous substances, with which it is naturally combined, as to be in any degree injurious. Hence, bitter almonds, peach and plum stones, and cherry-laurel leaves, have been favourite ingredients with cooks and confectioners to give a pleasant flavour to custards, puddings, and jellies; and several of our most excellent liqueurs, such as noyau, ratafia, and maraschino, owe their flavour to this subtile poison.

The rose, the strawberry, and their associates are herbaceous or shrubby, but never arborescent plants, with alternate leaves, either simple or compound, and almost universally furnished with stipules. The inflorescence is variable, the flowers monoclinous, rarely by abortion separated; very prone to become double, and in colour red, white, or yellow, but never blue; the calyx of four or five sepals, and more or less connected; the fifth or odd lobe being axial or posterior; the torus is variable, sometimes forming an annular disk, at others becoming large and hemispherical, or lining the urceolate tube of the calyx; the petals are equal, with short claws, perigenous, five in number, and rarely absent; the stamens are indefinite; the filaments free; anthers innate, two-celled, and opening lengthwise; the ovaries are several, superior, and mostly free, one-celled and one-seeded; the styles are lateral, exserted just below the apex of the carpel, and the stigma simple; the fruit either one-seeded nuts or akenia, occasionally becoming drupeolæ. This description is applicable to the strawberry, bramble, raspberry, dewberry, cloudberry, &c.

ROSCOEA (Smith). A genus of Nepalese herbaceous plants, belonging to *Scitamineæ*. The species thrive in loam and peat-earth, flower freely, and are increased by division.

ROSE ACACIA is the *Robinia hispida* of Linnæus, one of our most ornamental shrubbery plants. They are usually propagated by grafting on the common *R. pseudacacia*. By pruning back the shoots which bear the first flowers, they may be made to flower a second time in the autumn.

ROSMARINUS (Linnæus). A genus of two species, bearing diandrous flowers, and belonging to the natural order *Labiatæ*. The *R. officinalis* is a well known aromatic-scented plant, for which it has been long cultivated in gardens. Burnett says it gives its fragrance to Hungary-water; it is likewise one of the ingredients employed in the manufacture of *eau-de-Cologne*, and it enters into the composition of *four thieves' vinegar*, once so famed for its supposed power of preventing the spread of contagious diseases. Rosemary has some reputation as a cephalic medicine, relieving the headach, and exciting the mind to vigorous action. Hence it has been called the herb of memory and repentance. Hence also its use as a symbol of fidelity, and its introduction both into wedding-garlands and funeral-wreaths; and still in many of our distant counties it is customary with the mourners to wear sprigs of the plant, and strew them on the grave.

ROTTLERA (Roxburgh). A genus of evergreen shrubs, natives of the East Indies and Brazil. The flowers are diœcious, and the genus belongs to *Euphorbiaceæ*. The *R. tinctorea* is in our stove collections, and succeeds with the ordinary management.

ROXBURGHIA (Jones). An East Indian climbing plant, bearing some resemblance to the *Gloriosa superba*, hence it is named *R. gloriosoides*. It belongs to the eighth class of Linnæus, and to the natural order *Asphodeleæ*, increased by division.

RUBIACEÆ. A large natural order containing seventy-three genera, and above three hundred and eighty-seven species. The order is divided into nine sections under the following titles, viz., *Guettardeæ*, *Hameliaceæ*, *Cinchoneæ*, *Cephalantheæ*, *Hedyotideæ*, *Coffeaceæ*, *Spermacoceæ*, and *Galeæ*. The *Rubiaceæ*, collectively considered, are herbaceous plants, with square or angled stems, and whorled exstipulate leaves; the verticilli being formed of two opposite gemmiferous leaves, with a variable number of intermediate ones, not varying in appearance from the general foliage, but destitute of buds; hence being stipulaceous, and supplying the place of the interpetiolar stipules of the *Cinchonaceæ*. The inflorescence is paniculate, the flowers small, and in general united. The calyx is superior, the tube joined to the germen, and the limb from four to six-clefted; the corolla is synpetalous, rotate, or funnel-shaped, regular, with its petals equal to the sepals, and exserted from the calyx; the stamens are equal in number to the lobes of the corolla, and exserted alternately with them; the filaments are free, the anthers incumbent two-celled and open longitudinally; the germen consists of two connate carpels, invested by the adherent tube of the calyx; the styles two, and the stigma headed. The roots of the *Rubiaceæ* often contain a large quantity of colouring matter. This is epecially abundant in the madders, and several species of *Galium*. Madder is not much grown in this country, although the climate is suitable, because the imported madder is cheaper. Cattle fed on several of these plants have their secretions tinged with the colouring matter.

There are many beautiful as well as useful plants comprised in this order; of the first we may notice the *Gardenia*, *Ixora*, and *Portlandia*; of the second the *Cinchona*, jesuit's bark, as a medicine, and the coffee as an article of diet, as examples; although these are associated with many unemployed plants.

RUBY. This beautiful mineral is, in fact, but a peculiar modification of *corundum*. Next to the dia-

mond, it is the most valuable of the precious stones. The most highly prized varieties are the crimson and carmine-red. These gems are generally found in alluvial deposits, especially in Ceylon and Pegu; those from the former place being of a pale colour.

RUDBECKIA (Linnæus). A genus of ornamental herbs, chiefly natives of America. It belongs to the *Helianthoeæ* section of the natural order *Compositæ*. The flowers of several of the species are showy, and are fitting to be planted in shrubberies, or among the larger growths of the flower garden.

RUMEX (Linnæus). An extensive genus of herbaceous plants, mostly natives of Europe. It belongs to *Polygonaceæ*. The various kinds of docks and sorrels are well known plants, some few of which are cultivated, either for medical purposes or as pot-herbs.

RUMINANTIA. Those mammalia that chew the cud. See MAMMALIA.

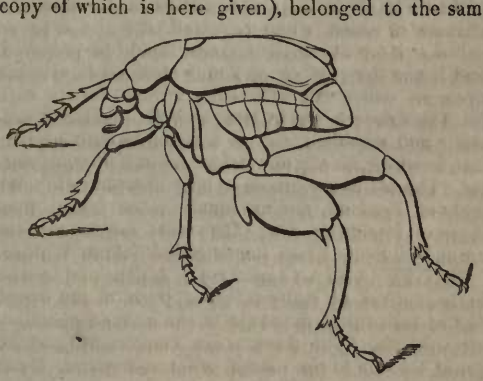
RUSCUS (Linnæus). A genus of low evergreen shrubs, belonging to *Smilaceæ*. The undershrub sorts are hardy and common in our ornamental plantations, and called butcher's-broom. Their foliage is remarkable, inasmuch as leaflets are borne on the disk of the larger leaves. There are three or four species which are climbers from South Africa: they are all propagated from suckers.

RUTACEÆ. A natural order containing thirty-seven genera, and one hundred and sixty-two species already described. They are an interesting, though a heterogeneous group, natives of all countries and all situations. The type of the order is the common garden rue, one of the most disagreeable scented plants; and with it are associated both shrubby and arborescent plants. They have all opposite or alternate leaves, with or without stipules, and for the most part punctate. The inflorescence is variable, either axillary or terminal, and solitary or aggregate; the flowers regular or irregular, and in general united. The calyx is formed of from three to five sepals; the corolla of five petals; the stamens are from five to ten, some of which are occasionally abortive; the disk is sometimes dilated and sometimes absent; the germen is formed of from three to five carpels, discrete or conjoined; the cells usually two-celled; the styles free or connate, and the stigmas simple or dilated. The fruit is most frequently capsular, the seeds are from abortion less in number than the ovules, with usually a crustaceous or membranous testa.

The genera here connected are divided into four tribes, viz., *Ruteæ*, *Diosmeæ*, of which last there are three sections, *Cuspariеæ* and *Xanthoxyleæ*. Most of these are strong-scented plants, and several of them are medicinal, especially the *Guaiacums;* and the wood of *G. officinale* yields the timber called *lignum vitæ*, so useful to turners and cabinet-makers. The common rue, formerly so much extolled for its great and various virtues, is now almost neglected, except by village doctresses.

The *Diosmas* are all favourite greenhouse plants, and easy of cultivation.

RUTELIDÆ (Mac Leay). A family of very splendid coleopterous insects belonging to the section *Pentamera*, and sub-section *Lamellicornes*, having the body short, rounded, and generally highly polished; the head and thorax are not armed with horns indicating the diversity of the sexes, the anterior margin of the labrum is exposed; the maxillæ are scaly, truncated, and toothed at the tips; the mesosternum is often produced in front into a strong spine; the scutellum is generally large, especially in the genus *Macraspis*, the tarsal claws are often of unequal size, and the mandibles are corneous. The species are almost exclusively tropical, and inhabitants of the new world; and from the scaly structure of the maxillæ, and the terminal teeth with which they are provided (and which are similar to those of the *Melolonthidæ*), it is most probable that these insects in the perfect state feed upon leaves, as do the species of the last-mentioned family. The splendid colours also with which they are adorned, indicate them to be species which are abroad by day. The genera are *Hexodon*, *Cyclocephala*, *Chrysophora*, *Chrysina*, *Rutela*, *Pelidnota*, *Oplognathus*, *Macraspis*, *Chasmodia*, and some others recently proposed. Of these genera, the most remarkable are *Chrysophora* and *Chrysina*, in both of which the posterior legs of the males are very large and thickened, with the tibiæ curved and terminated by a strong hook. To the first of these genera belongs the splendid *Melolontha chrysochlora* of Latreille, figured in the Voyage of Messrs. Humboldt and Bonpland, and subsequently in Mr. Griffith's Animal Kingdom, and the Naturalists' Library, Beetles, pl. 14. Like the common cockchaffer, this species lives in society, and was sometimes observed in great numbers by the distinguished voyagers above named. It has been generally supposed, Latr. (Règne Animal, v. p. 552), that the extraordinary insect figured by Shaw under the name of *Scarabæus macropus* (a copy of which is here given), belonged to the same



genus as the former; but the writer hereof having been favoured with a sight of a specimen of this very rare insect recently obtained by J. G. Children, Esq., is enabled to state that it belongs to Mr. Kirby's genus *Chrysina*, which was established upon the inspection of females alone.

The genus *Rutela*, Latreille, is rather numerous, and is distinguished by having the legs of equal size in both sexes; the scutellum small, the mesosternum not reaching the base of the fore legs, and the body oval.

RYE is the *Secale cereale* of Linnæus, one of our cultivated cereals, belonging to the *Gramineæ*, and extensively cultivated both in the north and south of Europe as bread corn. In Britain it is but partially cultivated, and then only for gingerbread bakers and as early spring food for cattle, or for the straw of which mattresses and straw-hats and bonnets are made.

SABAL (Adanson). A genus of palms, natives of the tropics. Some of them are lofty trees, and one of them, the *Palmetto*, is perhaps the smallest of all

the tribe. They grow well in our stoves, and sometimes throw up a sucker by which they are increased.

SABBATIA (Adanson). A genus of biennial herbs, natives of North America. The flowers are pentandrous, and the genus belongs to *Gentianeæ*. These are desirable plants, and can only be increased by seeds sown in a damp peat-earth border.

SACCHARUM (Linnæus). An important genus, belonging to the *Gramineæ*. The sugar-cane has been long celebrated for its invaluable juice, and cultivated in every latitude warm enough for the nature of the plant. It is extraordinary, says a late writer, that so fine a grass, possessed of such remarkable properties, should have been unknown to the ancients, or so little sought after by them when they procured so many luxuries from the East. Galen and Pliny both mention a sweet salt which they call *Saccharum*, and which was then only used in medicine. Until a comparatively modern epoch, its chief use was as a febrifuge, a small piece being recommended to be placed on the tongue to relieve the thirst of fever. In the tenth century sugar was first substituted for honey in medicine. Like many other medicines, it has escaped from the apothecary's store, and from being dreaded as a drug, is now esteemed a luxury, or rather a necessary of life. The consumption of sugar by the British population is estimated at about a quarter of a hundred weight per annum for each person.

SAFFRON is the *Crocus sativus* of Linnæus, the stigmas of which, when collected, are the drug so called. No part but the stigmas should be prepared, and hence the number of plants required to produce even an ounce will sufficiently account for the high price this drug bears in the market. Saffron is aromatic and stimulant, and is a favourite carminative; it is, however, chiefly now valued for its colouring matter. The plants are grown in large quantities in some parts of England, and are much higher priced than those of foreign growth. The chief saffron gardens are at Walden in Essex, hence called Saffron Walden.

SAGITTARIA (Linnæus). A genus of aquatic herbs, natives of many different parts of the world, and so called from the shape of the leaves resembling arrow-heads. The flowers are monœcious, and the genus belongs to the natural order *Alismaceæ*. None of the species are cultivated.

SAGUS (Gærtner). An East Indian tree, belonging to *Palmæ*, commonly called the sago-palm, from which the medical or dietetic substance called sago is extracted. This substance is the granulated pith of the tree.

SAINFOIN is the *Onobrychis sativa* of Tournefort, an agricultural plant, cultivated in chalky districts as a forage and pasture plant. The *Astralagus onobrychis* of Linnæus is also called sainfoin.

ST. JOHN'S WORT is the *Hypericum quadrangularum* of Linnæus, a British plant found in most meadows.

SALAMANDER (*Salamandra*). A genus of batrachian reptiles, having some slight resemblance to the lizards in its external shape, and accordingly classed with them by some of the earlier naturalists, but very properly separated since the structure came to be better understood. The general characters may be described as follows: the body lengthened, with four feet of equal dimensions, and a long tail; the head is flat, and the ear entirely embedded in the flesh, and without any distinct tympanum, and only a small cartilaginous plate on the opening; both jaws are furnished with numerous small teeth, and there are two parallel rows of such teeth along the bones in the upper part of the mouth, which represent the vomer; the ribs are merely rudimental, though they are not wholly wanting as in the frogs, but there is no sternum of bone; the pelvis is very imperfectly developed, and suspended to the spine by ligaments; the legs are of nearly equal length, and without any webs to the toes or claws on them, and there are always four toes on the fore feet, and, generally speaking, five on the hind ones. In the adult state they breathe in the same manner as tortoises and frogs; but in their early state they breathe in the water by means of gills. These gills are formed into tufts upon arches of cartilage attached to the bone of the tongue, and some of them retain these arches, in part at least, after they have ceased to breathe with the gills. There is a sort of membranous lid to the opening; but the tufts of the gills hang free, instead of being enclosed by any membrane. In their transformation the fore legs are earlier formed than the hind ones, and the toes are successively developed as if the one pushed out the other.

Salamanders are usually divided into land species and water species, but the division is not very precise, for the land ones inhabit humid places, and the aquatic ones breathe air, and are not wholly confined to the water. There are, however, distinctions between them, which are of importance, but which we can notice with more advantage afterwards.

Though among the humblest, least developed, and apparently least sentient of all the vertebrated animals, whether inhabiting the land or the water, the salamanders have been much famed in story for their powers of mischief and their tenacity of life under circumstances the most remarkable. There is scarcely a cottage in the country which has been visited by knowledge in any shape, where the salamander is not believed to be a creature which not only can live, but actually does habitually live, in the fire. Not only this, but where a little speculation is added to the mere report, it is said that the salamander is bred only in the fire, and especially in the long continued heat of powerful furnaces. We have heard it stated again and again, as matter of terror to a whole district, that the fires of glass-houses and other works requiring great and continued heat, had been kept so long burning, and burning with so much intensity, that salamanders had actually bred in them, and that the terrified owners had built up all the openings, so that the terrific reptiles might perish in the smouldering extinguishment of their burning cradles, instead of issuing forth to spread pestilence and death over the whole country. We need hardly say that this is not true, but still it is believed by many; and the fable has been so much interwoven with story and with song, and so much emblazoned among the nonsensical representations of the heralds, that the getting rid of it from the public mind will be no such easy matter, as those who are convinced of its absurdity may be apt to suppose. Pliny, to whom we are indebted for more of the nonsense of natural history, than we are perhaps to any other man, has tended much to perpetuate this ridiculous fable. We do not say that he invented the story of the salamander, or any other of the ridiculous stories of which his works are so full. Pliny was a mere compiler, and as such he was a pipe for transfusing the nonsense of others, just as is the case with

many of our modern compilers, and not a spring pouring forth its own waters of folly. But, as is the case to this day with compilers of facts and statements in natural history, who do not understand, and, therefore cannot appreciate the science of the subject, he appears to have had the stronger desire that a statement should be true, the more widely that it differed from common observation and experience. He gravely says, that by passing over and possessing the whole vegetation, a single salamander could speedily exterminate nations: now as we shall see afterwards, the salamander spends the greater part of its time in a state of perfect repose; that when it does move, its motions are very slow, and the space to which they are confined is exceedingly limited, and that, in short, the supposed poisonous exudation of its skin, by means of which it is said to have triumphed over the utmost intensity of fires, and extinguished all other kinds of life over extensive districts, is really nothing more than a very simple means of defence given to it against such enemies as attack so helpless a creature in its humble abodes.

It is generally understood, that the principal fables related of the salamander had their origin in the fertile imaginations of the ancient Greeks—imaginations which produced flowers in great abundance, and often of exquisite beauty, but of which the fruit was scanty and of most inferior quality. It was a habit with them to erect every thing of which they understood but little, either into a god or a devil, according as the multiplication of the one or the other happened to be more fashionable; and of course the salamander, all fire-proof as it was, was the very best subject that could be imagined for making a devil of; we may add, that it would have answered just as well with those modern *Hadestical* theorists, who will be satisfied with nothing short of material fire and substantial brimstone, as fitting instruments of torture for immaterial and immortal spirits. This fable is a more gross as well as a more mischievous absurdity than that of the salamander, though perhaps it has the same origin. It may not be amiss to remark in passing, that the allusions to the burnings of Tophet and Gehenna, which are drawn from the Old Testament, are all made to the burning of dead bodies, or of children or other victims who were burned alive in the horrid sacrifices to the Syrian idols. There is little doubt that these were subsequently mixed up with much of Grecian fable; and that the salamander has its share in those ridiculous and most unholy doctrines which still continue to be preached up for the purpose of terrifying the ignorant.

The belief in the marvellous accounts of the salamander is now, however, in a great measure confined to those visionaries; because the dissections of the anatomists and the reasonings of the physiologists have established the proper place of the animal in nature, and proved how helpless and how perfectly harmless a thing it is, notwithstanding all that has been said concerning it. They have thus spoiled quackery, both physical and metaphysical, of what was once one of its most powerful engines. Quackery invariably laid hold of every thing that really was, or could by artifice be, made an object of terror or any other strong emotion to the multitude. If it had deadly power to any extent, it was sure to have healing power to the same extent imputed to it. Accordingly the salamander was described as being capable of extinguishing the most violent conflagrations; so much so, that a basket full of salamanders would have quenched Etna itself. Its medical virtues were equally wonderful, and the most burning malady with which human nature could be assailed, vanished at the presence of the all-potent salamander. These and many other stories equally marvellous and ridiculous, have vanished before the light of modern science; and the salamander may be considered as now belonging only to natural history, and of no value or interest in any other respect or point of view.

Some naturalists consider the land and the water salamanders as separate genera or subgenera; and they appear to be justified in this view on account of the structure, the physiology, and the habits of the animals. The land ones, which are the proper salamanders, as being those upon which the ancient fables were founded, retain the name *salamander*, and *triton* is given to the aquatic ones. We shall consider them separately; but though there are several species of each division, their manners are so obscure and void of popular interest, that one or two of each will be sufficient.

Land Salamanders (*Salamandra*). These in their perfect state have the tail round, and not at all adapted for swimming. They are ovoviviparous, or bring their eggs to maturity internally, but the young are dropped in the water, and pass their tadpole state in that element; but this state is much shorter in them than it is in those oviparous *Batrachia*, the eggs of which are hatched in the water. They are found in various parts of Europe, of Asia, and of North America, but never in either of the extremes of climate, and they live in great seclusion. The American ones are more numerous than those of the eastern continent, but they are less known. They are said to want the two glands on the sides of the nape similar to those in toads, which are found in the European species.

Common Salamander (*S. maculosa*). This species is black, marked with large yellow spots rather bright in the colour. On the sides there are ranges of tubercles, from which, when the creature is alarmed, it ejects a milky fluid to the distance of several inches. This fluid has an offensive smell and an acrid taste, and is understood to be very annoying, if not deadly, to weak animals; but it is not a poison to animals of any considerable size. It is subject to considerable varieties of size and also of colour. Its abodes are all of the most solitary and gloomy character. In the moist earth, and in tufts of vegetation by the margins of marshy pools in upland woods, in holes of the earth under stones, in ruined buildings, and in all places which have a moderate temperature and are damp. The greater part of its time is spent under ground, and it never comes abroad in the sun during summer, while in winter it remains under ground in a state of unbroken repose; and when they are in this state, there are not unfrequently numbers of them twined together. Its movement is very slow and heavy; and, instead of being courageous which the fables represent it to be, it is passive almost to stupidity, neither facing danger nor flying from it, but discharging its acrid fluid in cases of necessity. Its food consists of flies, worms, small mollusca, and other little animals, and sometimes it is said even of mud; and as it attacks, and can attack, no animal of any considerable size, it is said to be in itself free from attacks, as the other animals which frequent the same haunt with it are said to partake in that aversion in which it is held by human beings.

It does not appear to have any voice, at all events it utters no cry, and indeed it has very little of the action possessed by ordinary land animals. Though the young inhabit the water for a short time, the mature animals are very impatient of that element. When put into water, it makes more vigorous attempts to get out than it seems capable of upon any other occasion; and if it is prevented from getting out, it rises much more frequently to breathe than would be supposed of an animal in which the development of life seems so imperfect, and its action so languid.

The seat of greatest sensibility in the salamander appears to be the skin; for all the rest of it partakes of that endurance which is common to the cold-blooded animals. It is not easily killed by mechanical means, but the application of almost any stimulus to the skin affects it powerfully. Vinegar or salt throws it into convulsions; and extremes of heat and cold, or of drought and moisture, appear to be equally annoying to it. The specific effect of these is not well ascertained; but that they affect the animal more than it is affected by any thing else is certain, because it bears equally ill the opposite extremes of season and of climate, both of which send it to its hiding places, and both perhaps, when pushed to great lengths, render it inactive.

In many respects the genus differ from all other animals; and though they are still pretty generally distributed, though but rarely seen, they really seem to be creatures fitted for a different state of the economy of the earth's surface from that which now exists. There are many peculiarities in their structure, and not the least remarkable is the extreme smallness of the brain, the diameter of which is really less than that of the spinal marrow; this last consists of two distinct chords, in the one of which the extreme sensibility of the skin is perhaps concentrated, and probably the muscular energy of the body in the other. The smallness of the brain, as a definite part of the nervous centre or foundation of the animal, is a strong corroboration of the generally supposed and nearly demonstrated hypothesis that the brain of an animal is always well formed in proportion as the organs of the localised senses are well developed, and of equal acuteness. One sense may be pretty keen, though the brain is small; but we believe there is scarcely an instance of an animal with a very small brain being perfect in all those senses which have their organs situated in the head. When we speak of senses which have particular organs, the eye is the one which claims our first and chief attention. In the salamander the eye is very different from that of land animals generally, and even from those of toads and frogs. Though much less aquatic in its habits than the frog, and though understood to have passed through its transformations before it is committed to the water by its parent, for the brief period that it remains in that element, the eye of the salamander bears a very striking resemblance to that of a fish. The ball is so fixed as that it cannot turn, and the skin completely covers the eye so that only the corner is visible. Of course, there is no lachrymal apparatus, the eye having no use for tears to wash, as it is covered by the undivided though transparent skin. The cornea is very transparent, but the coats of the eye are irregular in their thickness and form, and the central part of the crystalline lens, which is albuminous, hardens by boiling like that of a fish.

The organs of hearing bear a considerable resemblance in their general structure to those of the cartilaginous fishes with fixed gills; and it is not a little remarkable that an animal which, in its adult state, is very impatient of water, and which spends but little of its early life in that element, should have so many points of resemblance to the fishes. Below the skin and the muscles, there is a cartilaginous operculum to the ear of a rhomboidal shape. Within this there is a cavity lined with a greyish pulp, and containing a rudiment of a tympanal bone, but no definite tympanum. Within this there are cavities and labyrinths; but still the ear is a very imperfect one. The organ of smell appears to be the best developed, the nostrils are far apart from each other, and their conical tubes are pretty copiously supplied with nerves. The tongue is short and thick, having but little motion, and copiously supplied with a mucous secretion; but it is not understood that the sense of taste is very acute. The teeth are prehensile only, and not at all adapted for bruising or dividing the food. Little further is known of the sense of what is usually called touch than the extreme sensibility of the skin, and the muscular sense cannot be very strong in so dull an animal.

The form of the skull is nearly that of a cylinder, enlarged in the anterior part, and with two lateral projections which contain the ears. The bones of the head present many peculiarities, but they are not susceptible of popular description. The posterior part of the skull has two condyles, with the hole for the spinal marrow between them; and they are fitted to two cavities in the first vertebra of the spine. The vertebræ have their posterior surfaces convex. There are fourteen from the skull to the sacrum, and a variable number in the tail, often more than double that in the other parts. The spinous processes are a mere crest, and no part of the body is so formed as to admit of any powerful motion. The pelvis is suspended by cartilages to the fifteenth or sixteenth vertebra, but there is in no instance any bony connexion between this part and the spine, so that the hind legs have but little firmness. The articulation of the fore leg at the shoulder is supported by three bones, but they are so closely united as to seem only one. The blade-bone ascends toward the spine, and the coracoid-bone and the clavicle, united by a suture, are directed downwards. The glenoid cavity for receiving the head of the humerus is on the posterior edge, so that the joint is badly situated as well as badly supported for motion, and it is confined within a limited range by processes. There are two bones in the fore arm, the one placed over the other; five bones and two cartilages in the wrist; and four in the metacarpus. The first toe has only one phalange of bone, the second and fourth two, and the third three. Altogether, the bones of the fore feet are very imperfect. The bones of the hind feet are better made out in some parts; but the connexion with the spine is loose, and they are capable of only very slow motion. The head of the femur or thigh-bone is oval, and therefore has its principal motion in one plane only; and there are processes to stop its motions much in the same way as in the articulation of the shoulder; the under extremity of it is flattened and broad. Both the tibia and the fibula are thick and strong, though the former rather tapers toward its lower extremity, and is longer than the other. The tarsus consists of nine bones, and the metatarsus of five, and this is the part which is so

much more perfect in the skeleton than the corresponding part of the fore leg. The skin is of a leathery consistency, firm but smooth, with the epidermis semitransparent.

There can hardly be said to be any distinct gullet in this very singular animal. From the anterior part of the canal there is a gradual widening to a sort of spindle-shaped stomach, which is simple, and copiously supplied with glands or follicles which pour out a mucous kind of secretion, but little is known of the rate at which digestion goes on, though from the sluggish character of all the other actions of the animal it is supposed to be very slow. No provision can be said to be made for its hybernating as is known to be done in many other animals, by the depositing of fatty matter in the cellular tissue; but there are certain oily accumulations of a yellow colour in various parts of its body, which, by some, are considered as answering this purpose, though the fact of their doing so is not fully established.

The breathing apparatus, in the full-grown salamander, consists of lungs narrowed at the fore part, and rather enlarged backwards. The entrance to them is by a trachea of no great length, and their substance consists of cells, not of very large size, and partially divided by partitions, the vessels in which the blood receives the action of the air being ramified all over the partitions and the walls of the cells. The heart is a true batrachian one, consisting of a single ventricle and a single auricle, and it is enclosed in a proper pericardium. The heart is of a red colour. One large vessel, which brings the blood from the lungs to the heart, partakes of many of the characters of a vein; but the other trunk, which carries it from the heart all over the body, has much more the character of an artery. Taking it altogether, this is one of the most singular animals in the whole range of the animal kingdom, and a very intimate acquaintance with the animal economy is necessary for enabling one to understand and appreciate its character. The mode of its reproduction is not the least singular part of its economy. There can be no doubt that the impregnation of the ova is internal, which is not usual among the *Batrachia;* but the most curious part of the matter is that the young are understood to remain in the oviduct not only till they come out of the egg, but till they have performed all their elementary transformations, lost their gills, and are no longer proper tenants of the water, in which, however, they are understood still to continue for some short time, of course rising to the surface to breathe air whenever that operation is necessary. The common salamander is the largest of the European species or varieties, for their manners are so obscure that it is not easy, in every case, to say whether the distinction should be regarded in the one way or in the other. This one is sometimes met with as much as eight inches in length; but, we believe, very seldom more and generally less. It is quite unknown in the British islands; and is found about the middle latitudes of continental Europe, or rather perhaps in those more to the south, but in the upland districts rather than the low and warm ones. We mentioned that its colour is black, with yellow spots; but the black is true only of the upper part, the under being more or less of a bluish tinge; and the yellow spots are placed in a pretty regular row along each side.

There are, however, several other species, or at all events varieties. One of these, the black salamander of Laurenti, is rare in France, in some parts of which the one that we have noticed is not uncommon, although, from its habits, it is but rarely seen in proportion to the numbers in which it actually exists. It is, however, by no means rare in some of the mountainous parts of the south of Germany. It is only about half the size of the common one: wholly black on the upper part, without any rows of yellow spots on the sides, and yellowish altogether on the under part. Another, the spectacled salamander, is found in the Apennines. It is a small species, with only four toes on the hind feet as well as on the fore. It is wholly black on the upper part, and yellow spotted with black on the under, with a yellow band across and surrounding the eyes, from which it gets the epithet of spectacled. Another, called the dark or funereal salamander, is found further south in Europe, chiefly in Spain, and in the warmest parts of that country. It is shorter than the common salamander, but proportionally thicker in the body and more slender in the tail. It is dark brown on the back, paler on the sides, and passing into sand colour on the under part. It frequents the margins of the water, even in the hottest parts of Spain, as for instance in the beautiful plains of Andalusia. It remains in perfect concealment all the day, coming abroad only at night, and appearing in the houses of the people, especially where they have fires; for, though it cannot bear the glare of day-light, it is fond of heat. Another species still is common in some parts of the extreme south of France. It is called the variegated salamander. It has a line of bright or orange red along the back and the tail, and sometimes lines of the same colour along the sides. The upper part and the head are of a dull green, which varies in the shade in different specimens; and these parts are in general roughened by a sort of warts or tubercles. The flanks are greyish-black, and the under parts are reddish and quite smooth or free from tubercles. It is found about the sides of ditches, and in the damp meadows which are overshadowed by trees.

In the other parts of the eastern continent it is probable that there are more species, or at all events varieties. Some have been observed in the Japan isles, principally, we believe, in Niphon, where they have acquired at least some part of the celebrity which was enjoyed by the salamanders of Europe in ancient times. It does not appear that the Japanese, who are rather a sensible people in many respects, have connected these salamanders with any fire-proof quality, or that they have supposed them to be in any way conducive to the healing of burning fevers and other violent diseases; but they consider that not only the recent flesh, but the dried bodies, have potent medicinal virtues; and, accordingly, they are in much requisition by the apothecaries; and are supposed to have similar corroborative qualities to those which are attributed to the skinks, which appear to have just as much truth in the one case as in the other. In all these species it does not, however, appear that there are any differences of habit, which can be made the basis of any thing like useful popular description.

It is the same with the terrestrial salamanders of America. So far as has been observed, these are confined to the northern parts of that continent, though not to the regions of extreme cold. They appear, as is the case with the whole or the greater

part of the native animals of that quarter of the world, to be totally different from those of the eastern continent; but in what they differ has been so very vaguely ascertained, that it is quite impossible to say any thing about the matter that could be interesting to any ordinary reader; and therefore we shall not enlarge upon them.

There is, however, one animal, a native of many parts of the British islands, and by no means a rare one, though, from its retired habits, not often seen, of which some notice appears to be necessary, the more so that its place in the systematic arrangement of animals is by no means clearly established. This is the common *land newt* or *eft*, a very pretty and very harmless little creature, though, like the salamander, it has a sort of "Cain's mark" upon it, and whoever meets it thinks he does service in slaying it. It is found chiefly in dark and rather moist places, under stones and rubbish, or in other situations of concealment. It is seldom met with above four inches in length, and it is usually of smaller dimensions. The upper part of it is yellowish-brown with dusky spots and lines, and the under part reddish with dark spots. The skin has a peculiarly delicate appearance, and the animal altogether appears to be as perfectly harmless as one can well suppose an animal to be. It does not appear that the skin exudes any acrid matter like that of the real salamander, and it cannot bite or inflict any injury whatever.

The place of this animal in the system has not been very clearly established; and indeed it is somewhat singular, that an animal which is so common should be so imperfectly understood. The older writers, as a matter of course, classed it with the lizards, as they did every reptile that had four feet and a tail; and more modern ones have classed it with the water newts, which are *tritons*, according to the proper distinctions of the two branches of the salamander family. As far, however, as its habits are known, they would lead us to place it with the land salamanders. It is, though a smaller animal than these, a much more handsome and active one; but its places of abode and its habits, so far as these are known, are exactly the same. Though usually seen about damp cellars and outhouses, the shade and not the damp appears to be that which it prefers; for it is to be met with under stones and rubbish in places which are very dry, and no one has ever found it in the water in any stage of its existence. If put into water, it shows the same impatience of that liquid as is shown by the salamander; and, though it is sometimes found in places which are very damp, the water does not adhere to its skin, but stands upon it in drops, or runs off without leaving any impression. This is not the case with the naked skin of any animal whose habit is decidedly aquatic. The greater part of these, if not the whole of them, have the skin protected from the action of the water; but it is always by a mucous secretion, and not by any merely repellent power in the epidermis, such as there evidently is in the common land newt or eft.

The manner in which this singular creature is reproduced is not known; and this is the chief point which wants clearing up before it can be fully settled whether it is to be classed with the land salamanders or with the tritons. The analogies, so far as they go, would lead us to conclude that it belongs to the former, and that it is an ovoviviparous reptile; but in such a case the analogy of habit is hardly sufficient. This, however, is certainly the probability; and though nothing definite about the reproduction is known, there is another means by which some light might be thrown upon the true nature of the animal. We believe it is a general, if not a universal, law that the members of oviparous reptiles, especially those which pass through a tadpole state, are produced again after they have been destroyed by accident; and that those of ovoviviparous ones are not so readily restored, or rather not restored at all. In this we believe the water newts follow the same law as the water salamanders; and if it is found that the land newt follows the law of the land salamanders, then the classification may be held as established upon sufficient physiological grounds. At present, however, even this is not settled; and thus the newt remains a puzzle in natural history.

It is also a creature which is looked upon with great suspicion. It is not accused of poisoning, biting, or doing any mechanical harm; but it is alleged to be very fond of creeping down the throats of people when they fall asleep near the places which it frequents. Not only this, but it is supposed that the germ of the newt is often swallowed along with water; and that, coming to maturity in the stomach, it gives rise to the most terrible maladies. In remote parts of the country, we have often heard of fearful suffering, well understood, as the people thought, to proceed from the horrible calamity of swallowing a newt. We never indeed heard of any living newt being found in the interior of a single human body upon dissection; but the people to whom we allude looked upon dissection, for whatever purpose it might be performed, with at least as much horror as they did upon newts.

Aquatic Salamanders (*Tritons*). These have a general resemblance to the land ones in their form, though in them the tail is adapted for being a swimming instrument, which is prevented in the others by its round shape and its limited power of motion. In their physiology, however, as well as in their habits, they differ much from the land ones. Though in the adult state they all breathe air by means of lungs, yet they are constant residents in the water. Their tails are compressed laterally like the tails of fishes, or rather of tadpoles; and they swim by working them right and left. They are chiefly found in shallow and stagnant waters, very rarely in running streams, and never in the sea. They chiefly live at the bottom, under stones, and in other hiding places; and their food is understood to consist of larvæ and very small animals. They are perfectly harmless in every sense of the word; but the same dislike is shown to them as to the land salamanders and the land newts, only they are not supposed to be fire proof.

They are oviparous, and the mode of their production bears a considerable resemblance to that of the toads. The eggs are fecundated at the time of their exclusion, and they are united together in strings or chaplets, by which means they adhere to aquatic plants, to stones, and to other substances in the water. These eggs are deposited early in the season; and in many of the species they are hatched in about fifteen days. The young have tufted gills and also claspers, by means of which they can keep their hold upon substances under the water until they acquire strength for swimming. They all remain much longer in the tadpole state than the land salamanders, which are nearly or wholly out of that state before they are

excluded. The length of time which they continue in this state varies with the species, and also with the climate and the season. In very northerly places the eggs are of course deposited at a later period than they are in warmer climates; they are also often retarded by the frosts, which congeal the eggs, but do not extinguish the principle of life in them; and when the hatching is very much protracted in this way, the animals have not length of season sufficient for carrying them through their transformations, and thus they appear with gills in the following season. This happens also in the alpine regions of warmer countries, and it has led to a multiplication of species. The cartilaginous arches which support the gills are seldom wholly obliterated in these animals; and when the gills have stood the winter, they remain for almost the whole of the ensuing summer, and partially for a much longer time. It was from one of these specimens that Laurenti of Vienna formed his genus *Proteus tritonius*, a blunder which, in the blundering translation of the Règne Animal, purporting to be by "Edward Griffith, F.L.S., and others," has been charged against Linnæus instead of Laurenti, though the latter was without doubt the originator of it.

One cannot absolutely say that the water salamanders are more obedient to the influence of natural causes than the land ones, because the skins of the latter are sensible in a very high degree. The aquatic ones are, however, more capable of endurance than the others. They can bear to be frozen up in a solid mass of ice, and yet seem as healthy as ever when gradually thawed out. There are also few animals, whether vertebrated or not, that have such powers of reproducing lopped members as the water salamanders. They will, in a very short time, as was proved by the experiments of Spallanzani, reproduce the same member again and again, perfect in all its bones, muscles, and vessels; and, though their organisation certainly does not rank very high among vertebrated animals, it is far more complicated than that of the crustacea which have this reproductive power.

Among these animals there are wonderful degrees of endurance of all kinds; and though they are at present not very rare in some places, they appear more decidedly to belong to a former state of things than even the land ones. We are not aware that any vestige of the remains of an extinct species of land salamander has been found in any country, but the case is different with the aquatic ones. These bones have been found in the schistose strata at Œningen, in Germany, indicating a length of at least three feet, which is four times as much as that of any of the species now existing in Europe, or we believe anywhere else. The most curious thing about these reptile remains, is the fact that Scheuchzer, a physician of Zurich, who published a work in 1723, should have regarded them as the remains of a human being. Such, however, is the case; and that learned person wrote a treatise, *Homo Diluvii Testis*, endeavouring to prove that the fossil bones of an animal of the very lowest of the vertebrata were really those of the very highest. At that time, however, all the great accumulations of animal and vegetable remains, wherever they happened to be found, were referred to the Deluge in the time of Noah, as stated in the book of Genesis. The parties never paused to consider whether the flood there mentioned occurred in such a manner as to produce circumstances of this kind, or into the question of there having been human beings in Germany at the time referred to by the sacred historian, or not. But the proofs are now abundant that there is not a vestige of human remains in any one accumulation to which a general cause or a very ancient date can be assigned. The once famed fossil man has thus now quietly taken its place as nothing more than the evidence that there once existed in that part of the world an aquatic salamander of much larger size than any that now occur in the living state. This, it will be admitted, is not much information; but the refutation of error is always in itself, in so far, the establishment of truth; and it is one of the many proofs which the earth furnishes that it was fit for the habitation of very different animals, and these, for the greater part, of aquatic habits, before it was fit for the habitation of human beings. Of the living species of these singular animals not much can be said; their manners are obscure; and they appear to vary so much with age and season, and also with climate, that the specific differences are not easily made out. There appear to be several species both of Europe and of North America, but they are comparatively little understood.

The Marbled Salamander (*T. marmorata*) is found rather plentifully in the south of France, and in some other of the warmer parts of Europe. It spends the summer in the water, or, at least, rarely appears on land at that time; but it is said to winter in holes of trees or of the earth, hybernating in a state of torpor even in the warmest places in which it is found. It grows to the length of eight or nine inches. Its skin is slightly roughened by small tubercles. Its colour, on the upper part, is dull green, with large irregular blotches of brown; and on the under part it is brown, with small speckles of white. There is a reddish line down the middle of the back; and, in the male, there is a small crest along this line marked with black spots. It does not appear, however, that this dorsal crest is permanent, or anything else than an ornament in the season of reproduction. This is described as being the least aquatic of the whole; but, though it is an animal of which specimens can be obtained without much difficulty, very little is known of its feeding or of any of its habits.

The Spotted Salamander (*T. alpestris*) is found in more elevated places than the preceding species, and it does not attain the same size. It is mottled with slate-colour, and brown on the upper part, and red or orang on the belly, with a row of small black spots, close to one another, along each flank. The skin in this one, as in the former, and indeed in all the aquatic salamanders, is roughened by small tubercles.

The Crested Salamander (*T. cristata*) has the dorsal crest on the male much larger than any of the others, but still that crest is only an appendage of the breeding season, and wears off in the course of the summer. It has the skin roughened with tubercles; is brown on the upper part, and orange on the under, both being marked with round blackish spots; and the sides have lines of small white spots. The crest of the male is high, and formed into a series of points; and in the pairing time it is of a violet colour.

The Puncturated Salamander (*T. punctata*) has the skin free from tubercles. It is bright brown

on the upper part, and orange, or brownish-orange, on the under, the whole marked over with round black spots, and the head streaked with black. The crest on the dorsal line of the male of this species has a curious outline, as if it were formed into a number of lobes. The toes are flattened, and slightly marginated, but they are not in the least webbed.

The Web-footed Salamander (*T. palmata*) is brown on the upper part, with lines of black and brown on the top of the head; the flanks are light brown, with spots of black; and the under parts are also light brown, but without any spots; the toes are broad, and united by membranes; the male has three small crests on the back.

These are the principal species or varieties mentioned by those who treat of the reptiles of continental Europe; but it is not known what differences of habit accompany the differences of colour or of crest. Indeed, the animals are invisible for so long a portion of the year, and they appear to be so much affected by differences of climate and locality, that no very definite conclusion respecting them can be arrived at, farther than that those which have the toes widened or webbed appear to be more exclusively aquatic than those which have them simple. In North America, which is a much more marshy country than Europe, there are many more species of these animals, but nothing is known concerning them that could be in the least degree interesting to the general reader.

None of the species or varieties hitherto mentioned are known to be inhabitants of the British islands. There are, however, two reptiles found in Britain which have been called *tritons*, and which seem to belong to the water salamanders rather than to any other genus or family. These are the water efts, or water newts, of which there are two species, the one larger than the other, and not so habitually aquatic, though never found in places so dry as those in which the land eft is sometimes met with. Their structure and mode of production are very similar to those of the water salamanders. Their bodies are elongated, and their long tails are compressed laterally, so that they work as swimming paddles in the same manner as those of the salamanders. Like the aquatic species of these, they are oviparous, and their eggs are disposed in a similar manner. The young are tadpoles, breathing with gills in their early state; and when they come to maturity the gills are absorbed, and the lungs come into action. They are not found in clear or running waters, or in the sea, but in marshes and shallow pools which are matted with aquatic plants. The young have claspers, by means of which they can adhere to these plants; but the claspers, as well as the gills, belong only to the early stage of their life, and they disappear about the same time. They are not very numerous, and they are but rarely seen in proportion to the numbers in which they really exist. They are perfectly harmless creatures, but the country people have the same aversion to them as to the land newt, and kill them wherever they are found. The draining of the ponds and marshes, and the general cleaning out of the ditches and water-courses, which form part of an improved system of agriculture, have tended much to diminish the numbers of aquatic reptiles. Both the British species have the feet formed in the same manner as those of the land newt, that is, with four toes on each of the fore feet, and five on the hind, without either webs or claws. As is the case with the salamanders of the continent, both of these are described as lizards in many of the books, but they are true *Batrachia*.

The Warty Eft (*T. palustris*) is the least aquatic of the two, not being met with out of the aquatic herbage, and often lurking in that where the water has dried up. It grows to the length of six or seven inches, and is of a brownish colour above, and orange, with black spots, below. The skin is roughened by small warts or tubercles, like that of many of the water salamanders; and some have alleged that these give out an acrid liquor, but there does not appear to be any truth in the statement. The head is flattened, and the muzzle blunt, and finely variegated with yellowish white; the middle of the belly is without any tubercles; the tail is much compressed, and rather deep; and the ridge of the back and tail are furnished with a crest which is notched on the back. It is, taken in whole, rather a handsome little animal, notwithstanding the dislike in which it is held.

The Water Eft (*T. aquaticus*) is more abundant and more generally distributed. It is more aquatic, also, than the warty one, and often seen in clear water, though in ponds and ditches, and not in running streams. It is a smaller animal than the other, being seldom, if ever, met with larger than four inches. Its skin is nearly, or altogether, smooth, greenish-brown above, and orange below, with blackish streaks on the former, and spots of the same colour on the latter. The head is flattened, and marked by two lines of black dots, but it has none of those beautiful mottlings with yellow which are on the muzzles of the warty one. The tail is also less deep in the section, and tapers to a more slender point. This animal is viewed with even more suspicion than the warty one; for it is alleged that both human beings and domestic animals are liable to swallow the spawn along with the water which they drink; and then this terrible tormenter is seen to come to maturity in their stomachs. Now, that any vertebrated animal can live in the stomach of another is an absurdity; and that a batrachian reptile should do so is most palpably absurd. To say nothing of the suffocation from want of air, no reptile of this kind can bear a degree of heat equal to that of the interior of the human body in a state of ordinary health. We have heard of many cases, however, in which this was most firmly believed; and we have actually seen persons whom nothing would persuade that they had not a water eft in the stomach which tormented them, and rose in the throat when the stomach was empty. Such persons were, we believe, troubled with indigestion, a malady which puts more crotchets into people's heads, and is, on that account, more incurable, than almost any other that can be named. The plague of the eft is, we should suppose, not so common now as it once was; but we remember the time when, in a rural and remote part of the country, there were some persons who wandered about and picked up a tolerable living, and no small degree of rustic fame, by quacking the afflicted for this and other imaginary diseases. We have actually seen a roasted shrew prescribed and taken, in order to make the newt or eft quit its abode in the stomach; but we never heard of the expelled intruder making its exit bodily, though the patient might probably be cured, as imagination is often the best and the only cure for imaginary diseases. This

is the grand hold which medical quacks of all kinds have upon the public; and though the fashion of the quackeries changes with the times, perhaps the sum total bears a pretty constant ratio to the population; and many who would treat with ridicule the idea of swallowing a roasted shrew, in order to get a live eft out of the stomach, are in all probability believers in as great absurdities. The story told about the late Mr. Abernethy, in curing the dyspeptic lady of the dread of a spider in her stomach, is well known; and though we cannot vouch for its authenticity, it was not unworthy of that very talented and eccentric character. The lady could not get rid of the spider, of course, as there was none to get rid of; but she applied to the Doctor.—"Madam," said he, in the usual gravity of a prescribing face, "there is only one way in which you can get rid of it, but that is sure to succeed." The lady was all ear. "Madam, you are to go home, catch a bluebottle fly, put it in your mouth, and let it buzz there; depend upon it the spider will come up to catch the fly; then watch your time, spit them both out together, and your cure is certain." The sequel is not given; but it is highly probable that the prescription was of that valuable kind which cures when given without being taken.

SALICARIÆ, or LYTHRARICÆ, a natural order of plants. See LYTHRARICÆ.

SALICORNIA (Linnæus). A genus of small shrubs and herbs, chiefly natives of cold countries. Three or four of the species are natives of Britain, where they are known by the name of glasswort. They are placed in the first class and first order of Linnæus, and belong to the natural order *Chenopodeæ*. Under the name of marsh samphire, these plants are used as spinach.

SALISBURIA (Smith). An ornamental tree, native of Japan, belonging to *Amentaceæ*. The flowers are monœcious, and it appears that the female plant is scarcely known in Europe.

SALIX (Linnæus). A most extensive genus of trees, shrubs, and undershrubs, mostly natives of the north of Europe and America. The flowers are diœcious, and the genus belongs to *Amentaceæ*. The willow, of one kind or other, is common everywhere, and several of the sorts, as the *S. rubra*, *S. viminalis*, and others, are extensively cultivated for the basket-makers, and the *S. fragilis* and Huntingdon are preferred for fencing; while the *S. Babylonica*, or weeping-willow, is exceedingly ornamental. There are numerous species not yet described.

SALMON (*Salmo*, or perhaps *Salmonidæ*, the salmon family). A family of soft finned fishes with abdominal fins, and the fourth in order in Cuvier's arrangement, standing between the family of the *Silures* and that of the herrings. They are exceedingly numerous, amounting to twenty genera in the subfamily of the salmon, and one genus of another subfamily *Sternoptyx*, which agree with the salmon in some particulars, but have the body differently shaped, and are different in geographical distribution.

The soft-finned fishes, that is, those which have the rays of the fins jointed, whether they have or have not any fins absolutely soft, are in point of numbers the most abundant of all the true fishes; and, in an economical point of view, they are the most valuable. This will be understood from the mere mention of the names of the leading families, which are salmon, herrings, cod, and flat-fish, of which if the waters were deprived, man would sustain a greater loss than if all the rest of the finny tribes perished together. Among the other divisions and families there is a valuable fish here and there; but when we come to the four which have just been named, it is difficult to say which of them is the most valuable; and if they were all taken away, our fish markets would have but few attractions compared with what they have at present; for the staple of them all at every season of the year is one or other of these four.

In the elegance of their forms, and perhaps in the richness of their flesh, the salmon family are probably entitled to take the lead; and when we consider their habits and their geographical distribution, we are constrained to acknowledge that they are the most accessible of all fishes, and almost the only ones in which man can be said to have a property which can yield him a revenue. None of the family are, strictly speaking, pelagic fishes ranging the wide seas, and none of them resort to the banks in the distant parts. The greater number are natives of the fresh waters, even though they spend a considerable portion of the year in the sea, and not a few are permanent inhabitants of the fresh waters; but they are all inhabitants of the clear water, active and lively in their manners, and never lurking in the mud.

The capture of the salmon family thus becomes the finest sport of all fishing. It is really a "field" sport, though the objects of it are in the waters; and there is more exercise, more enjoyment of scenery, and altogether more of the elements of healthful enjoyment in fishing for the members of this family, than in the capture of animals of any other description, be they what they may; all this is very delightful in itself, and certainly it is not the less so from the consideration that the produce of it is equally savoury and healthy. The other finny tenants of the fresh waters are found chiefly in ponds and pools, or in the broad and stilly places of the stream; but the clearer the water is, and the more brisk the current, the salmon family like it all the better, and frequent it in the greatest numbers. We find perch in a dull pond, and pike in a sedgy pool or stagnant part of a river; but if we wish to have a salmon or a trout we must go to where the bank is clear, and the place both delightful and healthy.

There is something more in this than the mere consideration of fishes, whether regarded in an economical point of view, or as they afford sport to the captor. These fishes entice us to the place where health and long life is be found, and bring us acquainted with nature in its fresh and simple beauty. There is a richness of enjoyment in it which cannot be told in words, or communicated in any other manner than by actually engaging in it, and not merely engaging in it, but doing it with enthusiasm and zest. No one can conceive but one who entirely feels it, the high degree of superiority with which one who has been accustomed to catch trout after trout, or a salmon now and then, looks upon the humble fisher for dace and gudgeons in some flat, lazy, and currentless river, which crawls along making the man who stands on the bank watching the bob of the float, ten times more dull than he would be were he engaged in the most mechanical drudgery of the workshop or the counting-house all the while.

The salmon family thus form a subject upon which one could dwell and luxuriate for a long time, and always the longer the less wearied; but as all waters

are not fit abodes for these most delightful of fishes, so all the days of our lives, and few days of those of the majority of us, cannot be spent in fishing for any one member of the salmon family, and therefore we must leave this delightful part of the subject, in order that we may inform those who cannot enter into the delightful romance of the subject, where the plain business reality is to be found.

The more characteristic members of this family of fishes are found in the cold and the temperate latitudes rather than in the warm ones. The shores of the Atlantic without the tropic, and the rivers which discharge their waters into that part of the ocean, are their head-quarters. There are, we believe, some species in the northern parts of the Pacific, and the rivers which are affluent there; they are, however, nothing either in number or in value to those which are found in the Atlantic and the Atlantic rivers, and in these the salmon improve after we pass the middle latitudes of the quadrant; and it may be said that, until we come to the absolute barrier of the ice, the farther north that we get, the salmon become the more abundant in numbers, and the better in quality. They are thus fishes not merely of the places which are most favourable to the development of the human powers, but of those in which the land is less calculated to repay in food the labour which man bestows on the cultivation of it.

Numerous as the members of the salmon family are, and different as they are from each other in size, in colour, and in various other particulars, there are still very close family resemblances among them. This is perhaps most strikingly the case in the mode of production, and in the appearance of the fry or young in their very early stages. All of them ascend the streams for the purpose of spawning, even though they spend much of the intermediate time in the sea. Those which are in so far marine in their haunts, and in finest condition when caught in the salt or the brackish water, are yet capable of living and continuing their race wholly in the fresh water. This is proved by the fact, that there are salmon in some inland waters, the falls upon which are so high as to prevent all passage of the salmon—at least all passage upwards. A positive cascade of about fourteen feet in height is a complete barrier against the upward passage. But the downward is another matter, and one respecting which we have but little positive knowledge. When the fish are ascending, they keep as near the surface of the water as they can find passage and safety. They are over the shallows near the shores, at least, if the water is deep and stilly in any part.

That they should do this is part of the instinct, or perhaps we should say, the adaptation, which brings them from the sea, or makes them ascend the streams, namely, the air, heat, and light necessary for bringing forward their eggs. This is so deeply rooted in their nature, that it impels them for many hundreds of miles, at least in some of the species; and their attempts to pass obstacles are equally wonderful. Some of the species are, however, more permanent in the same localities, and they are of course less under the influence of seasons. When a salmon approaches the shore or ascends a stream, that is not to be considered as an independent act of the animal, in the same sense as we speak of an independent action performed by a human being; but there is a great disposition to confound them, and this confounding puts an end to our rational progress in the study of nature, by leading us away from the conclusions to which a more philosophical mode of viewing the same subjects, would speedily and easily bring us. No one who has not devoted much attention, and it is a species of attention of a painful nature, would be apt to suppose this.

The human action, when it is properly such, that is, when the plan and purpose of it are forethought inferences by the mind from experience, it is, so to express it, taken out of the genera loperation of physical causes, the season and the climate for instance, do not affect the formation of this plan; and they have but a partial influence on the execution of it. The will does not work to the weather any more than the weather works to the will; and, therefore, though the mere working instruments which put the purpose into execution upon matter, must be in so far affected by physical causes, the mental part is not affected in that way at all. The sun rises to the evil and the good, and the rain falls alike upon the just and the unjust, without in the least affecting their moral distinctions; and that a man is wise and good, or the reverse, is not an element which we can in any way apply to the study of the rest of nature in any one of its departments.

The animal, on the other hand, is wholly under the influence of physical causes, though these admit of division into two distinct parts, the nature of the animal, and the circumstances under which the animal is placed. These are, in some respects, opposed to each other, and it is this opposition which occasions what we may properly call the working of the animal; for if the animal were either passive to the rest of nature, or the rest of nature passive to it, there would and could be no display whatever of animal life. The adaptation of the animal and the circumstances to each other, thus becomes by far the most important part of the natural history of animals, because it is that through the means of which they can be trained, improved, or made in any way useful; different animals are of course differently obedient to, or affected by circumstances; and the degree to which they are so is the measure of the hold that we have upon them, both for knowledge and for practical use.

Perhaps there are no animals, certainly no fishes, more obedient to circumstances than the salmon family; none are more useful; none are more within the limits of our observation and management; and therefore, none are more worthy of being generally observed and studied. They have this farther to recommend them that, in all the more valuable species they are exceedingly numerous and widely distributed as British fishes. Many other genera are common and valuable fishes of our seas, but the salmon family actually dwell among us; with only this difference, that they are in the stream, and we have our most pleasant dwelling, and our most refreshing and gratifying walk, on the bank.

The members of this most valuable family of fishes are so sensitive, that we can hardly mention one variation of locality, or of the succession of seasons and weather, or the mere locality, by which they are not affected to such an extent, that superficial observers would be apt to regard them as distinct species. This has led to a very needless, and indeed mischievous multiplication of species and varieties, when the whole was explainable by differences, and these often apparently very slight, in the circumstances of their localities.

The water in which they live is of course one of the circumstances by which they are affected the most, and the differences which affect them may be the temperature of the water, the substances which it holds in solution, or the food which it supplies. Those which have seasonally free access to the sea, have of course a more constant uniformity in the state of their dwelling there than those which are confined to the inland waters. But still there are differences in the appearance of the salmon even of rivers which flow into the sea at no great distance from each other. Thus in the case of the rivers of Scotland, one might be perhaps prepared to find differences in those of two great estuaries like the Forth and the Tay, which are separated from each other by a whole country. But this is not all; for the fishermen can readily tell from which of the smaller salmon rivers which fall into these estuaries, a fish comes. It is a general law that the nearer to the open sea the mouth of the river is, the fish are the finer both in colour and in flavour; and a Tay salmon caught below Dundee is far better than one caught above Perth,—and in all rivers the farther inland the fish are obtained, they are always the worse in quality. This is still not the only difference; for the salmon of rivers which have low and warm courses and clear water, are always finer, as well as found earlier, than those in mountain ones, where the water is much tinged with peat earth. Thus, on the Fife side of the firth of Forth, a Leven salmon is better than one found at the confluence of the mountain rivers farther up the Forth. It appears to be the pure water much more than the rich country through which the river flows, which improves the character of the fish. So also, at Aberdeen, the Dee and the Don enter the sea at no great distance from each other, and the valley of the Don is richer than that of the Dee; while the Dee, from the greater purity of its water, is by much the better salmon river of the two. These facts are well known to fishermen on the rivers and also to dealers. Many more might be given, but these are sufficient for proving the point.

The alternate adaptation of those *Salmonidæ* which migrate between the sea and the river, to the salt water of the one, and the fresh water of the other, shows that they are readily obedient to circumstances. It is doubtful whether upon an instant transfer from the one to the other the animal would live, or at all events be uninjured; but some additional information is wanted before this point can be cleared up in a manner quite satisfactory. It is probable, however, that they "hang" in the brackish water for some time, both in their ascent and descent; and the probability of this is strengthened by the fact that they do not ascend the smaller streams which enter the sea abruptly, with little brackish water at their union.

Of the three species, the salmon, the bull-trout, and the sea-trout, which have this migratory habit, the salmon is certainly the most discursive, both seaward and inland; and, in Britain at least, it appears to be more generally distributed, although the others are very numerous at some places. The bull-trout is perhaps the next in point of discursiveness, at least up the rivers, though its inferiority for the table makes it less an object of interest. It is a more hardy fish than the salmon, and ascends the rivers earlier; but as it is in little demand at the great markets where so much salmon is purchased, its history is left more to naturalists, and its flesh to the country people where it is found. The sea-trout, or the salmon-trout, as it is more correctly called, resembles the salmon more in appearance, and also in the quality of its flesh, than the bull-trout does; but it is the least discursive up the rivers of the whole, and probably does not go so far to sea, or into such deep water as the salmon. It is often found in shoals of considerable number beating about the coasts, and even in the mouths of the smaller rivers, which the salmon do not enter. But it does not ascend very far up these rivers, even where there is little or nothing to stop its progress; and thus it may be considered as more a fish of the shores and the brackish waters, than of any other locality. On these accounts it would appear to be less affected by seasons than the salmon. It is, however, a good deal affected by the character of the waters, being always in the best condition where the water is pure, and the soil from which it comes, especially on the lower part of the river, rich. On the shores of the Hebrides, especially in the sandy bays, which are generally found skirting the more fertile spots, the salmon trout is found in great abundance and of excellent quality, even where there are no streams of any consequence. In many of these places it attains considerable size, is in fine flesh both as to colour and quality, and called salmon by the inhabitants.

But the changes which are produced by differences of quality or admixture in the water, even in those species which never resort to the sea, are fully as conspicuous as those which the fresh and the salt water, and the different qualities of the latter in the several rivers, occasion. We might be prepared to expect this; because the quality of the water of a river where it falls into the sea is different from that of the inland branches of the very same river. The ultimate river, as we may call it, is a mixture of many minor waters, each partaking of the characters of the particular soil from which it comes. One may be from the mountain, a second from the moor, a third from the morass, a fourth from the grassy valley, and so on through a very great number; and the compound will partake of the nature of all of them, in the proportion in which they happen to enter into it. Then after these are all collected into the main channel, the impurities may subside there, and give very different characters to different parts of the river. All these have very decided effects upon the *Salmonidæ*, especially upon such as are permanently resident, in the appearance and colour, and also in the quality, of the flesh. If from any accident the waters become permanently foul, the *Salmonidæ* quit them sooner than any other fishes, and the salmon is the first to depart, or rather it ceases to resort to those polluted waters. The impurities of all kinds which mix with the Thames may be said to have completely banished the salmon for which that river was so celebrated in former times, and there are many other instances. A remarkable one occurred in the Ness, between Inverness and the lake where the operations on the Caledonian Canal rendered it necessary to turn the river into a partially new channel. In doing this, great part of the old channel was filled with loose gravel and sand, tinged more or less with iron, of which the curious little hills in the lower valley of the Ness are composed. This banished the salmon; and when they are once banished from any locality, they do not soon return, even though the cause which banished them should cease to operate. We might be prepared to expect this, from the fact that the salmon resort so

regularly to the same river, as to produce the river characters to which we have alluded. The grilses, or young salmon, almost invariably return to the river in which they are spawned; and it is probable that the full-grown ones return to their last spawning grounds, even though they have been driven from previous ones. The return of the fish to the ground has no connexion whatever with what we are accustomed to call memory; and its present conduct is not in any way influenced by its past feelings. The circumstances of the present moment and the present place are the only ones which influence it; and such being the case, we can see no reason why it should return to a former place, if it has once since spawned in another. The return of salmon to a river which has once been wholly deserted by them, must therefore be entirely owing to accident. It is true that they beat along the shores, until they come to the brackish water, toward which they ascend, in numbers proportioned to its quantity and its quality. Even after they have cleared the estuaries, and got into the rivers, the quality of the water will make them take one bank in preference to another. Temperature may have a good deal to do in these cases, but it will not account for the whole. They always prefer the river which comes from a lake to that which brings snow water from the mountains, at least in the early part of the season; but there are some flooding rivers, which have no lakes, in which they appear very early. The Severn is a river of this description.

There are many cases in which there appear to be three varieties of trout, or even species, if colour and quality were to be admitted as specific differences, in two small streams, and the one formed by their union. If the one branch is clear, with a fine bed, dry banks, and kindly plants on the margins of the pools, then the trout are yellow and beautifully spotted. If, on the other hand, the source is marshy, and the channel contains the coarser aquatic plants, the trout are dark-coloured and coarse, and then, when the two branches unite, the character of the fish is intermediate. All those varieties, which may be found within the space of a few miles, show how much the members of this family are modified by the waters in which they reside, and renders much caution necessary in treating of species and varieties.

Food appears also to have great influence both on their appearance and their size. The whole family are exceedingly voracious and miscellaneous in their eating, though, of course, the staple food varies with the locality. In the narrow streams the principal food is those insects and larvæ, chiefly flies, which frequent the waters in such places; and this is the kind of food which appears to agree best with the species which inhabit the streams at all seasons of the year. Where there are copses, and other shelters, for those flies near the banks, the trout are always more numerous, finer, and larger, than in places where the food must consist more of worms and mollusca, and even of small fishes; and upon trouting streams the anglers know particular spots where there is better sport in one half mile than there is in several miles either above or below.

It seems, indeed, that the rapidity with which trout grow when they get abundance of flies, is at least one of the natural causes of their ascending the small creeks and streams for the purpose of spawning. The young begin to be able to feed at the time when the flies are most numerous upon the water; and thus the young grow so fast, that they are, even in the case of the salmon, in a condition for spawning the same year. Those which are more in the brackish water, in the shallows of the sea, or in lakes, appear to feed more upon the smaller crustacea and mollusca, and some of the other invertebrated animals of diminutive size which swarm in those parts of the water, especially at the time when the young of the migrant *Salmonidæ* resort to them. They are not, however, confined to food of this kind, for they have not the least objection to a frog, if nothing else can be had; and the author of this article has sometimes seen a small trout with a frog, too big for it to swallow, hanging partly out of its mouth.

Most of the species are exceedingly active, though they spend much of the day, if clear, in a state of repose. This great activity requires a corresponding supply of food and degree of respiration; and accordingly, the feeding and the breathing apparatus are both well developed. The teeth are not of very large size in any of the species, but they are numerous. In the trouts, which are the best supplied in this way, there are five rows of teeth in the upper part of the mouth and four in the under part. The middle row of upper teeth is on the vomer, or central bone, and extends the whole length, but the salmon have fewer teeth on this part. The next rows are on the exterior margins of the palatal bones, and extend to the point, having, in all, the shape of a horse-shoe. The remaining rows are on the maxillary bones, nearly parallel to the last mentioned, and also meeting in the front. The bones of the lower part of the mouth are so placed as to fall or lock between these when the mouth is closed. There are two rows of teeth upon the tongue, and a sort of groove between them which receives the teeth on the vomer, and the remaining teeth are on the inferior maxillary bones. All these teeth, but more especially those upon the vomer and the tongue, have their points directed a little backwards. They are all prehensile teeth, and the middle rows are more strictly swallowing teeth; but the whole armature of the mouth is such as not to miss a very small object, and to be capable of holding one of considerable size. They can swallow with great rapidity, and thus can fare well upon minute animals. Their power of swallowing is farther increased by teeth on the bones of the pharynx. Indeed, though all these teeth are prehensile, they have more of them than any other family of fishes. When the mouth is open, the lower jaw seems longer than the upper one, but it shuts with a motion obliquely backwards, so that it closes within the upper one. This motion farther assists in the operation of swallowing; and perhaps there is no animal that can swallow so often in the same time. The stomach is ample, and furnished with many cæcal appendages. The air-bladder has generally a communication with the gullet at the upper extremity. The gill-lids and flaps, upon the freedom of action in which the degree of breathing in fishes much depends, are remarkably well made out; and some of the species, the salmon especially, have more blood in proportion than many other fishes.

To enter into the details of this very abundant family would require many times the space that we can afford for this article, and even then there are great uncertainties, not only about the species, but about the genera, that have been proposed by some of the writers on the subject. This arises in great

part from that adaptation to circumstances, and modifications by them, of which we have given an account. There are some perplexities among those which are found in Britain, and these are greatly increased when we come to the continental ones. We must, therefore, confine ourselves to rather a limited enumeration, and to notices as short as possible—premising that, in our language, the whole are called either salmon or trout, though the local names, even for the same species, are often many, and the local differences not few.

Salmon (*Salmo salar*). This is the fish, *par excellence*, of the whole family, and one which is exceedingly abundant. When in the very young state, it is the "smoult," or "smout," the meaning of which is "little one;" when it acquires more size, it is a "grilse," or "gilse;" and when it comes to the full colour and flavour of its flesh, it is a salmon. The characters of which it partakes, in common with the rest of the genus, are: the body scaly; the head smooth; the back, with two dorsal fins, the first of which has jointed rays, and the second is a fleshy lobe; the ventral fins nearly under the first dorsal; the teeth as above stated; and the rays in the gill-flap from ten to twelve, but not constant in the same species, or both equal on the two sides of the same individual.

The form of the salmon is elegant, finely adapted for getting through the water; and, when it first comes from the sea, there is a peculiar metallic lustre on the covering of its body. This is common to it and the others which migrate, and would at once distinguish them from the species which reside constantly in the fresh water, even if there were no other differences between them. At this time the head and back are bluish black, passing gradually through lighter shades to silvery white on the belly. The dorsal, pectoral, and caudal fins, are dusky black, with the exception of the second, or fleshy dorsal, which is of the same colour as the part of the back to which it is attached. The ventral fins are white on the outer side and blackish on the inner, and the anal fin is wholly white. When they first quit the sea they have dusky spots on the sides above the lateral line, more numerous on the females than the males, but these wear off in the fresh water; and in time the lustre also decays so much, that, in their exhausted condition after spawning, they are called black fish. The teeth are short, but stout and pointed backwards, and there are seldom more than two, and often only one, on the vomer. The posterior outline of the gill-lid is more rounded than in the other species, and the lower line of it curves more upward at the rear. The dorsal fin has thirteen rays, the pectoral twelve, the ventral and anal nine each, and the caudal nineteen. In the fry the tail is rather deeply forked; in the grilse the termination is concave; and in the full-grown fish it is nearly square over. The body is long, with nearly the same curve in the upper and under parts, and the lateral line straight and widening between them. The head occupies a fifth part of their whole length, and the beginning of the dorsal fin is exactly midway between the nose and the tail, with the ventral fins under the middle part of it.

The whole economy of the salmon is highly interesting, and it has the advantage of being better known than that of almost any other fish. In noticing it, however, there must not be any very precise reference to time, because that varies not only with the situation of the river and the season, but with different fish the same year in the same river.

They appear first in the offings and lower parts of the estuaries, the females before the males, and the grilse before the full-grown fish. The young ones, and a few of the old, are found in the lower parts of the rivers before all those of the former year have descended. At this very early time, although a few fine fish are sometimes obtained, the fishing is not judicious, because the descending fish are apt to be taken along with the others; and this is injurious to the fishery, and also the cause of unwholesome ones being sent to market. As they are then scarce, and only obtained in particular parts of the rivers, they bring a high price; and as it is fashionable to have them, and all buyers are not judges, many bad ones are disposed of; and though they are not absolutely poisonous, people often pay a high price for suffering the luxury of a salmon in bad condition. They continue to come during the summer months, and those which make their appearance in the estuaries during the summer months are always both the largest and the best. If the river is not interrupted, they ascend to a great distance from the sea pretty early, though they are always the worse the further that they "run" as it is called. If they do meet with interruptions in a river, the water of which is favourable for them, they make unwearied efforts to overcome these obstacles. When the drought is great, and the river very low, there is comparatively little stir among them; but when the rivers are swollen by rains, which is often the case in the mountain districts even in summer, they are more on the *qui vive*, springing at the breastworks of the cascades in one place, and taking higher leaps than hunters, and darting up the temporary rapids in others. Their spring is of course taken from a lateral bend of the body, the caudal fin laid flat being the starting point. Their passage up the temporary rapids is not so easily observed, as these are generally so foul and foaming that a salmon can hardly be seen, unless when it springs out of the water. There are, however, some very peculiar places of the rivers, generally about the places at which these issue from the mountains, where vast numbers of them accumulate, waiting the rising of the waters. In some of them the current has won for itself so peculiar a channel that the salmon cannot leap at the fall when the water is low. The pools at such places are often very deep, and partly under the projecting rocks. Basket-nets at the end of long poles are used for catching them at such places, and many are caught; but the fishermen sometimes fall in and get rather an unpleasant bath. When there is an insurmountable fall, not very far from the sea or a river of any size, with a large pool, they collect in great numbers, and continue their fruitless leaping for a long time, till at last they commence spawning. Rivers of this kind have salmon very abundant below the fall, large in size, and of excellent quality. Except the leaping at the breastwork, which is probably not very often tried by the same individuals, their summer labours are shorter and less violent than where they can range further up the river; and thus they can spend a longer time in the sea, the situation in which chiefly they gain both size and flesh. Where they accumulate in such numbers, they have many enemies. Otters and probably foxes, and even wild cats, attack them; and

the others are said to get so dainty in such places that they merely eat the tidbit, and leave the great bulk of the body. Man comes too with spears, and grapnels, and various other engines; and the treacherous practice of "burning the water," that is, holding a torch over it, which at once shows the salmon and bewilders them. This last operation is of course performed during the night only, and they who engage in it must lay their account with many a ducking; and besides this, the practice is illegal. By one or other of these means, many a female salmon is widowed over and over in the course of the season. The females are the suitors, and they fetch the males, one at a time, from the deep to the bank or run in which the trench for the young is to be made. The poacher (for none but a poacher would do it) spears the male, and the female goes and fetches another.

The spawning takes place in the autumn, but the time varies, though the mode is in all cases nearly the same. The pair make the furrow with their snouts, working with their heads to the stream; for though they can descend a current with ease and safety, they cannot "hang" in it with the head downwards, or the water would get under the gill-lids, entangle the gills and choke them. The time of spawning takes on the average about ten days, the large ones taking the longest time; and after it is over they go into the deep water quite exhausted. The time that the eggs remain in a state of repose varies with the river. Three months may be about the average time in Britain; but it varies with the place and season, the hatching of the eggs being produced by external causes. In consequence of this, though the eggs are deposited at very different periods of the autumn, some, in fact, in the end of summer, and others not till the beginning of winter, yet they are all hatched at the same time, that is, in the same part of the river and the same season. That this must be the case, must appear at once to any one who thinks for a moment on the subject. That the eggs should remain inactive in the bank or run in which they are deposited by the parent fishes, whether that period be three or four months, or even longer, which it is in the rivers far to the north, tends in no way to ripen or bring forward the eggs. They remain perfectly unchanged until the warmth of the ensuing season has acquired the strength necessary for stimulating them; and if that were to be delayed for a year, or for many years, an unlimited number indeed, there is no reason to suppose that their fertility would be in the least affected. There is, in fact, an *experimentum crucis*, which has been actually made, and which goes very far toward establishing the point. It is a general law of nature, to which we believe there is not one exception, that when any natural operation can be hastened by one mode of treatment, it can always be retarded by the opposite mode. Now the eggs of salmon, in their unaltered state, have been put in water, exposed to a moderate temperature, and thereby hatched in a very short time. In the natural state they do not require above three or four weeks; and perhaps the time required by artificial treatment is shorter. That, however, is not a matter required for establishing that there is no definite time by the kalendar between the depositing of the eggs by the parent salmon and the appearance of the young fry. When deposited they are wholly left to the care of general nature as a stepdame, and, of course, the time of their coming to life depends upon her. It must not, however, be supposed that all which are in the same run, or even in the same spawning-bed, must come to maturity in the same hour, or even in the same week. The eggs are many, and they are piled upon each other, so that the heat of the season cannot act equally upon them all, and therefore it is impossible that they should all come in a moment without involving the most unphilosophical doctrine, that causes differing in power or circumstances, can produce effects exactly equal, which would be a virtual destruction of all reasoning from experience. The young salmon remain for a little time in sand and gravel, supported by the remains of the egg which still adheres to the abdomen, and not requiring any other food. But this state continues only for a few days, and then they bore their way upward and through the sand, "spring up like young onions," as we have heard a very intelligent salmon-fisher say. At this early stage they are about half an inch to an inch in length. Their earliest food, after they "come off the egg," is not very well known, but they cannot be in much want, because, by this time, the small life with which the waters swarm in such abundance, comes into its greatest activity. They grow rapidly, attaining a length of three inches during the first week or ten days. The head, and especially the eyes, are the parts first developed, and they are so large in proportion to the rest, that, according to our knowledge, an infant salmon is not handsome. This early maturity of the eyes, shows us that the young must depend chiefly on the sense of sight in finding their food. Indeed, it is the sense of the fishes through life, and it is probable that they have no other seated or local and appropriate organs which have any great degree of acuteness. That they have taste or smell, both the structure and the fact lead to show; the hearing of fishes is an obscure matter, and probably in a great degree merges in the general muscular sense of the body, which is very keen in the whole family.

The very young salmon have dusky crossbars along the sides, the same as are seen on parr; and probably the whole family have the same when very young; but they go off in the majority before these attain any considerable size. This is of some importance among systematic naturalists, who wish to be precise in species; but it is of small utility in those general views which are most interesting to the public. Granted that they all have these bars when young, and that the parr is the only species that retains them: What follows? That parr is the "typical species?" It would be difficult so to persuade any one who has seen a salmon or even a trout.

The whole matters of the migration to the spawning ground, the passiveness of the eggs during the cold season, their ready obedience to the returning heat, and all the other movements connected with the operation, are most striking instances of natural adaptation. The salmon resort to those places where their eggs are secure from destruction by the variable weather of a long spring, which would call them into life during the blink, and leave them to perish in the blast. Where they are deposited, the warm season comes late, but for that very reason they arrive at maturity sufficiently early for enabling them to maintain their ground. This is one of the reasons why the salmon is so much a fish of the cold northerly places; for though there are a few in the

there are not many, and they are chiefly in those rivers which have their sources in cold and bleak districts.

After the present fishes have performed their grand work in the general economy of the system of life, by nursing a succession of future salmon, they rest for a little in the upland pools; and then descend, first by very short stages, and never with that vigour and animation which they display in ascending. Their descent is in the winter, or the very early spring, and the very same sensibility to the weather which makes them show themselves on the ascent, by being on the shallows or near the surface, sends them into concealment on their descent. The air is then much colder than the water, and the shallows are much colder than the depths, which is the very reverse of the state of things when the fish come most abundantly into the rivers. Their food is also *down* in the winter, and the very early spring, and *up* when the season is advanced, by the very same law of nature which regulates the movements of the salmon. These descents are thus from pool to pool, and as they pass they keep the deepest parts of the channels. The fish are weak and exhausted, unable for much exertion and unwholesome as food, while they are descending; and nature harmonises with them, so that they reach the estuaries with little diminution of their numbers, compared with what they sustain on the ascent. In ascending, too, they have the current to contend with, though the fact of their keeping near the banks helps them in their ascent, by giving them the advantage of the eddies. But in descending, when they are weak they have the advantage of the deep water, and they have it the more from keeping in the stream.

These adaptations, though only part of what are to be met with in the whole of nature, have much of very pleasing instruction in them, if our limits would permit us to point it out; and probably there are few subjects of a nature so very familiar, which are better calculated to show man the advantages of his situation, and the means of turning those advantages to account, than the economy of the salmon. If all those that enter a good salmon river were to spawn there, and all the eggs were to come to maturity, there would not be room, far less food, for the young. Thus when they are in the very best condition, they come into the situations where man can most easily capture them and turn them to account as an article of merchandise. And they come so much loaded with wealth, that though nearly ninety-nine out of every hundred were to be taken, the remaining one would replace the waste more than a hundredfold. Therefore, besides the most valuable and inviting store which they offer to man, there is still a great surplus for the general purposes of nature; and there are many animals in and upon the water which would perish of want if it were not for the supply afforded them in the eggs and the fry of the salmon. We may mention one—the Dipper, which is often found on the rocks and runs of the mountain streams, caroling as blithely as a lark in the dawn of the spring, while the snow on the mountain yet remains pure and unspotted in its whiteness; but were it not for the eggs of the salmon, and other fishes of the same family, the dipper would be mute and motionless.

In this manner do the productions of nature support each other, and one race actually has its own preservation in the supporting of another; and though man as an intellectual being cannot be said to be wholly within and under the laws of this wonderful system of physical nature, yet the system is so adapted as not only to include him as a member, but actually to measure his enjoyment in proportion as he can bring his intellectual powers to bear with rational knowledge and proper effect upon that part of the system which is wholly physical. Look at any natural production, animal or vegetable, which man has with proper knowledge of its nature, taken, we will not say under his *protection* (for protection is of a higher order), but under his management; and say, whether improvement and increase have not been the invariable results. Are there fewer sheep and oxen, because they are used largely for food, or fewer horses because they are worked in England, than there would be if they were all left to nature, and man were a naked savage in the woods? Certainly not. It is the ignorant man, who comes to the rest of nature with only his physical adaptations, as if he also were a beast, that spoils and depopulates nature: the man who acts with knowledge improves and multiplies; and wild nature partakes in the blessings of civilisation.

When the descending salmon reach the brackish water in the estuaries, which is the very time when life in that most fertile of all situations, is in the prime of its activity and abundance, they tarry for a long time, and regain their flesh and continue to increase in size. It is probable that the young of the year do not go very far below the limit of the brackish water, for they begin to ascend at an early period of the season. They are obtained of two or three pounds weight about the end of June, and much more than that in August; and they continue to furnish a supply at the time when older salmon are not fit for the market.

Perhaps the salmon go farther out to sea as they get older; but still they cannot go very far at any time. They are not pillager sea-fishes, or properly sea fishes at all,—they are fishes of the streams, the estuaries, and the shore. They are also not bottom fishes; for the soft-finned bottom fishes are formed for ascent and descent, by having the ventral fins as far forward as the pectorals; whereas all the salmon have them abdominal, and are thus formed for straightforward motion. Salmon cannot therefore go to those depths of the sea which may be regarded as the utmost limits of fertility at the bottom. The bottom fishes then all have spinous fins, generally fit for being weapons; great heads, and large eyes directed upwards, and the lateral fins concentrated on the fore part of the body. The salmon have small heads, and small eyes directed laterally; and they are but little fitted for motion in ascent or descent, although finely formed for progressive motion.

From these circumstances, or rather from the induction of those to which they lead, there may be drawn one of the most important conclusions connected with the whole economy of the sea. We have no room for the expansion of these; but the hints which we have given may render them easy to any one; and the result is this;—the salmon which are bred in a river can never go to any great distance from that river, or pass their time at very great depth in the sea. They very speedily regain their flesh in the brackish water; therefore the conclusion is, that if the habits of salmon were properly known, we might have *an uninterrupted supply of salmon, in the very best condition, all the year round.*

There remain three other very interesting subjects connected with the salmon, of which, however, we can only mention the names. First, anecdotes of salmon, some of which are very curious; secondly, the catching of salmon, many ways of which are equally so; and thirdly, the progressive history of the laws relating to salmon-fishing, in which there are to be found some of the most matchless instances of human cupidity completely caught in the net of human folly, that ever helped to render the statute-book the most splendid monument of blundering that is to be found upon earth,—we had almost added—or in the sea; but a single foot of that puts an extinguisher upon the most magnanimous of land-fools.

We have exceeded our limits, in consequence of the attractive nature of this archon of the waters; and yet we have barely begun what we could have wished to say. This is, however, the only opportunity which we shall have of "serving up a salmon" to our readers; and we could have wished it were "better done," as underdone salmon is unwholesome. We refer the reader to Yarrell's *admirably dressed fishes*, for a synopsis, reserving to ourselves personally a few points, and a very few, upon which we are at issue with him, natheless the *recherchéness* of his *cuisinerie*.

Salmon Trout (*S. truta*). Though this species is not entitled to rank with the salmon, either in interest or in commercial value, it is unquestionably worthy of the second place in the order of value. In colour it is not very unlike the salmon; and in many instances it passes for small salmon or grilse, and for the table it is certainly not inferior, we should say it is superior to the latter; but any one who has seen them together, can be at no loss in distinguishing them, even if they should be exactly of the same size. Besides the particular differences, of which we shall take some notice, there is a *je-ne-sais-quoi* difference which strikes one at first sight, but which it is not easy to explain in words. Upon looking at them one would at once point to the salmon and say, "This fellow is the better swimmer." The head is more tapering; the muzzle more pointed; the body more stretched out; and the fish is better formed. The caudal fin especially, which is the grand organ in swimming, is considerably smaller, and the fleshy back which forms its base is more slender. The difference, however, is in the length of the rays rather than in their number. The caudal has the same in both; the pectoral and anal have each a ray more, and the dorsal has a ray fewer than in the salmon. The spine also has only fifty-eight vertebræ, while that of the salmon has sixty. In fact, however large and coloured like a salmon it were, if one at all acquainted with fish were to see it lying on its side, he would at once and without hesitation say, "that's a trout;" although most likely the only explanation he could give would be, "it is more like a trout than a salmon." The contour is not so light and elegant; the fish looks more lumpy; the colour is not so pure, either in the bluish or the silvery part; and the spots on the side are smaller, more defined, and some of them come below the lateral line. There is also a considerable difference in the posterior outline of the gill-cover, which forms a sort of parabola, not a circle as in the salmon. The scales, too, are smaller, and not so free at their hind edges. The examination of the mouth presents other differences; and leads to the conclusion that there must be some difference in the food,—that the food of the trout consists of smaller substances than that of the salmon. The teeth of the salmon are larger in proportion; but they are less numerous in all parts of the mouth, and there are only one or two on the vomer. The vomer of the trout is toothed for a considerable part of its length; and the teeth in the other rows are closer together, though smaller. When the salmon is in the offings of the estuaries it returns with the flood to feed on the sand larmer which then comes up out of the banks, whereas the food of the trout is the sand hopper and other crustacea and mollusca which are nearer the land.

It should seem that, altogether, the salmon trout is a fish much more confined to the line between the ebb and flood, coming and going with the water, and not, at least in some places, passing to any considerable distance up the rivers. In many places it does indeed ascend the rivers; but certainly not to such a distance from the sea as the salmon, though it is more plentiful in the estuaries, on the shores, and in the lower parts of the rivers than the salmon. Its flesh is not quite so rich as that of the salmon, but it is very good, and like the other always the better the nearer the sea that it is caught. Those which are obtained in the sandy bays where there are no rivers that they can ascend to any distance, are hardly inferior to salmon of the same size; and their abundance, and the fact of their being met with at places where there are no salmon, are additional recommendations of some importance. The quantity in which they can be obtained in some of these bays is perfectly incredible to those who have not actually seen it; and the take, by one haul of the net, exceeds that of the salmon in the very best pools of the shoal rivers, where the fish are stopped by falls. Though not unknown, they are by no means very numerous, on the southern coasts of Britain; but on the west coast of Scotland, and especially among the Hebrides, and on many parts of the coast of the west Highlands, they literally swarm. On the east coast of Skye we have seen a large boat-load captured in little more than one hour; and the last haul as plentiful as the first. They were not in one bay, but in every bay; and yet on that particular part of the coast, there is no stream larger than a brook, and these are not ascendable beyond a few hundred yards; nor was there any reason to doubt their being equally numerous in all the islands where there are eddies. What may be the case now, we know not; but at that time they were but little heeded. There was no market for them in the fresh state, and nobody to eat them; and the salt duty prevented them from being cured. It was with no small trouble we could get one boat load given away, as any one who cared for them could have them fresh out of the sea when he pleased. The neglected wealth of these western seas, at the time to which we allude, was inconceivable; it may be better now; but we have doubts.

Familiar as this fish must be to all who live near the sea on the coasts where it is so plentiful, there are some mystifications in its history; for there are two, a larger fish with redder flesh found more in the estuaries, though never far from the shore, and a smaller one with the flesh still reddish, only much paler than that of the other, which is found chiefly in the lower parts of the smaller rivers, or in the tidal water immediately at their mouths. This larger is called locally the sea trout, or sometimes the red sea trout, alluding however to the colour of the flesh, not of the surface. The dusky black on the upper part has a greenish tinge, and there is a shade of purple

in the spots. In size and weight it varies considerably,—three or four pounds being about the average, though some are met with weighing fifteen or more. This one is a thick and compact fish, with the curve of the back nearly the same as that of the belly, and answering to the characters usually given to the sea-trout.

The small one is more uniform in size, at least at the same place and time, being in general about a foot long. It is thin and not nearly so much arched in the back as the large one. The upper part of the body has a greyish instead of a greenish tinge; the under part in both is white, but this one has much less of the silvery or metallic lustre, though enough to procure it the name of sea-trout, whatever other it may receive. It is found in smaller streams than the larger one; but it does not run far; and it seems to spawn earlier in the season than the other. Smaller ones are met with about the upper part of the brackish water of the streams in the earlier part of the season; and one or other may be had, not far from the same locality, all the year round, or nearly so. The form and armature of the mouth are the same as in the larger one. There are we believe sometimes differences in the number of rays in the fins; but when we find some of the salmon family with more rays on the gill-flap on the one side of the head than on the other, we must hesitate before we admit the number of rays in fins as a very definite specific character.

The small one gets different names; and these have perhaps, contributed to the erecting of it into a species which has been done. But smault, grilse, and salmon, are also different names, and yet we know that they mean only different ages of the very same fish. This is not the only assistance which the analogy of the salmon affords us here; for the habits of the whitling, as it is called in some places, or the white trout, as it is called in others, bear very nearly the same relation to those of the larger sea-trout that the manners of the grilse bear to those of the salmon. It seems, therefore, that this small fish is really nothing else than the sea-trout of the first year; and its being so is corroborated by the fact, that it is not found excepting upon places of the coast where the other is also found, only they are not both met with in the same spot, or at the same time, which is also the case with salmon and grilses. The only conclusion to which we can fairly come in the meantime therefore is, that these are only one and the same species. This is the conclusion at which Mr Yarrell arrives, from a careful comparison of this supposed species of salmon-trout of the first year.

Bull Trout (*S. eriox*). This species, which from the colour of the upper part is also called the grey trout, is the only remaining British species which is migratory between the sea and the fresh waters. In the form of the head, the projection of the under jaw beyond the upper when the mouth is open, and in the adaptation of its form for swift and long-continued swimming, it resembles the salmon more than the sea-trout does; but still the air of it is quite different from that of the salmon. There are also some structural differences. The tail at the insertion of the fin is thicker than in either of the others; and the fish altogether seems rougher and coarser. The outline of the gill-cover is straight behind and under. The dorsal fin has a ray fewer than in the salmon trout; and the pectorals and the anal have a ray more. The spine has a ray more than in the salmon trout, and one less than in the salmon. The teeth are rather larger than in the salmon trout, and there are not quite so many on the vomer. Along with its coarser appearance, it appears a more vigorous fish than either of the other two, and anglers find it stronger in the water. It grows to a size and weight intermediate between the salmon and salmon trout, being sometimes met with three feet in length. When of that size it weighs about twenty pounds; but specimens of such magnitude are of rare occurrence. It is not so generally distributed as the salmon trout, and is not much seen except in the rivers. In some places it is called the sea-trout, indiscriminately with the salmon trout; and the young of the year is also called the whiteling. It is probable, indeed, that the small ones referred to in noticing the salmon trout may consist of a mixture of the young of both species, for externally they are very like each other; and the colours even of the adult ones, when out of the breeding season, are not very different. When they come to table, however, there is a wonderful difference between them. The flesh of the bull-trout, even when in the best condition, is only dull yellowish white, and that of the young ones is dull white. In both states it is comparatively juiceless and flavourless; and therefore it is not in such demand at the first-rate markets as to render fishing for bull-trout much a matter of commerce. Accordingly, it is left to the anglers, who find it earlier in the waters than any of the other migrants of the family; and though it is not the very best prize for the pot-fisher, it is one which affords a good deal of wholesome exercise to those who fish for sport. It has not the weight of a "prize" salmon, and thus it may not be so difficult to land; but it is more vigorous when struck, and dashes, plunges, and leaps, with so much muscular vigour, that it can be kept only by the best tackle handled in the best manner. It is, however, easily *found*; for it is one of the most voracious of the family, and not so wary as the common trout, which, after all, is the prince of the family for *fine* fishing. In fishing for bull-trout one does not require to be very particular as to the fly that is on the water; for fly or bait, it will bite at any thing; and so determinedly, that it can be struck without much difficulty. It also admits of stronger tackle being used than the other *Salmonidæ* of the rivers; and thus its voracity furnishes at least part of the means of overcoming its strength. In the breeding season, or rather preparatory to it, which is the time of blooming with fishes as well as with flowers, there is a difference in the colour of the males and the females,—the former being reddish brown on the back, and the latter dusky grey; but at other times both fade to dusky black, in which state their external colour is very like that of the salmon-trout. We believe that this species is more common in the southern or middle parts of the island than in the northern ones; and even though its flesh were of better quality, it is doubtful whether very profitable fishing for it could be established.

It is by no means improbable that the *Hucho* of the Danube and its branches may be the same as the bull-trout of this country, though there are some differences in the lateral spots, and the muzzle is said to be more pointed. There are not, however, greater differences than are known to be produced by climate in some of those members of the family with which we are more familiar. The foreign salmon are, how-

ever, in many of the species, puzzles which nobody can explain; and we have not room for the explanation, even if we could give it. The species that we have shortly described are the only migrant salmon whose history is well made out, and they are also the only ones which are of interest to the English reader.

On some parts of the continent there are said to be salmon which are cut off from all connexion with the sea, as, for instance, in the Rhine and its branches above the great fall of Schaffhausen, and also in some parts of Scandinavia, where there are cataracts near the sea. Analogy would lead us to suppose that there should be something analogous in the American lakes, and the streams which fall into them above the fall of Niagara; but these are subjects the investigation of which is difficult. It is no violence to the analogies, however, to suppose that the migrant species could live wholly either in fresh water or in salt.

Common Trout (*S. fario*). This is the most common, the best known, the most varied, and, in some of its varieties, the most beautiful of all the species; and we may add, that in the pleasure which its capture affords, and the quality of its flesh, it is far from being the least valuable. It is also a fish of the most pleasing manners, if the epithet can be applied to a finned inhabitant of the water. It is a very handsomely formed creature; its motions are lively and graceful; its disposition is energetic and brave; there is more speculation in its eye than in that of most fishes; it is susceptible of education, and evinces (an animal) feeling for kindness done. To see it in the water, one would conclude that it is the most timid creature in existence; and it betakes itself so quickly to its hiding-place, upon being seen, or rather, upon seeing any one approach, that one would not fancy that it could "hurt a fly;" but, for all this apparent gentleness, the pike itself is not more voracious. It is true that the trout does not stand accused of preying upon "geese and swans," as is sometimes alleged of the pike; but the trout is the more clever fish in the water, and also the more courageous; and instances are mentioned in which the pike has been beaten off the ground by the trout.

The trout is one of the best weather-wisers that inhabit the streams, and shifts its ground with very slight changes of light or heat. It does bask sometimes when in a state of repose, but never in very shallow water. Nothing can surpass the quickness of its eye, or the sensibility of its muscular feeling, or that general sense of the body which seems to detect the very slightest change, or even agitation, of the water. A shadow thrown on the water, the tread of one passing along the bank, many things which a man would not notice unless he were actually looking out for them, are seen or felt by the trout. This is one of the reasons why trout-fishing is so favourite an exercise; and, as skill rather than strength is required in it, it is one which any person may take. In consequence of this, there is seldom any good trout-fishing near towns, as the waters, if open, are poached by everybody, and, if preserved, by the owner and his friends, so that but few are left, and these few appear to get wary as their companions are fished out. To give a very minute description of the common trout is unnecessary, and could not be made general, as the fishes, from their great sensibility, vary with almost every stream, and every considerable difference of the soil through which the stream runs. The following, however, is about the average: the head shorter, and the nose more blunt, than in the salmon, and the eyes larger and nearer the point of the muzzle; the dorsal fin with three more rays than that of the bull trout, and all the others the same; the vertebræ only fifty-six in number; the fins larger than in the bull-trout; the teeth in all the parts of the mouth where the *Salmonidæ* have them, and those on the vomer extending the whole length of the bone. These characters are pretty constant, only in old males the jaws lengthen, and become curved. The colours vary much more; but the following are perhaps nearly the average in fine pure water: the upper part rich yellowish brown, clouded with darker spots of reddish brown, the ground-colour fading into bright golden yellow on the lower parts of the sides, and into delicate silvery white on the belly, but without any metallic gloss; about a dozen of bright carmine red spots along the lateral line, and a variable number of smaller ones, of the same colour, above and below; the soft fin on the back margined with bright red; the red appears to be the nuptial bloom of the fish, and gets duller at other times. In the younger ones, in very small and clear streams, the colours are paler, there are fewer of the reddish brown mottlings, and the red spots on the sides are more conspicuous. In dark waters, which contain peat or bog earth, the beauty of the colours is in a great measure lost. The back is greyish black, the flanks lead-colour, and the belly greyish white. The lateral spots on these are dull and dusky, and in some instances almost black. In the small ones, that are finely coloured, the flesh is pure white; and in the large ones it has a very slight rosy tinge, irridexent if the flakes are separated entire. The dark ones have the flesh a little greyish.

The largest and fattest trout are found in the rich places, but higher up the streams than salmon or the sea trout are found in abundance or of good quality. They prefer waters where streams and pools alternate with each other; and though they ascend to spawn and descend again, they are not very discursive. Of their size it is as difficult to speak with certainty as of their colour; and, indeed, the size of a fish stated in any other way than as a rude average of those of a particular locality, cannot be looked upon as specific. The size of the trout depends a great deal on the food which its pasture affords. As illustrative of this, we may quote a passage from Mr. Stoddart's "Art of Angling in Scotland."—"Fish," says Mr. S., "were placed in three separate tanks, one of which was supplied daily with worms (*lumbrici*, we suppose), another with live minnows, and a third with those small dark-coloured water-flies which are found moving about on the surface, under banks and sheltered places. The trout fed on worms grew slowly, and had a lean appearance; those nourished on minnows, which, it was observed, they darted at with much voracity, became much larger; while such as were fattened upon flies only, attained, in a short time, prodigious dimensions, weighing twice as much as both the others together, although the quantity of food swallowed by them was in no-wise great."

In so far as finding the best fishing-ground is concerned, there is a complete angler's guide in this passage, short as it is; and it also affords a means

of judging at what season the trout shall be in finest flesh. We speak, of course, chiefly of those smaller streams which are a good deal influenced by their immediate banks; for a large river brings more power of character along with it, and of course it is less affected by local causes. But, in streams of moderate dimensions, the presence of minnows in large numbers is always a sign that there are few or no trout to be got there. Minnows shoal only where the banks are shelving and the water shallow; and such places do not suit trout. Worms, too, only come partially into the streams, and those that do come are in great part from wet ground, and trout will not readily take them as bait. Trout never have their finest colour, or are properly filled up in proportion to their length, if there are not overhanging banks of kindly soil, covered with wholesome herbage.

There are perhaps more anecdotes of trout and trout-fishing than there are of salmon; and as a very large trout is a much greater rarity than a very large salmon, it is accounted a greater rarity. If delicacy of food is the object, the small ones, which have the flesh pure white, are preferable to any others; but in this case, as well as in other cases, greatness is, on account of its rarity, probably preferred to goodness. There is one large trout, of which we shall quote the notice from Mr. Yarrell, which seems to have been one of the Anakim of the species.—"A few years since," says he, "a notice was sent to the Linnæan Society of a trout that was caught on the 11th of January, 1822, in a little stream, ten feet wide, branching from the Avon, at the back of Castle Street, Salisbury. On being taken out of the water, its weight was found to be twenty-five pounds. Mrs. Powell, at the bottom of whose garden the fish was first discovered, placed it in a pond, where it fed and lived four months, but had decreased in weight, at the time of its death, to twenty-one pounds and a quarter." We have heard of very strange notices and noticeable things being sent to learned societies, and, among the rest, of a portion of the blade-bone of a sheep, which had been blackened in the earth, sent and received as "ditto" of the blade of an elk's horn; but we are far from supposing that there was any hoax in this great Salisburian trout. The close of 1821 was remarkable for its floods—enough to make the monarch of all the trouts mistake a rill for a river; and it is for this reason chiefly that we have noticed the fact of this one. There is no doubt that early winters, or late autumns, according to the climate, which are remarkable for rain-storms and floods, are equally remarkable for the migrations of some of the *Salmonidæ*. This is a curious point in the natural history of fresh-water fishes, and one which has not hitherto received the attention which it seems to be worthy of.

Among the supposed varieties, or even species, of the common trout, there is one which we cannot wholly pass over in silence, and that is the *Gilaroo*, or gizzard trout, which is met with chiefly in Ireland. The stomachs of the *Salmonidæ* are all, in their natural state, membranous, but these are understood to get into places where they swallow crustacea, and more especially mollusca, the crusts and shells of which are too much for a membranous stomach, and so the trout get a sort of gizzard to help them through with this more severe labour. In the specimens of *Gilaroo* trout, examined by Mr. Yarrell with his usual accuracy, there was found to be no increase of the muscular substance or power of the stomach, though the inner coat of that organ was indurated. It was found to contain in the stomach shelled mollusca, chiefly the *Cyclostomum impervium* of Draparnaud, a small whorled shell, which is very abundant on the shallow bottoms of many lakes. That the stomachs of these trout should undergo the change which has been observed, is one of the most remarkable instances of the dependence of the minor characters of trout upon the nature of their food. It is in Ireland chiefly that the variety of trout, having the hardened coat to the stomach, have been found, chiefly in lakes, or in the outlets between those lakes and the sea.

It seems, too, that there is a great tendency in trout to perpetuate, in the successive generations, the accidental changes which are impressed upon them, even though these are mere definities. It is said that many of the trout, in some of the rivers of South Wales, have the spine crooked a little in advance of the origin of the tail. In some parts of the Highlands of Scotland they exhibit other deformities; as, for instance, there are some in Lochaber, the black lakes, near Pitmain, in the valley of the Spey, which have the lower jaw of the same length as usual, but the upper one truncated and rounded, so that it is hardly the diameter of that organ in advance of the eye. The cause of this, or the kind of food on which these trout chiefly subsist, are not known; so prone, indeed, are the trout to change their appearance from what appear to us very slight causes, and often in cases where we can see no cause at all, that the natural history of them is an extensive subject, and one to which justice cannot be done in a work intended for the use of the public generally.

Trout are as delicate in their nature as they are susceptible of changes of appearance from natural causes. We have already remarked how they are affected, both in their colours and in the quality of their flesh, by the admixture of the water of peat bogs, which contains only a vegetable admixture; and they are still more affected by anything of a mineral nature. The common trout cannot be brought to bear salt water, or even water which is very perceptibly brackish; but whether the gills or the skin suffer the most in such cases is not known. It is probable that the skin suffers considerably, for all the marine *Salmonidæ* have a different cuticular appearance from the fresh-water ones; and the same may be said generally of most of the fish which range freely through these waters. In farther proof of this, it may be mentioned, that the migrant *Salmonidæ* lose their sea lustre after they have been for some time in the fresh waters. Any mineral impregnation is equally unfavourable to trout. The drainage of a mine is sufficient to destroy those of a considerable stream; a few lumps of quicklime thrown into a pool will soon kill all the trout; and they disappear from the brooks among the corn-fields when these are highly dressed with lime. Nothing is more speedily fatal to them than the water in which flax is macerated, in order that the epidermis may be rotted, and the fibres come easily from each other. In short, there is hardly one product of soil which can get into the waters which is not deleterious to these highly sensitive fishes.

Grey Lake Trout (*S. lacustris*). This is a large species, of sequestered habits, residing only in those

upland lakes which are of considerable dimensions, and not rising to the surface, as is done by the trout of rivers and pools. It has of course less inducement, as there are few flies to be found on the surface of a broad lake. Hence, till of comparatively late years, this species was supposed to be peculiar to the lake of Geneva; and even Cuvier, whom no one can accuse of any overweening disposition to change names, called it *Lemanus* after that lake. It is now, however, ascertained to be very far from a rare fish. Indeed, it seems to be one of the most widely distributed of the *Salmonidæ*, and one which is less affected by differences of locality than almost any of the others—we say differences of locality, for there is but little difference of climate or of season in the haunts of this fish. It tenants the great lakes which have deep water, and which may be said to have neither summer nor winter, as the heat affects them but little, and their temperature, even in the bays, never sinks to the freezing point. It has been found in all the great lakes of England, Ireland, and Scotland, which have been carefully examined, and even in the Orkney and the Shetland isles; and, from its appearing so far to the north as these, and also as far south as the Lake of Geneva, there seems to be every reason to conclude that it is very generally distributed among the great lakes of the mountain countries of Europe, and that *lacustris* is the proper specific name.

It feeds on fish much more than upon invertebrated animals, which latter are necessarily but few in the very deep lakes. Accordingly its flesh is of a very inferior quality, dry, tasteless, and of a kind of dull buff-colour. The smaller ones, however, which are found upon the shallows of such of the lakes as have banks running into them are rather better, and the flesh is nearly white. Being generally found in districts where the mass of the people have but few luxuries, it is considered a tolerably good capture. Those resident near the lakes set baited lines for it in the evening, and generally find fish in the morning, as the species is exceedingly active and voracious, and not in any way particular as to what it seizes. Those who have leisure for sporting sometimes angle for it. The young may be caught with the fly, generally on or near the shallows, or, at all events, at no great distance from the bank; but the full-grown ones keep the deeper water, and are rarely or never taken in this way. The mode of fishing for them is from a boat, with a line from the stern or a rod as it happens, and a weight to keep the bait at some depth, to do which it is also necessary that the boat should be rowed slowly. The bait is usually a small trout, and a strong tackle and several hooks are necessary, as the fish cannot be struck in the usual manner, and indeed does not require it. Even though it disentangles itself, it soon bites again, as if it would not be left behind; but the line and rod must be very strong, otherwise the fish will get away. People in crossing some of the lakes often put a grey trout line over the stern, and leave it to chance, and they are not unfrequently successful. We have seen the fish, at least so far as our recollection serves us, taken from some of the Highland lakes long before there was any notice of it as a Highland fish, but we prefer the account given of it in the fifth edition of the Encyclopædia Britannica, as that was given after the fish was better known. "When," says the able writer of the article Angling in that work, "in perfect season and full-grown, it is a very handsome fish, though the head is clumsy, too large and long to be in accordance with our ideas of perfect symmetry in a trout. The colours are, deep purplish-brown on the upper parts, changing into reddish-grey, and thence into fine orange-yellow on the breast and belly. The whole body, when the fish is newly caught, appears as if glazed over with a thin tint of pure lake colour, which fades away as the fish dies, and so rapidly, that the progressive changes of colour are easily perceived by an attentive eye. The gill-covers are marked with large dark spots, and the whole body is covered with markings of different sizes varying in different individuals. In some these markings are few, scattered, and of a large size; and in others they are thickly set and of small dimensions. Each spot is surrounded by a pale ring, which sometimes assumes a reddish hue; and the spots become more distant from each other as they descend below the lateral line. The lower parts of the fish are spotless; the dorsal fin is of the same colour with the upper part of the fish; it is marked with large dark spots; the pectoral, ventral, and anal fins, are of a rich yellowish-green colour, darker toward their extremities; the tail is remarkable for its breadth and consequent power. In adults it is perfectly square, or might even be described as slightly rounded at its extremity; in the young it is slightly forked, and appears to fill up gradually as the fish grows older.

This change of the tail, from being forked in the young, to square, or a tendency to convexity, in the old fish, is common to almost the whole of the *Salmonidæ*; and if the difference of haunt and habit attending it in its various changes were fully investigated, it would perhaps throw some light upon the use of the differences of outline in fins, a subject of which we at present hardly know any thing. The grey trout grow to a very large size, specimens being met with nearly or altogether three feet in length, and weighing twenty pounds or upwards; but these are caught but rarely, and that always with bait in the deep water. It is possible that the fishing of them might be carried on to a considerable extent by many float-lines similar to those used for white fish in the sea, only the impossibility of giving much motion to the baits upon such lines might be an objection to their use. The great objection, however, is the want of a market, and the unmarketable quality of the fish. It is proved by very general observation, that the people of remote places where fish are abundant and of good quality, will hardly take the trouble of capturing enough for their own use, unless they have the prospect of a profit from sale; and this, by the way, seems to be one of the chief reasons why so little was known of the fishes, even of our own islands, before the commencement of what may pre-eminently be called "The age of Natural History."

Grayling (*Thymallus vulgaris*). This species has the general characters of the family certainly; but they are much more modified than in any of those that have been hitherto noticed in this article. The characters are: the head and body elongated, and the back more curved in the outline than the belly, and not the two of similar curvature as they are in the genus *Salmo*, properly so called. The scales are marked by bands running the whole length; the scales are in longitudinal rows, and the lateral line can hardly be traced otherwise than by the straight

rows of scales; the fins are the same in number and situation as in the true salmon, but they differ in form and development; the dorsal is very broad, consisting of as many as twenty rays; the tail has the same number, but it is narrow and feeble, and much more forked at the end than in the salmon and trout, when they are of the same size; the mouth is also much less in the opening than in the salmon, and the teeth are comparatively smaller than in any of the trout. The fish is indeed very inferior to the proper members of the *Salmonidæ* in point of teeth, for it wants the two rows on the tongue, and those on the vomer are only one or two, very small, and confined to the fore part. The size is less than that of at least some specimens of all the species of the trout; for five or six pounds is an extraordinary weight for the grayling. The usual length is about ten inches or a foot.

All these characters show that the grayling is a feeble fish as compared with the trout, both as respects its powers of motion and its feeding; and it seems to be as delicate as it is feeble. It is not in respect of climate, however, that this fish is delicate, for it is found in the very coldest parts of Europe; and is perhaps more abundant in the rivers which discharge their waters into the Baltic than it is any where else; but it seems particular as to the quality of the water and the ground in which that water is situated. Mr. Yarrell says, "However fastidious in the quality of the water, or the choice of situation in the stream, the grayling is known to be, experiment has proved that this fish will live in ponds that have been newly made out of hard soil, or such as have been very recently and carefully cleansed out; but in those situations the grayling does not breed, and they will not continue to live in old muddy ponds."

This statement,—and all that the author of it advances as his own may be implicitly relied on,—throws a good deal of light upon the character of the fish in relation to its haunts, and shows that if the country is not one of a very peculiar character, the grayling can be nothing else than a trial fish, one for which we might seek in vain in mountain streams tinged with moss; in rivers wending slowly through rich countries, and depositing mud, or in ponds or stagnant waters of any description. Clear running water and a hard bottom are obviously the proper situation for the fish; and there are instances in which these circumstances confine it to a particular part of a river, without being found either higher up or lower down. This is the case in the river Dee in North Wales. There are plenty of trout in all parts of the Dee, from the lake of Bala to the commencement of brackish water in its estuary; but the grayling is confined to the part of the river between the lake and the town of Corwen; or, at all events, it is not found so far down the river as the vale of Llangollen, though there is excellent trout fishing.

The fact of its being confined to an intermediate portion of the Dee, which has very clear water and a hard rocky bottom without any deposite of mud, might have sufficed completely to prevent the formation of the opinion that the grayling is a migratory species, which has been stated by Donovan, and also by some of the continental writers; for all the *Salmonidæ* that visit the sea, are sure to be found in the lower parts of the rivers, whether they are in the upper parts or not; and there is really nothing in the Dee to prevent either the ascent or the descent of a fish, for though there are currents and rapids, there are no falls of any consequence.

The whole structure, economy, and nature of the fish are against the fact of its migration, and may make us very reasonably doubt the allegation of Black, that they descend to the Baltic in autumn. From the character of its fins, the grayling must be but a poor swimmer, even within the range where it is found; and Sir H. Davy ascertained that it cannot live even in brackish water. Besides, the grayling spawns in the end of spring and the beginning of summer, and is in the very best condition in autumn, when all the typical *Salmonidæ* are out of season. We must therefore regard the grayling as wholly a river fish, peculiar in its localities, and confined to them. England, and perhaps Orkney, are the only parts of Britain in which it is found, though in some of the rivers it is very plentiful; but we never heard of its being found along the whole range of any river from its source to the sea; it is always in the clear water on the hard bottom. Its food is understood to consist, in great part, of insects and their larvæ. Its flesh is highly prized, though some part of the estimation in which it is held, may be owing to the fact of its not being to be had, except at particular places; and some more may be owing to its particular fragrance, which slightly resembles that of thyme, and is the reason of the name *Thymallus* being applied. The grayling is taken chiefly by angling with the flies which are on the water, or baits formed of the larvæ which are deposited there; besides these, however, it eats the small-shelled mollusca; but, we believe it rarely preys on any kind of fish, unless mere fry, and probably not much upon these. The grayling is a distinct genus,

Parr (*S. salmulus*). This species has many more of the characters of the salmon and trouts than the grayling, and were it not that the body fins are much more developed, indicating a different mode of action in the water, it might pass for a little salmon, which is the reason of its having the specific name *Salmulus*. As long, indeed, as colour was considered to rank high among the specific distinctions of animals, this was regarded as the young of one or other of the migratory species, chiefly the salmon trout; nor have there been wanting some who have made the distinction of salmon parr and trout parr. Laws have been enacted too, or, at all events, measures taken to prevent the capture of this little fish, lest the number of salmon should have been thereby diminished. But if any one had attempted to identify a salmon, by asserting that he knew it from its being a parr, the party so doing would have been in the same predicament as the Highland witness, who swore to the identity of the gun, because he had "kenn'd her ay sin' she was a wee pistol;" and any one who had examined a parr side by side with a salmon or trout of the same size, would have seen that the one was an animal with all its organs fully developed, and the other was not. The head of the salmon smault is "infantine," if the expression may be allowed; the fins are all small and feeble, and the tail is narrow and much forked. In the parr, on the other hand, all the lateral fins are better developed in proportion than in the full-grown salmon, and perhaps the same may be said of the caudal fin, though that remains a little forked, and indicates that the parr is to act in the same parts of the waters as the young salmon, only not in the same manner. This is proved by the

greater power of the fins; for we never find power given by nature, unless the owner, in the average economy of its species, has occasion for it.

The reason of all this perplexity about the parr was, that they looked only at the colour of the fish, and not at the peculiarities of its organs. "There's saumons in them both," was one of Fluellin's proofs of the identity of the rivers of Monmouth and Macedonia; and "there's spots on them both," was the ground on which it was concluded that the parr and the fry were "both saumons." Mr. Yarrell has the merit of settling the point about the spots, by showing that they are upon the young of all the true salmon and trout, that they can be traced on the skin after they have disappeared from the scales; and it may be added, that the dusky blotches which are on the sides of full-grown salmon, are remains of the general marking on the young. We believe that these dusky markings on the sides are not found even in the young of the grayling, the guiniad, and the other species which depart more from the true salmon character in other respects. The family, however, want some further observation as to these and several of their other characters.

In addition to this, it has been proved again and again, that there are parr in places where neither salmon or trout is to be found, either young or adult, and *vice versâ;* and also, that salmon have been almost exterminated from rivers, without the slightest diminution of the numbers of the parr in them.

Still it is understood that the parr (small as it is, for eight inches is reckoned a very large one), is migratory, spawning in winter or in early spring, thereafter descending the rivers, and returning upwards in the summer. As a British fish it is very common in many of the rivers in the southern and warmer parts; but the number fall off as we proceed northwards, and they are not found in the very cold and high-situated streams of the mountains. The following is the description of the colour as given by Dr. Heysham: "Head green and ash-colour; gill-covers tinged with a variable green and purple, and marked with a round dark-coloured spot; in some specimens there are two of these spots on the gill-cover; back and sides, down the lateral line, dusky marked with numerous dark-coloured spots; belly white; along the lateral line there are from sixteen to thirty bright vermilion spots; the sides are marked with nine or ten anal bars of a dusky-bluish colour; dorsal fin with a few dusky points; colour of lower fins inclining to yellow."

The parr, as we might suppose from the great development of its fins, is a most energetic little fish, dabbling about in the water with great celerity, and small as it is, it is exceedingly voracious. Insects and larvæ, and probably small crustacea and mollusca, appear to be its chief food; and, as is the case with most fishes that feed upon this kind of aliment, its flesh is very good. As is the case with many species, it has different names in different localities; and as the parr have in some instances been considered salmon fry, salmon fry have in other instances been mistaken for parr. They are, however, easily distinguished by the times that they are in the rivers, as well as by the other circumstances that we have mentioned. They are found in the rivers after the salmon fry have all descended; and when the salmon return, even in the first year they are in the state of grilse, they are far larger than parr. The last mistake about these fish which we shall mention, is the allegation that they are hybrids, and as such all females. Neither part of this is true; they follow the general law of the family in their reproduction; and though they were hybrids, all hybrids are not females.

Charr, or Northern Charr (*S. umbla*). This is a lake fish, still preserving the salmon and trout characters in some respects, but differing considerably from them in others. These are decidedly lake fish, never descending to the sea, even if the outlet of the lake is short, and not going into the streams which feed the lake, unless these are clear with rocky bottoms, and then only for the purpose of spawning. They occur in the greater part, if not the whole, of the lakes of Westmoreland and Cumberland, in many of those of Scotland and of Ireland, in the lake of Geneva, and in various other lakes of continental Europe. It is, however, always in alpine lakes with rocky bottoms, and with the water clear, that they are found. They do not appear in any of the large pools of the low and fertile districts, and even those of the Welsh lakes are different from the English ones. They are not, generally speaking, very large fishes. They are met with as long as a foot and a half, or from that to two feet; but generally they are not found above half these lengths.

They are subject to considerable differences of colour and of lustre, the causes of which are not very well known, and this has caused them to be called by a variety of names, such as case-charr, gilt-charr, red-charr, and silver-charr; but there do not appear to be very real specific distinctions between those that are so named.

Charr are retiring fishes, and inhabit the deeper parts of those lakes in which they are found; and they feed chiefly during the night, so that the catching of them is much less certain than that of many other fishes of the same lakes in which they are found. Fly-fishing, expressly for the capture of charr upon the lakes, would be an employment of far more labour than reward; but one is occasionally taken by those who fish for trout, which is a proof that they do occasionally catch flies at the surface. They are far more certainly obtained, however, by a minnow bait, which must have a heavy sinker at a little distance on the line to carry it to a considerable depth; and even then the fishing is much more one of curiosity than of profit. In those places of the British islands where they are most plentiful, they are in the best condition in the early part of the summer. Soon after this, the operation of spawning commences; and if the streams which fall into the lake have rocky bottoms, they ascend them in considerable numbers, but never to any great distance; and if they find, after they have entered the stream, that it is not suitable for their purpose, they return, and seek for another better adapted for their purpose.

In form and in the relative proportions of the head and body, the charr are nearly the same as the more typical *Salmonidæ*, but the dorsal and caudal fins are rather further forward. The head is one-fifth of the total length, and the depth of the body at the thickest part a little more. The pectoral fins are small; the tail is deeply forked; and all the fins are of moderate dimensions, indicating that the fish is not of a very discursive character. The eye is large, the teeth small, and only a few on the anterior part of the vomer. The top of the head and all the upper part are, when the fish is in high condition, of a rich

brown. This becomes lighter on the sides, and passes into rich orange on the under part, which is also the colour of the pectoral, ventral, and anal fins, excepting that the first ray of the ventrals and the anals is white. The sides are marked with numerous spots of a red colour both above and below the lateral line. That line is nearly straight, but rises at the posterior extremity, so as to meet the upper corner of the gill-cover. The gill-covers are dull orange with a greenish and brownish tinge; the irides are bright orange; the dorsal and caudal fins brown, with a slight gloss of purple. The scales are very small and ranged in oblique rows across the depth of the body. When out of season, the colours fade or alter so much that some have described it as a different fish. The brown on the upper part has then a dull purplish hue, gradually becoming duller on the sides, which are silvery, and the belly is very pale orange. The most remarkable change, however, is that of the lateral spots, which are of a fine red when the fish is in good condition, but which fade to white when it is not. The gill-covers and the irides also change to a silvery hue at this time; the dorsal fin is dull brown, the caudal fin purple brown, and the other fins brownish red. In fact, the changes of colour are so great that one can hardly wonder that the fish in the two states has been very generally described as two distinct species; and as, in the time of its "bloom," or finest colouring, there are considerable differences that has occasioned the description of it as three species. In its brighter colours it is *S. salaclinus* of authors, and when the colours fade it is *S. albinus*. Dr. Fleming, in his account of British animals, has enumerated it as both, calling it by the same local name as the Welsh charr when in its gayest colours, and as such referring to the mountain lakes of Wales and Scotland as its habitat; and as the case-charr when out of condition, referring it then to Winandermere, as if it were found in that lake only. He has also been misled respecting the number of rays in the fins in both, making twenty four in the caudal, where there are only nineteen; eleven in the dorsal where there are thirteen; sixteen in the pectoral when the colours fade, and thirteen when they are at the finest, while there are twelve in both states; and ten in the anal in the one state and eleven in the other, when there are eleven in both. These blunders are, however, excusable, as the charr is a sort of Proteus among fishes, and has the branchiostigeal rays sometimes in different numbers on the two sides of the same specimen; and therefore we can hardly expect that the number of rays in the fins shall be constant.

Welsh Charr (*S. salvelinus*). This is the species which Fleming describes as the red-bellied charr. It is in shape a much more clumsy fish than the charr; but, from the development of its fins, it appears to be more powerful in the water. In Wales it is a very local fish, being found only in one or two of the lakes; and the fact of its being met with in the Highlands of Scotland wants confirmation. It is rather a small fish, not occurring of a greater length than about seven inches, but it is esteemed a very delicate one for the table, partly, no doubt, on account of its rareness. This circumstance may both explain and excuse the mistakes that appear to have been made concerning it.

It has some resemblance in the form of the body, and the development of the fins, to the parr when that is of mature age, and one can trace the same blotches across the lateral line as are in the parr. But the teeth are very different, there being very few on the vomer, still the other teeth are considerably larger than those of the charr of the north of England. The habitats mentioned for the Welsh charr are, the small but deep lakes of Llanberris and Cawellyn on the two sides of Snowdon, and a few other places in North Wales; but it is said to have been destroyed out of the lake of Llanberris by the discharge of the water from a copper mine into that reservoir, which is very likely, as none of the *Salmonidæ* could live in water impregnated with the discharge from such a mine.

The length of the head and the depth of the body in the Welsh charr are each one-fourth of the whole length of the fish, whereas in the other charr they are only about a fifth. The dorsal and ventral fins are also farther back; and all the fins, as already noticed, are much more produced. There are fewer rays in the dorsal, pectoral, and anal fins; and although the body is shorter in proportion to its depth than almost any other of the *Salmonidæ* have it, the number of vertebræ is greater, being sixty-two, while it is fifty-nine in the northern charr and sixty in the salmon. The whole upper part of the fish is greenish black, or very dark olive; the sides are olive on the upper part, passing into golden yellow below the lateral line, and again into reddish orange on the belly. The sides above the lateral line are marked with white spots, and upon and below it with red. The irides are hazel, the sides of the head and the gill-covers pale olive, the pectoral, dorsal, and caudal fins brown, and the remaining fins the same colour as the belly. From the brightness of the colours upon this fish, it is probable that they fade when it is out of season, as is generally the case in very brilliantly-tinted fishes. We have heard a red-bellied trout mentioned in some parts of the Highlands of Scotland; but, as we never saw it, we cannot tell whether it was this species or not. Those whom we heard mention it were not likely to pay attention to the most remarkable character—the numerous teeth on the vomer in the trout; and as the grey trout of the alpine lakes has the belly reddish orange in some of the specimens, it may have been the one to which the name of red-belly was applied.

Gwyniad (*Conegonus*). This fish belongs to another genus, of which there are various species or at least varieties on the continent of Europe, but they are not very clearly made out. The name groyniad means white, which is not undescriptive of the fish, though it gets different names in other parts of Britain. In its general form and in the arrangement of its scales, it resembles the grayling more than any of the salmon or trout, and it may be considered as a sort of intermediate link between the typical *Salmonidæ* and the herring family, having a good deal of the character of the latter.

This fish is found in some of the Welsh lakes, in those of Cumberland, where it is especially numerous, and, as the authorities say, in some parts of Scotland, though this is a little doubtful. In Ireland there is a fish something resembling it, but perhaps not the same; and there are others in various parts of continental Europe, and probably also in the lakes of at least some parts of North America. Wherever they occur, they are sometimes called fresh-water herrings; and though they have not the details of the herring character, they have something of the shape. It is a

fish which can be kept only a very short time after it is caught, and even then it is not of the very first quality; but the country people sometimes salt it as a store against the time when fresh fish cannot be obtained.

The spawning time is winter, or very late in the autumn; and the fish do not leave the lakes in which they reside, at least to any great distance, for the performing of this operation. The length of the groyniad when full-grown is from ten inches to a foot; the head occupies about one-fifth of the total length; and the depth of the body at the thickest part is rather more than the length of the head. The dorsal fin rises midway between the nose and the base of the tail, and the ventral fins are immediately under the middle of the dorsal. The tail is considerably forked. The snout is pointed, and the head of a triangular shape when viewed laterally. Both the upper and the under outlines have considerable curvature, but the upper one has the greatest. The pupils of the eyes are dark blue, and the irides silvery. The upper part of the body and the tips of the fins are dusky blue; this colour becomes paler on the sides; and the under parts, and also the gill-covers and sides of the head, are silvery. The usual number of rays in the fins are: thirteen in the dorsal, seventeen in the pectoral, eleven in the ventral, sixteen in the anal, and nineteen in the caudal. The variety found in Ireland, chiefly in Lough Neagh we believe, has the muzzle blunter, the dorsal fin farther forward, the anal fin with fewer rays, and all the fins generally of smaller size.

Vendace (*Coregonus Willoughbii*). This fish is of the same genus as the groyniad, and resembles it in a good many respects, but there are specific differences; and the vendace, as a British fish, is still more limited and local in its distribution. It is found only in the waters of Lochmaben and some other small lakes in that part of Dumfries-shire, into which tradition says it was imported by Mary Queen of Scots; and as there is some romance about the fish, and its dwelling is in a romantic and somewhat romancing part of the country, the probability is that it will not soon be given up. There is rather a curious coincidence between one of the cognomens of the lake of the vendace and one of those which have been the most celebrated for Welch charr; "the Money Loch" is one of the names of Lochmaben, for Burns says of the town—

> Margery o' the Money Loch,
> Whare lang she did abide;

and Cas-y-gedawl, the name of one of the lakes by the side of Snowdon, has a similar meaning. The vendace is not confined to the Castle Loch, or Loch of Lochmaben by way of eminence, but occurs in the neighbouring ones, though in no other part of Britain. There are species somewhat analogous in some of the lakes on the continent, but they have not been examined with such care as to enable one to decide whether any of them is precisely the same with this one; and indeed a fish of so changeable a family, confined to a narrow locality, may be supposed, if originally an importation, to have taken a character from its new abode. Sir William Jardine, to whom we owe an interesting account of it, the only good one that has been given from actual observation, conjectures that it may have been introduced by the monks rather than by Mary. This we think very likely, for the holy fathers were fond of every thing that promoted good cheer. It is said that they introduced the grayling into England; and, whether that was the case or not, we know that they were the first introducers of many of our best sorts of fruit trees, and of an improved breed of cattle.

Vendace is but a small fish, the female being usually under nine inches in length, and the male not exceeding seven. The following is an extract from Sir W. Jardine's account of it:—"In general habits, the vendace nearly resemble the groyniad, and indeed most of the allied species of the genus. They swim in large shoals, and during the warm and clear weather retire to the depth of the lakes, apparently sensible of the increased temperature. They are only taken (taken only) with nets, a proper bait not being yet discovered; and the fact that little excrement is found in their intestines has given rise to another tradition, that they are able to subsist without food. They are most successfully taken during a dull day and sharp breeze, approaching (as they then approach) near to the edges of the loch, and swimming in a direction contrary to the wind. They spawn about the commencement of November, and at this time congregate in large shoals, frequently rising to the surface of the water in the manner of the common herring, and making a similar noise by their rise and fall to and from (from and to?) the surface. The sound may be distinctly heard, and the direction of the shoal perceived, during a calm and clear evening. They are very productive. The lochs abound with pike, of which they are a favourite food; but their quantity seems in no degree diminished, notwithstanding that vast numbers must be destroyed. They are considered a great delicacy, resembling the smelt a good deal in flavour; and, though certainly very palatable, the relish may be somewhat heightened by the difficulty of always procuring a supply. During the summer, fishing parties are frequent, introducing some stranger friend to this Lochmaben white-bait; and a club, consisting of between twenty and thirty of the neighbouring gentry, possessing a private net, &c., meet annually, in July, to enjoy the sport of fishing, and feasting upon the luxury."

The opinion which Sir William mentions, not his own of course, for he knows better, but the current opinion of the place, respecting the abstinence of these fishes, which is often selected with regard to salmon and to others of this family, as well as of the somewhat allied family of the herrings, is in direct opposition both to the analogy and the fact. The analogy is that, wherever there is much energy of action in an animal, there must be a corresponding supply of food to support the waste occasioned by that action; and the fact is, that all the family are ravenous feeders; that there should not be much of the remains of the food found in the intestinal canal is more a proof of the digestibility of the food and the power of digestion than any thing else. Mr. Yarrell found a copious supply of food in the stomach, but so acted upon that a microscope was necessary in order to ascertain its nature; and then it was found to consist of various small *entomostracous* crustacea, with the remains of small worms, beetles and flies, showing that these fishes are not at least confined to one species of food. The crustacea are swimmers, and probably so are the beetles alluded to; and therefore the vendace may, like most of the lacustrine species of the genus, find their food while they swim in the water, without

often rising to the surface. The food is in very minute portions, but it is of the kind which is understood to be most nourishing for fishes, and productive of the finest flavour of their flesh.

SMELT (*Osmerus eperlanus*). This is a small species, but it is one which is held in high estimation. It is found in the estuaries, generally about the top of the brackish water, or perhaps a little higher up, but not in the offings or very much in the fresh water, though it spends fully half the year there. They ascend in autumn, and descend again about the beginning of summer, the spawning time being about March, though of course varying with the place and the season. They prefer the quiet waters where the bottoms are rich, and generally congregate in a small space, moving a little with the tide. Their food consists chiefly of the smaller crustacea; but they can be taken with fly, though the net is used in their capture, as it is in that of most of the shoaling fishes. The sea is not absolutely necessary, for they have been bred in fresh water ponds, and have succeeded well. They are generally about seven inches in length, but one now and then occurs of ten inches or a little more. The form is long and slender, the tail much forked, and the anal fin continued with short rays nearly to the base of the tail. All the upper parts of the body are pale greenish ash, and the under parts of a silvery white. The fins yellowish, with black dots on the extremity of the caudal. As is the case with many others of the family, they avoid impure water; hence they are found in the estuaries of particular rivers only, and if a river, from any cause, becomes very foul, they desert it not to return. They seldom go far above the brackish water, and rarely out of the tideway, which seems to have considerable influence on their food.

Such is an outline of the leading members of the salmon family which are to be found in Britain. A few more have been mentioned, and there are many more in the northern parts of both continents; but we have already exceeded our limits, and must take leave of them, with simply remarking, that in the pleasant season of the year they are among the greatest attractions of the waters.

SALPIGLOSSIS (Ruiz and Pavon). A genus of annuals and perennials from Chile. They have handsome didynamous flowers, and belong to *Solaneæ*. These plants are treated as tender annuals, that is, sown in pots in the greenhouse or frame, and afterwards placed in the flower-border to bloom.

SALSAFY is the *Tragopogon porrifolium* of Linnæus, a British plant introduced into the kitchen garden, and cultivated for its fussiform roots, which are used as a table vegetable.

SALSOLA (Linnæus). A genus of herbs, chiefly annuals, found wild in many different parts of Europe. They belong to *Chenapodeæ*, and in Britain are called saltwort, because the species grow on the sea-shore. In Spain the *Salsola kali* is extensively cultivated for the manufacture of barilla, as sea-weeds are for kelp.

SALTICUS (Latreille; ATTUS, Walckenaers). A numerous genus of spiders, distinguished by their elongated form, the comparative shortness and strength of the legs; the eight eyes arranged in a large quadrangle opened behind, the two central ones in the front row being large. These are wandering spiders which do not spin webs, and are to be observed on walls, palings, &c., in hot and fine weather; they are extremely active, and exhibit a very considerable degree of intuitive caution in the capture of their prey, which they seize by a sudden leap, "and therefore," observes Swammerdam, "nature has provided them as well as other spiders with eight eyes." The proceedings of one of these spiders is thus interestingly recorded by Evelyn, "which espying a fly at three or four yards distance upon the balcony where I stood, would not make directly to her, but crawl under the rail, till being arrived to the antipodes it would steal up, seldom missing its aim; but if it chanced to want any thing of being perfectly opposite, would at first peep, immediately slide down again, till taking better notice, it would come the next time exactly upon the fly's back; but if this happened not to be within a competent leap, then would this insect move so softly, as the very shadow of the gnomon seemed not to be more imperceptible, unless the fly moved, and then would the spider move also in the same proportion, keeping that just time with her motion as if the same soul had animated both these little bodies, and whether it were forwards, backwards, or to either side, without at all turning her body, like a well-managed horse; but if the capricious fly took wing and pitched upon another place behind our huntress, then would the spider whirl its body so nimbly about as nothing could be imagined more swift, by which means she always kept the head toward her prey, though, to appearance, as immoveable as if it had been a nail driven into the wood, till by that indiscernible progress (being arrived within the sphere of her reach), she made a fatal leap, swift as lightning upon the fly, catching him in the pole, where she never quitted hold till her belly was full, and then carried the remainder home." There are a considerable number of species belonging to this genus, the type being the *Salticus formicarius* of Latreille, a common British species.

SALVIA (Linnæus). A very extensive genus of herbs and undershrubs, found in all parts of the world. The flowers are, by abortion, diandrous, but they manifestly belong to *Labiatæ*. There are above one hundred and twenty species of sage. One is a well-known culinary herb, and some are so highly ornamental, that they are placed in the first rank of greenhouse plants. They are all easily propagated by cuttings.

SAMBUCUS (Linnæus). A well-known genus of herbaceous, and chiefly shrubby plants, natives of Europe and North America. They belong to the third order of the class *Pentandria*, and to the natural order *Caprifoliæ*. The elder is seen on every spot of waste ground, and yet it is cultivated in some places for its flowers and fruit. A cosmetic and ointment are made of the former, and a kind of wine from the latter.

SAMOLUS (Linnæus). A genus of small herbs, one of which is a native of Britain, and called brooklime. The flowers are pentandrous, and the genus belongs to *Primulaceæ*. If brought into the garden, they must be placed in a moist soil.

SAMPHIRE is the *Crithmum maritimum* of Linnæus, a British rock plant, so much sought after and prized as an ingredient in salads, and as a pickle.

SAMYDEÆ. A small natural order, containing only two genera, viz., *Samyda* and *Cascaria*, and of these there are fourteen species. They are tropical shrubs or small trees, with entire stipulate alternate leaves, covered with pellucid dots and axillary flowers

of little show. Some of the species of *Samyda* are pretty, but very rare. The calyx is of from three to seven sepals, coherent by their claws; the corolla is absent, or reduced to a thin torus that lines the bottom of the calyx; the stamens are definite, two to four times as many as the sepals, and exserted from the calyx; the filaments are monodelphous and subulate, either all antheriferous, or alternately fertile and barren; the germen is free or superior, one-celled, and many ovules; the style is filiform, and the stigma lobed; the bark and leaves of the *Samydæ* are said to be slightly astringent; and the leaves of *Cascaria ulmifolia*, when boiled, are applied in Brazil to wounds, and are there reputed an antidote to the bites of poisonous serpents. Some of both genera are in our stoves, grown in light soil, and increased by cuttings.

SANDERLING (*Calidris*). A genus of birds belonging to the long-billed family of the stilt birds, resembling the genus *Tringa* in most respects, excepting that it has no hind toe like the members of that genus. The characters are: the bill of mean length, straight, soft, and rather flexible, compressed at the base, depressed at the point, and flattened for the greater part of its intermediate length; the nasal grooves continued almost to the tip; the nostrils placed longitudinally in the sides of the bill; the feet slender, with only three toes, all directed to the front, and free their whole length. There is only one species of the genus, but it is found more generally distributed than birds of other genera containing many species, being common in all the northern parts of Asia, Europe, and America—in none of which places there seems to be the slightest specific difference, though there are climatal distinctions between very many other genera as natives of the eastern continent and of America.

Abundant as the sanderling is, the history of it is involved in considerable obscurity. It is most frequently seen along the shores in the autumn and winter, for it flocks at that season. In summer, however, there are a few that linger till the season is considerably advanced, and then may breed in the country, though where does not appear to be known. In the arctic countries they breed in great numbers, making their nest-holes in the sand, and depositing five or six eggs, upon which the female sits very closely.

The plumage varies considerably with the season, the age, and the sex of the birds; but the bill, the feet, and the irides, are at all times black. The summer colours are brownish-ash on the upper part and reddish-brown on the under; but the under part begins to get mottled with white in the autumn, and becomes entirely white in the winter, the white extending to the forehead, and also to a streak across the eye. Sanderlings, when they are with us, are always on the margins of the sea, or on the rivers at no very great distance inland. They live chiefly upon the small crustacea and mollusca, which they pick up between the wet and the dry. Thus they follow the tide on the sandy beaches, and communicate a lively interest to them at the time when the land is most desolate. They are light-looking birds, and also birds of powerful wing for their size. The length is about eight inches, and the extent of the wings about twice as much. When alarmed they rise in a flock, and escape by a wheeling flight.

SANDORICUM (Cavenille). An East Indian timber tree, belonging to *Meliaceæ*, and called sandal-tree. It grows freely in a mixture of sandy loam and heath mould, and is increased by cuttings made of the half-ripened wood.

SANDPIPER (*Totanus*). An interesting genus of stilt birds, of the long-billed family, and forming a link in that numerous chain of birds which have their general habitat, as it were, between the land and the water. They are all, it is true, land birds; for, though some of them can enter the water, none of them have the feet webbed for swimming. Their pasture extends from the solid bank, where water never remains to stagnate, to the sea within low-water mark, which is never dry. This pasture of theirs is, in general, covered with sand or gravel, though sometimes with sludge, and at other times with vegetation, passing gradually from the land character to the aquatic. In some situations it is miles in breadth, and in others it is only a line upon the perpendicular face of the cliffs, on which the water rises and falls, and where there is of course not footing for a bird.

One would be apt, at first thought of the matter, to suppose that this must be the most barren portion of the whole surface of the earth; but, so far is this from being the case, that it is really very fertile, and its productiveness continues the whole year round with much less interruption than upon the land. From its composition and surface, the sun exerts a great deal of influence upon it, so that, in almost every part of the world, it is the line of greatest average annual heat. Hence it produces an immense number of small living creatures, and these supply food for great numbers of birds, among which the sandpipers hold not an inconspicuous place.

The bill of the sandpipers is flexible in the basal half of its length, but it becomes firm toward the tip, with sharp tomia, and a nail on the extremity of the upper mandible which covers over that of the under one. This is sufficient for enabling the bird to break the crusts of those little animals upon which it feeds, while the flexible portion takes off the jar which would otherwise be given to the head when the bird searches among the sand and shingle. The legs are long, and have a garter or portion of the tibiæ, above the tarsal joint, bare of feathers; their wings are long and pointed, the first quill being the longest, and thus they are well adapted for flying in circles, as they beat over the surface to find the places where food is to be had. Their eggs are four, placed in quatrefoil, and generally on the bare surface, without any formal nest. These eggs are large for the size of the birds, generally of the colour of sand or of small gravel, and with the ends very different in thickness. They are noisy birds, and utter shrill and wailing cries, but these are rather pleasant, as they break the monotony of the expiring waves, sighing on the sand, or murmuring among the pebbles. We shall very briefly notice the British species.

Red-shank Sandpiper (*T. Calidris*). As a British bird, this species is resident within the country, only it shifts its ground with the seasons. It is on the shores from the middle of autumn to the end of spring, and the rest of the year it is on its breeding-grounds. These are the borders of the marshes in the south part of the country, and those of the inland and upland bays in the north. The nest is in a tuft, very rude in structure, and the eggs are four in number, pale olive on the ground colour, and marked

with brown blotches, especially toward the thick ends. They do not go quite so far inland as the lapwing, nor do they build so much on the open moors, so that they are not so often seen or heard as these amusing birds; but when their nests are approached, they set up a wailing, and wheel about in the air, hinting to the intruder that he is treading forbidden ground.

When on the shores, they do not assemble in flocks, like many of the birds that winter there; they are scattered about, and thus they do not appear to be so numerous as they really are. Even then, however, they are noisy, and their whistle may be heard amid the roarings of the surges as these break on the shore. At this season their colour is ash-brown, with dusky streaks on the back, and the breast greenish-white, with faint lines of brown.

The length, when full grown, is eleven inches, and the stretch of the wings nearly twice as much. The feet and the basal half of the bill are orange-red, the point of the bill dusky, and the whole bill is about two inches in length; the tarsi are long, and there are very slight webs between the first and second toes at their bases; the irides are hazel, and the naked space round the eye greyish white. In summer the back, and upper parts generally, are dusky, spotted with grey, with the exception of the wing-coverts, which are ash, spotted with white and brown; the quills are dusky, with white tips to the secondaries; the rump white, spotted and barred with dusky; the tail with alternate bars of white and black; the breast white, with oblong dusky spots, and the belly pure white. The young of the year have the upper part brownish, and the breast ash-coloured, with a few brown lines. They have sometimes been regarded as a distinct species.

Common Sandpiper (*T. hypoleucos*). This species is rather a small bird, being only between two and three ounces in weight, and little more than seven inches in length; but it is a very active little bird. The colours of the upper part are ash, variously mottled with brown; the under part is white, with brownish lines on the breast; the feet are admirably fitted for running, an operation which the bird performs very swiftly. It often runs into the shallows of the water, and it can swim a little, for its feet are webbed nearly to the first joint of the toes, and the feathers on the under parts of its body are close and waterproof like those on the swimming birds. This species is very abundant in all parts of the British islands, which suit its habits, and passes into several of the western isles; but we believe it is not met with in the extreme north. In the severity of winter the greater part migrate, and leave our shores to birds less fitted for long flight. This one has very great powers in that way. Its wings are rather more than twice the length of the body, and they are firmly made. The tail is also an efficient instrument, It can be spread out like a fan, and the bird uses it both in picking up its food and in its ascents and descents. They disperse themselves widely over the wilds in the summer, frequenting the margins of the streams, and making their rude nests under the banks, or simply among the sand and pebbles, if there is no bank at hand. The nests are not very often seen; for the bird, when surprised, gets away so fast, and with so many doublings, that one cannot easily mark the place where it rises. Their cries are shrill and often repeated, and, as they are heard in bleak and lonely places, they are pleasing. The eggs are four, of a whitish flesh colour, mottled with dark reddish brown. They are not found in the rich parts of the country: and there do not seem to be half so many of them any where as there really are, for they live very dispersedly.

Green Sandpiper (*T. chloropus*). This is a larger and heavier bird than the common sandpiper, being more than nine inches in length, and weighing between three and four ounces. It is a resident bird, wintering as well as summering in Britain; and it is an inland one, building near the wild lakes and marshes, and frequenting their margins in the winter, unless when the weather is very severe, and then it betakes itself to the sea-coast. The bill and feet have a dull greenish tinge, only the head or distal part of the bill is dusky, as it generally is in the genus. The bill is very slender, but firm in its terminal part; the feet have webs between the outer and middle toes only. In summer the back is brown, with green glosses and some small white spots. The lower parts are white. The upper part is paler in the winter, and has not the glosses. The nest is near the waters, composed of a little withered grass if on the soil, but merely a little hollow if on the sand. This is also a very pretty tenant of the wilds, but, like the rest, it is not often seen.

Wood Sandpiper (*T. glariola*). This is rare, and by some supposed to be a winter migrant from the northern parts of Europe, where it is abundant; but the time of its appearance in the south of the country is rather against this. It is smaller than the green one. The upper part dusky and glossed with purple, and the under parts white.

There are many other species, some of them British, and among the rest the greenshank; but there is nothing very particular in their habits, which are pretty uniform in all the genus.

SANGUINARIA (Linnæus). The *S. Canadensis* is the poccoon or bloodwort of North America; a polyandrous flowering, tuberous-rooted perennial, belonging to the natural order *Papaveraceæ*. This dwarf-growing plant thrives in any light soil, and is increased by seed or divisions of the root.

SANGUISORBA (Linnæus). A genus of herbaceous perennials, mostly European. The flowers tetrandrous, and the genus belongs to *Rosaceæ*. The *S. officinalis* is a pasture plant in English farming, and known by the name of burnet. Although a portion of the seeds be frequently employed in laying down permanent pastures, cattle do not seem to be fond of it, as it is the last to be eaten.

SANICULA (Linnæus). A genus of British and North American herbaceous perennials, belonging to *Umbelliferæ*. The species are uncultivated, and only noticed by the botanist.

SANTALUM (Linnæus). A genus of tropical trees and shrubs, belonging to the natural order to which they give a title, viz.

SANTALACEÆ. A natural order, containing seven genera, and above twenty species. They are chiefly natives of South Africa, New Holland, and India, and collectively considered, are trees, shrubs, or herbs, with round or irregularly angled branches, alternate, nearly opposite leaves, stipulæ absent. The flowers are small, collected into spikes or racemes. The perianth is single and superior; the stamens are definite, exserted from the base of the sepals; the anthers are terminal and two-celled; the style is

single, and stigma often lobed. The fruit is hard and dry, sometimes slightly succulent, and one-seeded. The genera included in this order are *Santalum*, *Fusanus*, *Leptomeria*, *Thesium*, *Comandra*, *Hamiltonia*, and *Nyssa*. The *Santala*, or sandal-wood, especially the *S. album*, or true sandal, are fragrant. Hence the timber is much valued. It is made into musical instruments, cabinets, and curious boxes; no insect can exist it is said within its influence. Sandal-wood is extensively employed at the funerals of the Hindoos, and the nearer it is got from the root, and the deeper its colour, the greater is the fragrance.

SANTOLINA (Linnæus). A genus of evergreen European shrubs, commonly called lavender-cotton. They belong to *compositæ*. The hardy sorts thrive in the flower border, and are propagated by division or cuttings.

SAPERDA (Fabricius). A very extensive genus of coleopterous insects, belonging to the family *Cerambycidæ*, having the body of a cylindrical elongated form, with the thorax not spined at the sides. The species are in general very beautiful in their colours and forms, and are found upon flowers and the trunks of trees, within which the larvæ reside.

The tropical species are exceedingly numerous; there are six or eight British species, all of which are far from abundant; the type being the *Cerambyx cylindricus* of Linnæus, which is black with pale femora.

SAPINDACEÆ. An important natural order, comprising nineteen genera, and above eighty-eight species. The order is divided into three tribes, viz. *Paullinicæ*, *Sapindeæ*, and *Dodonæaceæ*. Nearly all the species have compound leaves and bunches of white flowers. The calyx consists of from four to five sepals, either discrete, or slightly adherent at the base. The petals are usually the same in number as the sepals, but sometimes one is abortive, and occasionally, as in *Dodonæa*, *Stadmannia*, and *Amirola*, they are altogether wanting. The stamens are definite, usually twice the number of the sepals. The germen is free, roundish, and formed of two or three carpels more or less distinct. The fruit is drupaceous or capsular, three-celled, or by abortion one-celled. The *Litchi* and *Longan* are common and favourite fruits in China, and are species of *Euphoria* or *Nephelium*. These fruits are sweet, with a sub-acid flavour, even when dried and brought to this country, but when fresh are delicious. Other species of *Nephelium* bear excellent fruits, but they are less agreeable than the preceding. *Melicoca bijuga*, *trijuga*, and *olivæformis*, are the honey-berries of the East and West Indies. Several other genera bear eatable fruits, but none are very superior, besides those mentioned.

SAPIUM (Linnæus). A genus of tropical trees bearing monœcious flowers, and belonging to *Euphorbiaceæ*. The *S. aucuparium* succeeds in the stove if potted in light soil, and may be increased by cuttings.

SAPONARIA (Linnæus). A genus of annual and perennial herbs, mostly natives of Europe. The flowers are decandrous, and the genus belongs to *Caryophylleæ*. The species thrive in the common soil, and some of them, as the *S. calabrica* and *S. ocymoides*, are suitable plants for rock-work.

SAPOTACEÆ. A natural order containing eleven genera, and forty-four species, already described. They are trees or shrubs with a soft wood, and lactescent juices. The leaves alternate, simple, entire, coriaceous, and petiolate, but destitute of stipules. The inflorescence is axillary, and the flowers regular and united: the calyx is free, and four to eight-cleft: the corolla is hypogynous in its exsertion, regular, and cleft: the stamens are definite and distinct; some being barren and some fertile; the anthers are usually extorse; the germen is superior; the style one, and the stigma simple. The *Sapotaceæ* are remarkable among lactescent plants for being in general innocuous. They yield great quantities of milky sap, which is used for alimentary purposes. Their fruit and seeds also abound in oil, which is solid like butter, and of a mild, pleasant flavour. Much of the palm oil of commerce is believed to be yielded by the *Bassiæ* or other *sapotaceæ*. The flowers of *B. longifolia*, *latifolia*, and *butyraceæ*, are all fragrant; a pleasant drink is made by infusing them in water, and this infusion, when fermented, becomes an intoxicating liquor, whence spirit is procured. The fruits of the several species of *Achras*, *Crysophyllum*, *Mimusaps*, and *Inocarpus*, are eatable, and more or less prized in different countries. The other genera not already mentioned are *Bumelia*, *Sersalisia*, *Sederoxylon*, *Nycterisition*, *Ochras*, and *Luciana*.

SAPYGA (Latreille). A genus of fossorial hymenopterous insects, belonging to and being the typical genus of the family *Sapygidæ* of Leach, which family is distinguished by having the body of an elongated form, the collar of the thorax large and transverse-quadrate; the legs short and slender, not ciliated nor spined, and the antennæ as long as the head and thorax. This family comprises the genera *Sapyga*, *Thynnus*, *Polochrum*, and *Scotæna*; the first of which has the antennæ elbowed, thickened at the tips; the body long, cylindrical, and the eyes deeply notched in front. Entomologists appear to be at variance as to the habits of the species of this genus. St. Fargeau expressly states that they burrow in the mortar of walls or in wood (although not having spiny legs), for the purpose of constructing their nests, which they provision with other insects, and that he had himself observed *Sapyga* 6 punctata, carrying an insect which it let fall on being alarmed. Robineau Desvoidy, however, has more recently published some observations showing that it is parasitical, and Mr. Curtis in the British Entomology for the present month, has also made the same remark. The writer hereof has watched these insects on many occasions, and their motions certainly appeared to him to be those of parasitic, and not of working insects. There are two British species, the type being the *Sapyga prisma* of Latreille.

SARCANTHUS (Lindley). A genus of elegant flowering herbs, natives of China and India, belonging to *Orchidaceæ*. These fine ornamental plants should be enveloped in damp moss fastened to a stump of wood, or enclosed in the outer fibrous coverings of cocoa-nuts, and placed in the air of a damp stove, kept at a high temperature.

SARCOCAULON (Decandolle). A genus of irregular-stemmed under-shrubs, natives of the Cape of Good Hope, and belonging to the natural order *Geraniaceæ*. They thrive in light sandy moor-earth, and are readily increased by cuttings.

SARCOCÉPHALUS (Afzelius). A fruit-bearing shrub indigenous to Sierra Leone, and there called the guinea peach. The flowers are pentandrous, and the plant belongs to *Rubiaceæ*. It is

readily increased by cuttings rooted in sand under a hand-glass in heat.

SARCOPHAGA (Meigen). A genus of dipterous insects, belonging to the family *Muscidæ*, having for its type the blowfly (*Musca carnaria*), which see for an account of its habits.

SARGUS (Fabricius). A genus of dipterous insects, belonging to the family *Stratiomidæ*, having the body elongated and depressed, the scutellum not spined; the head not produced into a nose in front. The species of this genus are very handsome flies, generally found during the summer months basking upon the leaves of various plants, and walking about slowly with the wings somewhat expanded; their flight is also slow, except during the hottest sunshine; at other times they are quite lazy. They are adorned with very brilliant metallic tints, especially green and gold. The larva of *Sargus Reaumurii*, has been observed both by Reaumur and Lyonnet; it is found in cow-dung, and is of an oval-oblong form, attenuated in front, and destitute of legs. It passes to the pupa state without shedding its larva skin. There are nine British species af this handsome genus (descriptions of eight of which have been published by Mr. J. Duncan in Jardine's Magazine of Zoology and Botany, vol. i.), the type being the *Musca cupraria* of Linnæus. Another species is the *Musca polita*, Linn., which, with several others, constitutes a distinct section, which Mr. Duncan has named *Chloromyia*, but which had been previously named *Chrysomyia* by Macquart.

SARRACENICÆ. A natural order of plants containing only one herbaceous genus, whence the title is derived. There are four species of *Sarracenia* already described, and remarkable for the singular form of their leaves, which are tabular and hold water, some of which have lids, which are said to shrink in dry weather. They are all natives of the North American swamps. In our collections they are grown in pots half filled with turfy peat, and having a coat of water-moss above: the pots are set in pans of water, and succeed best in frames kept in a shady place. The flowers are polyandrous.

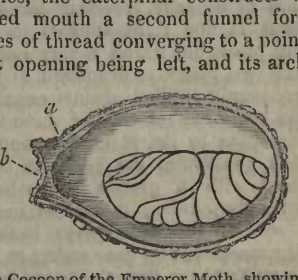
SARROTRIUM (Illiger; Orthoceras, Latreille). A curious little genus of beetles (*Colcoptera*), belonging to the family *Tenebrionidæ*, having the antennæ thickened, and forming a spindle-shaped mass covered with rigid hairs, the last joint being much narrower than the preceding; the body narrow and depressed; thorax subquadrate. There is a single species (*Hispa mutica*, Linnæus), of small size and black colour, found in sand-pits.

SATUREJA (Linnæus). A genus of herbs and under-shrubs, commonly called savory, and used in cookery as a seasoning, particularly the summer savory, which is an annual. The species are mostly natives of Europe, and belong to *Labiatæ*.

SATURNIA (Schrank). A genus of large lepidopterous insects, belonging to the section *Nocturna*, and family *Bombycidæ*, and nearly corresponding with the Linnæan section of *Phalæna*, named *Attacus* (see Phalæna), having the wings extended horizontally, consisting for the most part of exotic species of very large size, and handsomely marked in their colours; the wings often being ornamented with a large glass or talc-like spot in the centre; such is the case with the immense atlas moth of China (*Saturnia atlas*), the *S. cecropia* from America and the *S. luna* of America (forming the subgenus *Actias* of Leach, Zoological Miscellany), in which the hind wings are elongated into a pair of tails.

Another species is the *Saturnia promethea*, whose history we have detailed in the article Caterpillar, and of which, in the winged state, a figure is given in the article Moth (p. 289, *ante*). This species is destitute of the talc-like spot. From time immemorial the *Bombyx mylitta* of Fabricius, and the *Phalæna cynthia* of Drury (both belonging to this genus), have been employed in the manufacture of silk (see the article Silkworm). M. Latreille, who has devoted very considerable attention to this enquiry, states from a Chinese manuscript communicated to him by M. Hugard, that the caterpillars of these two species have been long known as the "vers à soie *sauvages* de la Chine," or *wild* Chinese silkworms. He also supposes that a portion of the silk which was employed by the ancients was procured by means of their commercial relations with the East, and was the product of these species.

Another species of this genus, known to collectors under the name of the emperor moth (*Phalæna*, Attacus, *Pavonia*, Linnæus), and which is the only British species belonging to this genus, has also been successfully employed in Germany in the manufacture of silk by M. Wentzel Hegeer von Berchtoldsdorf, under an imperial patent. This handsome moth is by no means rare, and varies in the expanse of its wings from two and a half to three and a half inches, and has the wings clouded and fasciated with grey, with a large central eyelet. It proceeds from a large caterpillar of a fine green colour with black bands, the latter being ornamented with red and yellow hairy warts. It is a very general feeder, and constructs a very interesting cocoon for the purpose of undergoing its transformations, of a brown colour and shaped somewhat like a flask. It is composed of a solid tissue of layers of silk, almost the texture of parchment; but at the narrow end it is composed of a series of loosely attached longitudinal threads converging like so many bristles to a blunt point, in the middle of which is a circular opening through which the moth makes its escape, the threads readily yielding to pressure from within, and acting somewhat upon the principle of the wires of the opening to a rat-trap, or the willow cricks of an eel trunk. In order, however, to guard against the danger which might arise from the opening permitting the ingress of Ichneumons or other enemies, the caterpillar constructs within the funnel-shaped mouth a second funnel formed of a similar series of thread converging to a point, without the smallest opening being left, and its arched struc-



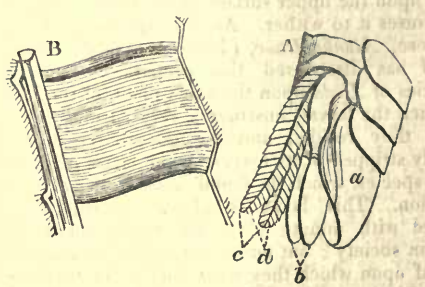
Section of the Cocoon of the Emperor Moth, showing the internal dome, *a*; and the external aperture, *b*.

ture rendering it impenetrable to the most violent efforts of any external enemy, whilst it yields to the slightest pressure from within, and allows the egress of the moth with the utmost facility, immediately resuming its former appearance, so that it is impossible at first to conceive how it is that the moth can

have made its escape from an entire cocoon. Meinecken * has also suggested that the pressure of these converging threads upon the abdomen of the moth as it emerges from the cocoon has the effect of forcing the fluids to enter the nervures of the wings, and give them the proper expansion, having noticed that moths produced from chrysalides taken out of their cocoons were crippled in their wings.

SATYRIUM (Linnæus). A genus of tuberous-rooted herbs, natives of the south of Africa. The genus belongs to *Orchidaceæ*, and, like the rest of the order, bears curious, though not very showy flowers. They grow in sandy peat earth, and require the protection of a frame in winter.

SAWFLY (Serrifera, Latreille). The English name for a very extensive group of hymenopterous insects, composing the Linnæan genus *Tenthredo*, and modern family *Tenthredinidæ*, distinguished by their large wings with many cells, the abdomen united to the body by its whole breadth, and terminated on the underside by a pair of organs (ovipositors), which are employed in the act of depositing the eggs something in the same manner as the common hand-saw of mechanics, whence the popular name of the family. The construction of this pair of instruments is, however, so much superior to that of the hand-saw, and exhibits so admirable an instance of contrivance in its design for a determinate purpose, that a minute account of its structure will not be uninteresting. Of course, the particulars cannot be observed without the assistance of a microscope, or high-powered lens; and when these are employed, it will be found that almost every species varies in some one or other particular. The eggs of these insects are deposited in the bark of trees, the twigs of various plants, or within the epidermis of the leaves, in which a slit is first formed, into which the eggs are successively introduced. The eggs have indeed somewhat of an analogy to vegetable nature, as, for a certain period, they increase in size, in consequence, as is supposed, of imbibing the fluids of the plants into which they have been introduced by the saws. The dorsal segments of the abdomen are deflexed at the sides in these insects, the terminal segment being produced at the base beneath, towards the base of the abdomen, forming a groove on the underside within which the saws play, being, moreover, protected by two distinct scaly plates. When the insect, therefore, is disposed to make use of its saws, it widens the groove, and extends what at first sight appears to be a single membranous piece, but which is very soon perceived to consist of two plates, each formed of two distinct portions, constantly applied against each other when at rest; the lower half of each of these instruments, that is, from base to tip, is the saw, and the upper half of each constitutes the supports of the saws, being formed with a groove somewhat like the structure of a clasp knife; in each of these grooves, therefore, one of the saws plays backwards and forwards, the muscles at its base acting as the moving power, and when these four pieces are brought into contact, a central space is produced which serves for the passage of the egg. The back, or support of each saw, indeed, at first sight appears very similar in its construction to the saw itself, being of equal length and breadth, with similar transverse, or rather slightly oblique ridges; but a more minute examination shows them to be unfitted for action as sawing instruments. These ridges or oblique channels correspond in number with the number of teeth in the saw. It will be easily conceived that, from the support given to the supporting piece by the corneous plate of the abdominal segment, it is well fitted for enabling the saw to work backwards and forwards. In the carpenter's saw there is somewhat of the advantage of a double edge (which we here find produced by the presence of two saws), because the teeth of the carpenter's tool are alternately directed to the right and to the left; and the groove between the two lines made by the teeth, which is called the *course of the saw*, is represented in the sawing of the sawfly by the action of the two saws having straight teeth. It will therefore be probably asked, where is the necessity for two saws, when even the ingenuity of man has effected a similar purpose with only one saw? and if the action of the insect had no other object than that of sawing the plant, there might be perhaps ground for the enquiry. But the insect has another and far more important object to perform, namely, the depositing of its eggs in the groove made by the saws, which could not be done by a single saw. At first sight the saw appears to be composed of simple teeth, but the application of high-powered lenses proves that one of the edges of each tooth is itself furnished with very minute teeth, thus combining the property of a rasp or file, in their lateral action, with that of a saw in their vertical movement. Moreover, the sawfly has the power of working the saws alternately, a peculiarity necessary, because each works in the same channel, and not, like the compound saws of artificers, in distinct lines. More highly magnified powers, also, show that even the membranous sides of the saws are furnished with an infinite number of minute points, which, in all probability, serve to irritate still more forcibly the edges of the wounded part of the plant, causing it to produce a greater supply of extravasated fluids, which is serviceable for the development of the egg.



A, extremity of the abdomen of the Sawfly, showing the two saws *c* and their supports *d* extended; *a*, the terminal joint of the abdomen; and *b*, the two internal horny sheaths. B, a small portion of one of the saws very highly magnified.

After the groove is rendered sufficiently deep, the saws are made to conduct an egg into the place prepared for its reception, immediately after which a drop of frothy fluid is introduced into the hole over the egg, of which the probable use is to close the wound. Each groove contains but a single egg, and there are accordingly sometimes as many as a couple of dozen of grooves to be made; these are placed in a line on the same branch, six of them occupying

* Quoted by Kirby and Spence, from whom this account is abridged.

the insect (according to Reaumur) about ten hours and a half in their construction. The grooves, at first, are scarcely perceivable above the surface of the branch, but, by degrees, become more and more convex by the increased size of the egg, a circumstance of considerable interest, and quite at variance with the analogy of the eggs of the majority of insects and birds. In some species, however, the eggs are deposited together in a single large groove, and in some species the parts of the leaves wounded by the sawfly produce galls (as in *Nematus interius*, &c.) similar to those formed by the true gallflies. These galls are variable in their form and substance, being either woody or pulpy, and either of the ordinary form, or resembling a small fruit. In these species the larvæ hatched from the eggs continue to reside within the galls, either alone or in company, but in general the larvæ of the sawflies are external feeders, devouring the leaves of trees and plants. These larvæ, from their general form, and the number of their legs and prolegs, bear a very great resemblance to the caterpillars of lepidopterous insects, so that they are ordinarily termed by the French naturalists *fausses chenilles*, or false caterpillars. The number of their legs differs from that of the true caterpillars, which have from ten to sixteen; whereas these false caterpillars have either only six, or from eighteen to twenty-two. Many of these false caterpillars have the habit, when alarmed, of rolling themselves up in a spiral manner, like an *Iulus* and others, whilst feeding, generally elevate the hind part of the body in the air, giving themselves a very droll appearance, and twisting their tails about in all directions. In order to undergo their transformations to the pupa state, they construct a cocoon, partly of silk and partly of earth, glued together with a gummy secretion, which they emit from the mouth, and within which they remain for a great length of time without throwing off their larvæ skin. The pupa is incomplete, and closely resembles those of other hymenopterous insects in its general form. Many of these insects are very obnoxious to the agriculturist and horticulturist. Thus the larva of one species preys upon the upper surface of the leaves of barley, and causes it to wither. Another species feeds upon the rose, *Athalia Rosæ*, (Linnæus); and the writer hereof has discovered the preparatory states of a species of *Lyda* upon the same plant, of the leaves of which the larvæ construct a very curious case, in which they reside; and the gooseberry is occasionally stripped of its leaves by the larvæ of another small species, which is found upon it in very great profusion. This larva is of a greenish colour, covered with minute black tubercles, and at first feeds in society; but no sooner have they consumed the leaf upon which they were born, than they separate, and the work of devastation is carried on to such an extent, that in a very short time not a leaf remains on the tree, and the crop of fruit is entirely consumed. Fumigation, by means of sulphur or burnt leaves, may be successfully employed.

Another species, *Tenthredo cerusi* (Linnæus), feeds, in the larva state, upon the leaves of the cherry and some other fruit-trees. At this period of its existence it has scarcely the appearance of an insect, being covered with a slimy secretion, which causes it to resemble the fæces of some small bird (and thus to escape from the insectivorous birds), and which is aided by its sluggish habit, as it does not stir until it has entirely consumed the epidermis of the leaf in its immediate vicinity. In North America the cherry-pear, apple, and plum, are occasionally attacked by another insect very nearly allied to the preceding, and which is there known under the name of the slugworm. In 1797, they entirely covered the smaller trees to such an extent that the atmosphere in the immediate neighbourhood was charged with a sickening odour. Twenty or thirty were to be seen on a single leaf, and, many trees being completely stripped, were obliged to put forth fresh foliage, thus anticipating the supply of the succeeding year, and cutting off the prospect of fruit. (*Peck, Nat. Hist. of the Slugworm*, quoted by Kirby and Spence).

But the most destructive insect of the present family is one of which the larva is commonly known under the names of the "blacks" or "niggers," and which have, during several of the past years, entirely consumed many of the turnip crops in the south of England. About twenty years ago they were observed to be equally abundant as well as in the year 1783. It would therefore form a very interesting and not wholly useless subject of inquiry, to endeavour to ascertain what identity of natural causes existed in those years in order to permit the development of the insects to so great an extent. The admirable meteorological tables which are now published from time to time must evidently be of great service, by taking the averages in prosecuting such an inquiry. These larvæ are about half an inch long, and feed upon the fleshy part of the leaf of the turnip, leaving the fibres so clean that the leaves are reduced to perfect skeletons; when disturbed, they roll themselves up in a spiral manner; they are of a slaty black colour above, with a pale dirty lateral stripe, which is also the colour of the under surface. It has been observed that they do not attack the Swedes or rape. The most successful remedy which we have yet heard of has been to turn in a great number of ducks among the turnips, accompanied by a boy who brushes the plants with a long stick, which causes the grubs to fall, when they are greedily devoured by the ducks, which are very fond of these palatable morsels. When full-fed they descend into the earth, form an oval cocoon, and therein undergo their transformations. The perfect insect (*Athalia centifoliæ*) is about a quarter of an inch long, with the head and antennæ black, the abdomen and legs bright orange, the thorax also orange with dark spots at the base of the wings. In this state indeed it is very conspicuous, and an intelligent farmer, by going over his fields, would not only be able to foresee the danger which would ensue to his crops if left untouched, from observing the presence of these flies amongst his plants, but also probably to some extent be enabled to guard against the danger by employing children to capture and destroy the forerunners of these nigger caterpillars.

We shall treat of these insects technically, under the title TENTHREDINIDÆ.

SAXICOLA (*Chat*). A species of birds belonging to Cuvier's dentirostral family of *Passeres*, and to the small-billed section of the family, and of course insectivorous in their feeding. The characters of the genus are: the bill slender and nearly straight, a little broader than high at the base; the upper mandible with a ridge which advances on the point, and is covered at the base with some hairs; the mandibles awl-shaped and pointed, and the upper one curved

at the tip. The nostrils lineal, oval, half covered by membrane. The tarsi in general long ; the toes four, three to the front, the exterior front one united to the middle one at its base ; the claw on the hind toe short and very crooked. The first quill very long, and the third and fourth the longest in the wing. They have not much song, but they are very handsome and hardy birds. Their habitations are various ; some in the woods, some in the bushes, some in the bare uplands among stones ; but they are all insectivorous, and with us they are all migrant. The species are numerous, and met with in various parts of the world ; but we must restrict this notice to a few of those which are most interesting to British readers.

The Wheat-ear Chat (*S. Œnanthi*) is a migrant, departing from Britain in the fall of the year, and returning again pretty early in the spring ; but it is one of the most numerous of the genus, and indeed more generally distributed over the wild and half-cultivated parts of the country than almost any other bird which comes to us during the summer. It is not a bird of bowers, or even of bushes, but of the open fields, where these are not in a state of high cultivation. The particular form of the claw on the hind toe unfits this bird for walking upon, or rising from the grassy sod, as the lark does ; and consequently it is found only on the bare ground. Its perch is on the clods, or on a stone ; and the nest for its young is under the same. The flight of these birds during the nesting time is short and low, and the song of the male, though sweet, is audible only at a very short distance. The usual note, which is like the tapping of one pebble against another, seems to be in some way connected with the feeding of the bird, but in what way is not known. This is the largest British species, as well as the most abundant. It is six inches in length, or rather more, and nearly an ounce in weight. The naked parts outside, and also the gape, are black, and so are the quills, the middle tail feathers, and the tips of the lateral ones. The breast is buff-coloured ; and all the rest of the under part and the rump white. One knows not for what reason, but this bird is much persecuted in many parts of the country ; and in the southern parts great numbers are caught and eaten in the autumn, at which season they become very fat.

The Whin-Chat (*S. rubetra*) is about five inches long, and half an ounce in weight. It is a migrant, coming to the south of England in April, and getting gradually north, though not to the extremity of the country, or so far up the hill as the wheat-ear. Its place is on the margins of the cultivated grounds, wherever it can find cover for its nest, either in a bush or a tuft of tall grass ; but it prefers the former. Furze bushes are favourites with it, as they are not easily entered by any predatory bird from above, or by a large bird from any quarter. The magpie and the crow are the great plunderers of nests in these wild places ; but neither of them is very fond of taking a furze bush by storm, bristling as it does with spears innumerable. The bird itself is just as safe. It usually perches on a lofty twig, darting like lightning on any fly that comes within the range of its keen vision ; and the moment that any danger appears it drops into the bush, where it makes its way to the place most distant from that at which it entered. In situations favourable to their habits they are not rare ; they make their appearance rather early in the spring, and when the cold weather begins to set in they depart from all the northern parts of the country, and only a few of them remain in the counties bordering on the channel. The number that may do so must, however, vary with the season ; and as this is the case with all birds that have short migrations, it is never easy to draw the line between total migration and partial residence.

In the male bird, the upper parts are blackish brown, with dusky and white markings on the breast ; the breast is pale, passing into dull yellow on the belly, and white on the vent feathers. The female has the white on the head less conspicuous ; and the young birds have the brown parts mottled with white and grey.

They are birds of more feeble make than the other chats, and their wings are not formed for long flight, so that they are rare in the south-west of England where the channel is broad.

The Stone-Chat or Chut (*S. rubicola*). Though this is by no means the most plentiful species in Britain in the summer, it is the only one which is decidedly a permanent inhabitant of Britain. It is found on the dry moors, downs, and commons, where there are bushes ; and, like the last mentioned one, it is particularly partial to furze. It is a very pretty bird, handsome in shape, rich but not gaudy in its colours, and the male has a pleasant song. That song is indeed not very loud and varied ; but the place where it is heard, and the early season at which it is given, tend to heighten its effect. It sings before any other note of bird but its own is heard ; for the call of the grouse ceases at daybreak, and the crow does not come till there are nests to plunder.

The bill, which is stout at the base, a little bent, and pointed at the tip, is black, and so are the head, throat, and upper neck, in the male. The rest of the upper plumage is dusky with brown margins to the feathers. The rump, a large patch on the greater coverts, and another on the side of the neck, are white. The breast is of a rust colour, passing into dull yellow on the belly, and white on the vent feathers. In winter the black on the head becomes mottled with rusty brown, and the rust-colour on the breast fades to a dull white. The female has the whole upper part brown and the under pale brown, without any white on the rump. The colours of the female change very little with the season.

The chats, or at all events birds which very closely resemble the chats in their economy, are numerous in some parts of the world ; and the climates in which they are found, together with the localities which they occupy in this country, and the food upon which they subsist, point them out as having a well-defined place in nature. They hold an intermediate station between the wagtails and the fly-catchers, being farther from the water than the first, and farther from the wood than the second. All the three subsist in great part upon full-grown insects, which they capture by lying in wait, and not by chase. The number that pass among the bushes is greater than one would suppose from the dryness of the place, for many of the insects which arrive there pass their larva state in the earth, indifferent of what may be on the surface. All places of which dryness and bushes are characteristic are favourable for chats ; and therefore they are numerous in Southern Africa, and in all countries that have the same extreme of drought during part of the year. Most of the insects of such places

are of small size, and they pass so rapidly that they could hardly be taken by the swallows and swifts. These fly rapidly, no doubt, but some time elapses before their long wings can get the proper momentum. Hence they are fit for such places only as abound with aerial prey. The most vigorous of them would be worn out before they could make half a meal; and therefore there are set over the winged insects of these places birds which have keen eyes, can get readily on the wing, fly rapidly for a short time, and fly in every direction. All these are characters of the chats, and there are no birds in the class better suited to their places.

SAXIFRAGEÆ. A natural order comprising ten genera and one hundred and forty-two species, chiefly alpine herbs. Their leaves are opposite or alternate, in general, simple, and without stipules, but occasionally compound, and furnished with interpetiolar stipules; the calyx consists of five sepals, more or less connate, and joined to the germen; the germen is sometimes inferior, sometimes half-inferior, and sometimes free; the petals are equal in number to the sepals, exserted from the tube of the calyx, and alternate with the lobes; the stamens are perigynous, proceeding from the calyx; the filaments are awlshaped, and the anthers ovate and two-celled, opening by pores or chinks; the germen consists of two carpels; the styles equal to the carpels and persistent; the stigmas clubbed. The fruit is a two-valved capsule, opening either from the base or apex.

Saxifraga is a very extensive genus, and various attempts have been made to break it up into several genera, but their affinity is so close, and the gradations so complete, that it seems preferable to consider most of them only as subgeneric groups. The genera included in this order are the following: viz., *Saxifraga*, *Heuchera*, *Tiarella*, *Astilbe*, *Mitella*, *Tellima*, *Chrysosplenium*, *Adoxa*, *Hydrangea*, and *Galax*.

SCABIOSA (Vaillant). An extensive genus of annual and perennial herbs, found in all parts of the old world. The flowers are tetrandrous, and the genus ranks among the *Dipsaceæ*. A few of them are British weeds; the East Indian annual sorts are admitted into our flower gardens; and the African sorts are shrubby.

SCÆVOLA (Dr. Brown). A genus of undershrubs from the East and West Indies, and herbaceous perennials from New Holland. They belong to the class *Pentandria*, and to the natural order *Goodenoviæ*. The stove species being somewhat succulent, must not be over-watered; both these and the greenhouse sorts are propagated by cuttings.

SCALARIA (Lamarck; TURBO SCALARIS, Linnæus). This mollusc has been commonly called the wentletrap, a corruption from the German word wendle-treppe, a winding staircase. At one period large sized examples of it were extremely rare, and no shell ever produced a higher price, the enormous sum of one hundred guineas having been given for a specimen, which, at the present time, would find no purchaser at as many shillings. The writer of this article has had an opportunity of seeing numbers of these shells, many of which were sold at high prices, but no one produced more than fifteen guineas. This shell is now by no means rare of an ordinary size; it seldom exceeds two and a half inches, but when it reaches three and a half, it is of very rare occurrence, and still bears a price out of all proportion to the smaller specimens. Linnæus, in this instance, exhibited that want of observation and correct judgment which so frequently marks the generic arrangement of his conchological system; he classed this mollusc with the genus *Turbo*, and subsequent writers have blended it with the modern genus *Cyclostoma*; it has, in fact, a circular aperture, but its habitat is different, and its turreted form unlike that genus; another distinguishing distinction is the longitudinal elevated ribs, which are never connected together entirely; these ribs are only the thin reflected margins of previous terminations of the aperture, each one exhibiting the growth and addition made to the shell by its inhabitant at successive periods of enlargement, and these would, if it were possible to mark them from time to time in their native element, demonstrate the age of the shell, a circumstance now involved in the greatest obscurity, and merely a matter of conjecture, no parity of reasoning bearing upon that point with any degree of satisfactory conclusion. The *Scalariæ* are marine shells, their spire is more or less elongated in the different species, but in all the succeeding whorl is always larger than the preceding, which occasions the turreted form of these shells to differ from the cylindrical shape of the pupa, to which in some other respects they may be said to possess a resemblance, particularly in having numerous ribs on the whorls. The aperture of the *Scalaria* is round or nearly so, sometimes a little more depressed on the inner than the outer side; the edge of it is thickened, sharp, and outwardly reflected at right angles, and there appears a very slight indication of a groove or canal on the columella side not mentioned by Lamarck or other writers; they possess an operculum, but it is extremely uncommon to meet with it, as the animal is rarely imported with its shell. The *Scalaria pretiosa*, which, from its name, implies its estimation, is very singular for its umbilicus and the separation of its spiral whorls, which appear like an attenuated tube spirally evolved round a cone. The whorls are drawn out, and some examples have been met with in which the whorls do not touch each other in any sense. They are, however, ordinarily touching or connected together by the longitudinal ribs formed of the previous terminations of the aperture. Several species are known, both recent and fossil, but their distinctions are none of them so marked with each other as the *Scalaria pretiosa* is with them. In such examples as present the whorls totally unconnected with each other, the so called ribs not being in any way essential to their support, an alliance may be traced to the genus *Vermetus*, but the animal differs in many respects: it is spiral, the foot short, oval, and inserted beneath the neck; there are two tentaculæ terminated by a thread carrying the eyes at the extremity of the larger end. The Chinese and Japanese seas produce the rare species we have above described; but the *Scalaris communis* is abundantly found on our own coast, and in other northern latitudes. The late Dr. Leach named that species whose whorls are totally disjunct *Acyonea*, but we rather view such an occurrence as a sport of nature, than caused by any specific distinction, similar lusæ being observable in many other mollusca, and even in the genus *Helix*, though they are extremely uncommon.

SCALLOP SHELL is the familiar name of the *Ostrea maxima* of Linnæus, the *Pecten maximus* of Lamarck. Under its English name it is so well

known as an edible in our fish markets, that a minute description is needless. The animal is precisely similar to that of every other species of *Pecten*; as a delicacy for the table it is much admired by some gastronomers, and we will only add a few remarks upon what may be termed its historical character. The scallop shells were abundantly found on the shores of Palestine, and the chivalric crusaders of olden times, as well as pilgrims journeying to the Holy Land to expiate some sin, or to accomplish some thoughtless vow to their mistress, affixed one of the valves to some portion of their dress, to indicate beyond all doubt that they had crossed the sea in pursuit of their pious purpose; those who survived the perils of their pilgrimage preserved this emblem as an armorial distinction, still to be found in the heraldic quarterings of many English and other families of ancient descent. Our native poets and minstrels, with the troubadours of old, often sang of this distinctive honour, and Macpherson informs us that in the dreamy days of Fingal's cloudy songs, these shells were introduced into the feasts of heroes as the cup of their festive libations, by the Gaelic name of *sligha creachin*, or the drinking shell; and, to the present time, the valve of a large species of scallop is used, for the less classic but more useful purpose of skimming milk by the hands of the industrious daughters of Scotia, in the Hebrides, and other parts of Scotland. The ghosts of antiquity appear to have been content with a very moderate libation in honour of their heroes, as we cannot imagine the draught could have been long or deep, which the scallop shell supplied; but of their size, or the frequency of their being replenished, Fingal does not speak. Temperance societies were certainly not introduced at that period, and if the many tongues of Fame are to be believed, they have not yet made great progress in our sister kingdom; as a step to their completion we, however, recommend the *toddy* lovers to commence their reformation by drinking out of scallop shells.

Many fanciful tales are related in the poetical language of modern-would-be naturalists of the scallop being capable of expanding one valve to answer the purpose of a mainsail, and thus floating in fleets on the calm surface of the ocean tide; we are, however, sceptical, and the fact must rest upon better evidence than a poet's dream ere we lend our faith to it. The genus *Pecten* certainly possesses the faculty of springing on the sandy shore by the contraction of its foot, and it is possible that its progress through the deep sea may be effected by the sudden expansion and contraction of its valves acting as a propelling force against the watery medium; but we are yet ignorant of their habits of life to that extent. The flimsy tissue of fiction has been thrown around many objects of natural history, and it is difficult to forget our nursery tales, but the march of intellect will divest them of their marvellous attributes; and it may be added, that many of the tales of antiquity, when shorn of these, are found to possess some foundation in truth, though so strongly distorted by fictitious additions and ignorant superstitious credulity: thus, seals may become mermaids, the eider-duck a phœnix, and the anatifa a soland goose; not to enumerate many other instances in the annals of natural history illustrative of the poetic effusions of vivacious minds.

SCARABÆUS (Linnæus). Under this generic name Linnæus comprised a very extensive tribe of coleopterous insects, placed by him at the head of the insect tribes—and answering to the *Petalocera* of Dumeril—as well as the Latreillian section *Lamellicornes*, (including, however, the *Lucanidæ*), under which latter name we have given a sketch of the modern distribution of this interesting group. By the French entomologists of the present day, as well as by some English writers, the name is still retained generically, for the gigantic insects placed by Linnæus at the head of the genus, such as the elephant and hercules beetles, &c., of the latter of which a figure is given in the article Dynastes, which is the name given to them by MacLeay and Kirby, whilst by the Germans these gigantic species are called *Geotrupes*. Mr. MacLeay, on the other hand, gives the generic name *Scarabæus*, and the sub-generic one *Heliocantharus*, to the sacred beetles of the Egyptians (see Heliocantharus), and the name *Geotrupes* to the shardborn beetles (see Geotrupes). Nothing can be more troublesome than this uncertainty and constant changing of generic names, which cannot however be remedied so long as naturalists are not agreed upon the most fundamental principles of zoological nomenclature. We have already given under the article Lamellicornes the chief characters and disposition of this group.

SCARITIDÆ, or more properly Scaritides, a subfamily of the predaceous land-bettles *Carabidæ*, having the elytra entire and rounded behind, the antennæ elbowed, the thorax separated from the base of the elytra by a distinct peduncle. The anterior tarsi of the males are not dilated, and the anterior tibiæ dilated and palmated, or deeply notched. This latter character indicates the chief habits of the group, that of burrowing into sand in the neighbourhood of the sea, or in the banks of water. They chiefly frequent hot climes, some few, and these of small size, being found in this country. They keep close in their retreats during the day, but come abroad at night to feed upon any insects or dead matter which they can find. M. Lefebure de Cerisy, a distinguished entomologist at Marseilles, has employed the following method for capturing the *Scarites Pyracmon*. During the day he deposits a quantity of dead cockchaffers (*Melolontha vulgaris*) in those situations where the *Scarites* is probably an inhabitant, and then examines the insects at night with a lantern, when he generally meets with them in the act of feeding upon their prey. The species are for the most part black and very glossy. The genera belonging to this subfamily are: Enceladus, Siagona, Coscinia, Melænus, Carenum, *Scarites*, Acanthoscelis, Oxystomus, Oxygnathus, Camptodontus, Pasimachus, *Clivina*, *Dyschirius*, Ozœna, Scapterus, Carterus, Odogenius, Pachycarus, Morio, Ditomus, *Distomus*, Aristus, and Apotomus. Those printed in italics contain British species.

The typical genus *Scarites* is distinguished by having the fore tibiæ palmated, the mandibles strong toothed, and the thorax semilunate. There is only one British species (*Sc. Beckwithii*) of which three specimens only have been noticed, one of which was captured on the Yorkshire coast.

In Clivina (which see) the thorax is quadrate, and in *Dyschirius* globose. The following observations upon the habits of a large species of the latter genus have been published by the Rev. Mr. Rudd in the Entomological Magazine. This species occurs in great abundance in the sandy shores of the estuary of the Tees, and in turning up the sandy tracks or

burrows of a small burrowing staphylinideous insect (*Hesperophilus arenarius*) above high-water mark, he found their ferocious enemy the *Dyschirius* pursuing its work of destruction. These *Dyschirii* burrow after, seize, shake, (as the *Cicindela campestris* does its prey) and devour the luckless *Hesperophili*; and so intent are they on their purpose, that he frequently observed them shaking their victims after they were brought to light.

SCATOPHAGA (Meigen). A genus of dipterous insects belonging to the family *Muscidæ*, having the legs formed for walking, and spinose, antennæ inserted between the eyes; the wings considerably longer than the abdomen, head nearly conical in front, and rounded behind. The type is the *Musca Merdaria* Linn. or the cow dung-fly, an insect which appears early in the spring, and which is constantly to be found upon the excrement of various animals, and it is in such situations that they deposit their curiously formed eggs, of which a figure is given in vol. ii. p. 833, fig. 5. The perfect insects are generally of a yellowish brown colour. There are a considerable number of species nearly resembling each other.

SCHEDONORUS (Beauvois). A genus of grass formerly called *Festuca* in English botany. Several of the species are agricultural, and form a part of the mixture of seeds employed in laying down permanent pastures.

SCHIZANTHUS (*Flora Peruviana*). A genus of fine flowering annuals, bearing diandrous flowers, and belonging to the natural order *Scrophularineæ*. Though natives of Peru, the species flower and ripen seeds in our open borders, as well as if in their own climate.

SCHIZOPODA (Latreille). An order of crustaceous animals, chiefly characterised by having the legs cleft from the base into two appendages, giving the appearance of double legs. The species of which this order is composed have been but little investigated, with the exception of the opossum shrimps Mysis, which see. The other genera are *Mulcion Crytops*, and probably *Nebalia*, *Zoe* and *Condylura*.

SCHÆNUS (Linnæus). A genus of bog plants, natives of Europe and Australia. It belongs to *Cyperaceæ*; not in cultivation, but useful for making bands for tying up goods.

SCHOTIA (Jacquin). A genus of African evergreen shrubs belonging to *Leguminosæ*. The flowers are beautiful, and the species are well worth cultivation in the coolest end of a stove.

SCHUBERTIA (Mirbel). This is one of the most beautiful of trees. It is the *Cupressus disticta* of Linnæus, the *Taxodium distichum* of Richard, and the *deciduous Cypress* of English authors. It is one of the *Coniferæ*, and, like the others, is usually raised from seeds.

SCIENOIDEÆ. The third of the families into which Cuvier divides the spinous-finned fishes; and one, the genera and species of which are so numerous that it would form an extensive study in itself. These fishes resemble the perch family in many of their characters, but still they are distinct. They have the body scaly, but the scales are not so large as those of the perches; they have two dorsal fins in some; the spinous rays of the anal are slender; but the principal distinction is in the teeth. There are none on the vomer or the palatal bones; their gill-covers are toothed in the margin, and furnished with spines; and very often the bones of the face are enlarged with cavities, which produces a thickness in the appearance of the muzzle. The most obvious division of them is into those with two dorsal fins, and those with one only.

None of the family can be said to be natives of our seas, but there is an occasional straggler of some of the most celebrated ones. Many of them are fishes of large size, very powerful swimmers, and much esteemed as food. They are abundant in the Mediterranean and in the warmer parts of the Atlantic, where they are among the most valuable fishes for the table, and consequently the capture of them is an employment of considerable profit. We can afford room to notice only two of the genera, and a single species of each, merely naming the others.

Sciena. These have the head tumid, produced by cavernous bones; two dorsal fins, or one with a large notch, and the soft rayed part occupying a greater length of the back, than the spinous part; the whole head covered with scales; and the air-bladder with a curiously fringed margin.

The Maigre (*S. Umbra*). This is a Mediterranean species, attaining the length of six feet or upwards, and seldom caught of less than three feet. It is supposed to spawn in the south part of the Mediterranean, as small ones are met with on the shores of Egypt, but not on the shores of Italy, the south of France, or Spain. The general colour is silvery grey, paler on the belly, and inclining to brown on the back. The fins are reddish brown. They are very restless fishes, always moving about in small parties; and it is said they make a sort of grunting noise, which betrays them to the fishermen, even though they are twenty fathoms under the surface. A curious circulation of the head of one of these fishes from party to party at Rome, is recorded by Paulus Jovius. The fishermen gave it to the conservators; these gave it to the nephew of Sixtus X.; he presented it to a cardinal; the cardinal gave it to his banker, and the banker to his courtesan. This was, of course, the *ne plus ultra* of transfer for the head of a fish; but it is not the most curious part of the matter; for a "dining" gentleman scented it all the way, and at last shared in the feast. The head was accounted the prime part, and the conservators alluded to were the magistrates who had charge of the city.

Its rambling habits often lead it as far to the north as the extremity of Britain; and of late years several large ones have been caught on the south coasts. We shall quote Mr. Yarrell's account of one of them. "In the month of November 1834, a specimen five feet four inches long, was taken by some herring-fishers off the Kentish coast, and brought to the London market. This fish was bought by Mr. Groves of Bond Street, who very kindly gave the skin to the Zoological Society for preservation. Part of the flesh was eaten by several persons, and by all reported to be good, particularly by those who prepared their portions by stewing. When plain boiled only, it was rather dry and tasteless. The two hard bones usually found just within the sides of the head in fishes, are larger in proportion in the *Maigre* than in any other fish, and were supposed, the older writers say, to possess medicinal virtues. According to Belon, they were called colic-stones, and were worn on the neck mounted with gold, to secure the possessor against this painful malady. To be quite

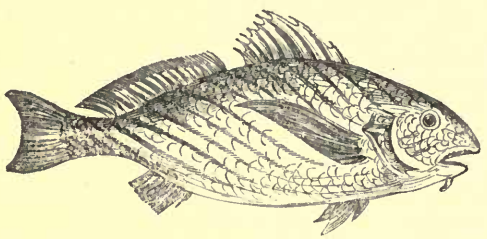
effectual, it was pretended that the wearer must have received them as a gift ; if they were purchased, they had neither preventive nor curative power.

The general aspect of the *Maigre* is heavy and lumping ; but it is a remarkably well-finned fish, and gets quickly through the water. The family are inhabitants of the pure water, rather than bank fishes.

Umbrina. This genus resembles the former in the main features ; but it has a barbule at the point of the lower jaw ; the teeth are smaller and more numerous, and the rays of the anal fin are stouter.

The common Umbrina (*U. vulgaris*), is a species of this genus, very common in the Mediterranean, and one solitary stray at least has found its way to the British coast. This was to the coast of Devon in 1827 ; but none, even of the most experienced fishermen, had any name for it.

It is a very beautiful fish in the colours, and described as being excellent. The following cut will give some idea of it.



The ground colour of the back is golden yellow, more or less bright according to the season, and condition of the fish. The oblique bands are silvery white and steel blue; and the under part is white. The irides are silvery, and the pupils of the eyes deep black. The head is short and blunt ; the upper jaw the longest, with three mucus pores at the extremity ; and the lower one flat, and with a short barbule at the junction of the maxillary bones. The teeth are small but numerous, forming a broad band like a rough pavement in each jaw. The rays in the fins are : ten in the first dorsal, and twenty-two in the second ; seventeen in the pectorals ; one spine, and six soft rays in the ventrals ; one and seven in the anal ; and seventeen in the caudal. The lateral line is high on the side, and parallel to the outline of the back. The fins on the back are brown, with two bars across ; the caudal fin is red ; and all the remaining fins are nearly black.

As a fish for the table it is superior to the maigre, notwithstanding the celebrity which that has acquired. It is generally about two feet long ; but some specimens weigh forty pounds, it being a very deep and thick fish in proportion to its length. The flesh is white and well flavoured. Altogether it is a much more handsome fish than the maigre ; and it is still more common. Its food is various,—small fishes, mollusca, and, as it is said, sea-weed. It is much more common on the Spanish coasts than the other ; is well known at Gibraltar, and *Umbrina* the Spanish name for it. It is said to occur not unfrequently in the Bay of Biscay.

Otolithus. The fishes of this genus have no barbule on the jaw ; they have the teeth very large and crooked ; and the anterior part of the swimming bladder is divided into two branches. They are all or chiefly natives of the warm seas,—the tropical parts of the Atlantic, and the Indian Ocean. One is the stone perch of the Coromandel coast, another the Lutjan of the West Indies. They are in fact numerous, and most of them are esteemed as food.

Carvina. This genus have the teeth small and i a band like those of the *Umbrina*, but no barbule ; they also differ from the preceding genus, in having the second ray of the anal fin thick and strong. One species is very abundant in the Mediterranean, and there are various others in the Indian and American seas.

Johnius. The fishes of this genus very much resemble those of the last mentioned one, only they have the second spinous ray of the anal fin shorter and weaker. They are natives of the warm seas, and are caught on the shores of India, Africa, and America. Their flesh is white and light, highly esteemed, and can be had in abundance, so that they are very valuable fishes to the inhabitants of those countries.

Pagonias (*Drummers*). These fish get that name because the sound which they utter resembles that of drums at a distance. They are very like the genus *Umbrina*, only instead of one barbule on the under jaw they have a number. One species, *Fasciatus*, is of a silvery colour, with brown bands, which are most conspicuous on the young. It has the bones of the pharynx thickly set with large and flat teeth. It is an American fish, and grows to a size not inferior to that of the maigre.

SCILLA (Linnæus). A beautiful genus of bulbous stemmed plants, mostly natives of Europe. The flowers are hexandrous, and the genus belongs to *Asphodelia*. The squill is a native of the southern parts of Spain, Italy, and Greece. It has (the *S. maritima*) long been celebrated for its medicinal virtues ; it is extremely bitter, and is esteemed as an expectorant, nauseant, and diuretic. The small hardy species are in every flower garden.

SCINCUS (Skink, and also Scincoidæ—the Skink family). The skinks form the eighth and last of the families into which Cuvier divides the saurian reptiles, and the general characters of the family are : the legs very short, the tongue not extensile, and the body and tail covered with imbricated scales, all of equal size. They all have more or less of a snake-like form, and some of them have two of the feet merely rudimental, or altogether wanting. The family comprises these genera . *Scincus*, *Seps*, *Bipes*, *Chalcides*, and *Chirotes* or *Bimana*. Some of them have acquired an interest in the history of quackery, but they rank rather low in the scale of animals.

Scincus. This is the typical genus of the family, and of course the one upon which the name is founded. The following are the generic characters : the feet four in number, and short ; the body and tail of nearly the same length ; no power of inflating the nape ; no crest on the back ; and no ruff or other appendage to the throat ; the feet are rather well formed, and the hind ones are longer than the fore ; the tail in general conical, and that and the body covered with scales, not very large, and regularly imbricated ; the tongue is capable of but little extension ; it is of a fleshy consistence, and cleft at the tip ; the toes, which are longer on the hind feet than on the fore, are generally five in number, and have small claws ; the head is small, generally of a quadrangular shape, and hardly to be distinguished from the neck at the occiput ; both jaws are closely set with small teeth for their whole length, and, in addition to these, there are two rows on the palate ; the

tympanum of the ear is seated more deep than in the lizards; and the anterior margin of the auditory opening is furnished with three or four teeth.

As is the case with all the reptiles, and with the *Sauria* more than any of the others, the various species of skinks are not well arranged, owing to their number, and the limited knowledge which we have of their manners. They are all natives of warm countries, and the typical species belongs to Africa; but there are some in the hot and dry parts of the south of Europe. From the character of the teeth, we naturally conclude that these reptiles feed upon insects; but very little is known of their manners, or their use in the economy of nature. As is often the case, however, the absence of an apparent use in nature led to the adopting of a fancied one. This was a medicinal one, and it is somewhat curious, though perhaps not unnatural, that such should have been the case—the causes of disease were unknown, and substances which had no other known utility were supposed to have medicinal virtues.

Common Skink (*S. officinalis*). This is the one which has been so much celebrated for its supposed medicinal virtues, though it is not the animal which the Greeks called by the same name, for that was the land crocodile of Egypt, which is a *Monitor;* but this is the one which has been so celebrated in more modern times, and which still maintains its character in some parts of the world to such an extent, that it forms a considerable article of export from Upper Egypt. The other is called *auran el pard* by the Arabs, and this one *el adda.* It is a small reptile, seldom exceeding six or seven inches in length, of a yellow colour, with some bands of black, and with the tail about one-third of the whole length. The scales with which it is covered have a metallic lustre, and, altogether, it is not an ugly creature. It is found in all the countries on the Upper Nile, and also in Arabia, inhabiting sandy places, where it burrows in the sand so quickly that one would imagine it crept into a hole ready made.

It would not be easy, and certainly it is not necessary, to enumerate all the imaginary virtues of the skink. They are older than the days of Pliny, and for hundreds of years it kept up its character as one of the most efficacious purifiers of the blood and renovators of the exhausted constitution. We believe that the dead bodies of these reptiles were boiled down into a kind of soup, a use to which, on account of their gelatinous nature, many reptiles which are now neglected might no doubt be turned. It is a curious fact, that the name "skink," and at least one part of the supposed virtue of it, by implication at least, are, or were till very lately, kept up by the country people in Scotland. Their *skink* was really beef soup, but it formed the stock dish at nuptial feasts, occasions upon which the virtues of the true skink were understood to be especially requisite.

Schneider's Skink (*S. Schneiderii*) is one of the largest and most handsome of the genus. It is found in Egypt, and various other parts of the East. It has the tail round, and very small in the terminal part, and forming nearly two-thirds of the total length of the animal; the scales on the lower jaw, and also on the head, are longer than those on the other part; the upper part of the body is bright yellow, mottled with olive brown; the tail irregularly mottled with black and yellow; a white band passes down each side; and the lower parts of the feet are white.

Paved Skink (*S. pavementus*). This species inhabits the same countries as the preceding, and resembles it in many particulars; but it is more slender, and has the tail longer. The upper parts are of a bright brown colour, and the under yellowish white, and there are four or five white lines extending from the upper part of the head to the middle of the tail. These lines maculate with each other, so as to give the upper part a spotted appearance.

There are some other species or varieties still, of the same parts of the world, which do not appear to differ from those that have been noticed in any thing but size and colour, and these can hardly be admitted as specific differences. There are also some in the south of France, in Barbary, in the south of Africa, and indeed in all the warm, dry, and sandy parts of the old continent, but there is nothing about them of any particular interest. We may remark, in passing, that one of the places of Europe upon which the smaller *Sauria* are most likely to be met with, is the sandy tract, below Montpelier, which lies between the plain of Languedoc and the sea.

There are several in Australia, and in the isles to the north and east, but they are not much known, or apparently of much interest. In the West India islands, too, there are reptiles which are at least very similar to the skinks of the old continent. Some of them are of larger dimensions; and they have not the same healing powers, at least in the estimation of the black population, as those of the east. There is one, called popularly the "galley-wasp," the bite of which is dreaded as being exceedingly poisonous, but the dread is wholly without foundation; for, instead of having a venomous bite which is speedily or instantly mortal, it does not appear to be capable of inflicting any bite at all. The West Indian ones, and indeed all that are found on the American continent or its islands, ought, in all probability, to be referred to another genus. They do not frequent the sand, but the holes of trees, and other places of concealment; and the one which is most dreaded by the negroes is partial to humid places. There are also some that have no teeth on the palate, and they probably ought to form a different genus. The habits of the family have been, however, wholly overlooked; and the only use of all that has been said of them in detail, is to enable the keepers of museums to arrange them in a particular way, and to say something about each, if that can be called use.

Seps. The name of this genus is supposed to be derived from the Greek verb "to corrupt;" but what they corrupt, or how they do it, no one has attempted to say. In many respects they resemble the skinks, but they make a nearer approach to the snakes. They are much more elongated and slender, and their feet are smaller, and farther apart. Indeed, they have the feet so very small and rudimental, that naturalists have often been puzzled what to do with them. In former times, when all the *Sauria* were called lizards, the seps were lizard-serpents, or serpent-lizards, according to the fancy of the party imposing the name. In so far as their habits are known, they probably resemble those snakes which have rudiments of extremities within the integuments more than they do the characteristic *Sauria.*

One of the usual modes of distinguishing them is by the number of the toes. Those which most nearly resemble the skinks have five toes on all the feet, and those on the hind feet of unequal length. Others, with the same number, but the toes of equal length, are the quadruped snakes of Linnæus. Some have four toes, but those with fewer than four are the most characteristic members of the genus, however, as they differ most from the skinks. We shall just notice two of them.

Three-toed Seps (*S. tridactylus*). This species has the feet and toes remarkably small, and the latter only three in number. The general colour is steel-blue, having two longitudinal bands of white, with blackish borders. It is by no means rare in many parts of the south of Europe, and also in the opposite part of the Mediterranean. Like all the rest of the family, it is a perfectly harmless creature, but it is, like them, regarded with very serious apprehensions by the country people. Some are of opinion that this seps is the "snake in the grass," the metaphorical allusion to which is so common. It is said to lurk in the herbage, and to occasion the most serious maladies to domestic animals, cattle especially, when they happen to swallow it. It does not appear that there is very much truth in this statement, which has very much the appearance of the stories of efts which are sometimes told with horror in the country. See the article Salamander. The authorities say that this species is ovoviviparous, but it is doubtful.

One-toed Seps (*S. monodactylus*). If this is anything more than an imperfect specimen of the other, it is a very singular creature. The feet are described as being exceedingly short, with only one toe upon each, and apparently of very little use as organs of locomotion. The scales upon these are very small, and those on the body and the tail are marked with a sort of elevated crests. The specimens that have been described are from Southern Africa.

Bipes. These do not differ from seps in almost any other respect than that of having only two feet, and thus making a little nearer approximation to the snakes. The anterior extremities consist of hardly any more than a blade-bone, which is of course concealed under the integuments; the hind feet are also but little developed, and in some they appear to terminate in scaly plates, though, when examined, the usual bones are partially found, only there are no phalanges to the toes. They are found in New Holland, in Southern Africa, and in South America. They are perfectly harmless creatures, living in mud and rubbish, and very little is known of their habits.

Chalcides. The distinguishing characters of this genus are: the length of the body, as compared with its thickness, the smallness of the feet, and the great distance between the fore ones and the hind. They have very much the aspect of little serpents, but their scales are differently arranged from these, and even from the more typical members of the present family. Instead of being imbricated, they are of a rectangular shape, and so ranged as to form rows across, in the same manner as the scales on the tails of the true lizards. They also, in this respect, bear some resemblance to the *Amphisbæna* among snakes. This, in fact, is nearly the limit of the saurian type; and one feels not a little puzzled how to refer from these animals to others, so as to preserve anything like a gradation. There are many species of these most harmless little creatures in the warm countries, but almost the only distinctions between one and another are the numbers of toes on the feet.

C. tetradactylus has, of course, four toes on the feet, but the feet are so exceedingly short, that they are hardly of any use to the animal in walking, which thus creeps on the belly very much in the manner of a snake, though it has not equal power in the spine to help it onward in its march. It is only about six inches in length; indeed, the whole of the genus are very small animals. They swarm in many of the warmer parts of the south of Spain, especially in the beautiful valley of Andalusia. Others are mentioned with three toes on the feet, and others still with only one; but it is highly probable that the latter has been confounded with the one-toed seps of Southern Africa, from which country the one-toed specimens supposed to be referable to this genus have also come. Some of the East Indian species have four toes tolerably well made out upon all of the feet; and others, in tropical America, have these organs so little developed, that it is not easy even to count them.

Chirotes, or Bimana. These have the character of bipes in so far reversed, that they are without the hind feet, while that genus is without the fore ones. Only one species is known, found on the table land of Mexico, which, as it is peculiar in its physical character, is peculiar in many of its productions, and especially so in its reptiles.

Bimana canaliculata is about eight or ten inches in length, and as thick as the little finger. It is flesh-coloured, and marked with about twenty-two half rings over the back, and as many on the belly, which meet each other alternately on the sides; it is on this account that it is called canaliculated or channeled, and, from the same markings, and also the colour, it is called *Lacerta lumbricoides*, the worm-like lizard; but it is not a lizard, neither is it in any respect like a worm. It has true fore feet, which are very well made out in their bones; they have blade-bones, clavicles, and a small sternum; and they end in four toes, and a rudiment of a fifth. In this part of its skeleton, therefore, it is organised like a quadruped, but in all the rest it more resembles the footless reptiles. Its tongue is but little extensile, and cleft at the tip, and ending in two horny points; its eyes are very small; and the tympanum of the ear is so much concealed by the skin, as not to be visible on the outside. There are two rows of pores on the under part in advance of the vent. The lungs make a nearer approach to those of the serpents than those of any others of the *Sauria*. They consist of one principal lobe, and of another which is very small and rudimental. This may, in fact, be considered as the last of the saurian reptiles, at least in so far as structure is concerned, for we know very little of its habits. That it feeds upon insects is very well understood, but the mode in which it gets at them is hardly known; and we have no knowledge whatever of the mode of its reproduction.

SCIRPUS (Dr. Brown). A genus of hardy bog plants known in Britain by the name of club-rush. The plants belong to *Cyperaceæ*. The *S. tuberosus* is the water-chestnut of the Chinese and is cultivated in that country. The roots of *S. maritima* are esculent, and they have been ground and used as flour

in times of scarcity. Some of the other species are used for chair and mat making.

SCITAMINEÆ. A natural order of plants, containing eleven genera and one hundred and twenty-six species. These last are mostly natives of the warmer parts of the world, and are stemmed or stemless herbs with long broad leaves, and bearing white, yellow, or red flowers, often of great beauty and fragrance. They are often large herbs, and even tree-like plants, with perennial, tuberous, or fasciculated fibrous roots. The stems are mostly round and simple, the axis being occasionally abortive; the leaves alternate, vaginant, and wing-nerved. The flowers united; the perianth superior, of six pieces, and irregular; the three outer ones like sepals, and the inner like petals. The stamens six, one or more often becoming like petals, and barren; the anthers one or two-celled; the pollen powdery; the germen inferior, three-celled or one-celled. Seeds many, style simple; stigma simple, or three-lobed; and the fruit capsular. The genera included in this order are, *Globba*, *Mantisia*, *Curcuma*, *Roscoea*, *Kæmpferia*, *Zingiber*, *Amomum*, *Costus*, *Hellenia*, *Alpinia*, *Hedychium*.

SCOLIIDÆ (Leach). A family of fossorial hymenopterous insects, having the collar either arch-shaped and extending to the base of the fore wings, or transversely square, legs short, thick, and armed with many spines, with the thighs curved near the tips, the antennæ shorter than the head and thorax in the females, but longer and straight in the males. These insects are for the most part inhabitants of tropical or hot countries, and some of them attain a very large size, being amongst the most bulky of the *Hymenoptera*. They are generally found in sandy districts, and the structure of the legs clearly indicates them to be fossorial. The genera are, *Tiphia*, *Myzine*, *Meria*, and *Scolia*: the first only being an inhabitant of this country. The genus *Tengyra*, hitherto placed in this family, has been ascertained to be the male of *Methoca*, one of the *Mutillidæ*.

SCOLOPENDRA (Linnæus). A genus of apterous insects, consisting of the species generally called *Centipedes*. See the articles CHILOPODA and CENTIPEDE.

SCOLYMUS (Linnæus). A genus of annual and perennial herbs, natives of Barbary and the south of Europe, called in English lists the golden thistle. Of course the genus belongs to *Compositæ*.

SCOLYTUS (Geoffroy; ECCOPTOGASTER, Herbst). A genus of small but very destructive coleopterous insects, belonging to the family *Bostrichidæ*, or more properly *Scolytidæ*, having the antennæ terminated by a large flat club commencing at the ninth joint, the abdomen beneath obliquely and abruptly truncate, the tibiæ terminated by a recurved spine, &c. There are several species of this genus of which the characters are not sufficiently determined, neither does it appear, from the recent memoir of Dr. Erichson, that the specific name Destructor, usually given in this country to the elm-destroying species, has been correctly applied. Without entering into the question of these specific names, we shall confine our subsequent observations to the insect above mentioned, and which, from the devastation which at the present time it is committing upon the elms in the public parks, gardens and promenades, both in this country and in France, may be considered as a public nuisance. This insect is generally almost or quite one-fourth of an inch in length, of a black colour and shining, with the antennæ and tarsi reddish, and the elytra punctate-striate. It has been well figured by Mr. Curtis in the first volume of his British Entomology.

There has long been considerable discussion as to whether this insect attacked and destroyed trees which were in a healthy state, although it was admitted on all hands that they never attack dead trees. In the year 1825 a fine avenue of elms was destroyed in Camberwell Grove, which gave rise to a chancery suit between the inhabitants and the proprietors of the gas works, from which the neighbourhood was supplied with gas, which was supposed to be the cause of the mischief. On this occasion the general conclusion of persons employed to examine the trees was, that other causes either than the gas or the insects induced the decay of the trees; but it was not until the last year or two that the natural history of the insect, which could alone lead to a satisfactory view of the subject, has been entomologically studied by Mr. Spence and M. Audouin of Paris, the latter of whom has published a notice on the subject in the Annales de la Société Entomologique de France, for the past year (1836). The observations of Mr. Spence have been communicated to the Entomological Society of London, and the result thereof to Mr. Loudon, who has embodied them in the article Ulmus in his very valuable work, the Arboretum Britannicum, for the last month; and, from the importance of the subject, we trust that we shall be excused for communicating the following practical extract from that work. "It is quite true, as Mr. Denson maintains, that the female scolyti never deposit their eggs in trees perfectly healthy, but it is equally true that both they and the males pierce young and healthy trees for the sake of eating the inner bark, which constitutes their food; and that the numerous holes which they thus cause, partly from the loss of sap which exudes from them, and partly from the effect of rain which lodges in them, in a few years bring the trees in which they occur into that incipient state of ill health, in which the female selects them for laying her eggs just as in trees beginning to decay naturally, and thus *healthy trees are effectually destroyed* by the combined operations, first and last, of the *Scolyti of both sexes*, though not in consequence of the sole deposition of the eggs of the female." This explanation, first detected by M. Audouin, and subsequently confirmed in numerous instances by Mr. Spence, in the boulevards of many of the towns of the north of France, from Dunkirk to St. Lô and Granville, satisfactorily reconciles the conflicting opinions of previous observers, and proves that hundreds of young trees may be brought into an incipient state of decay by the *Scolyti* without containing a single egg.

"It is scarcely possible," continues Mr. Loudon, "to overvalue in an economical point of view the importance of M. Audouin's discovery, which if it had been formerly known and acted upon might have saved the greater part of the fine elms in the promenades of many of the principal cities in the north of Europe, which have fallen victims to the ravages of *Scolytus destructor*, as well as 50,000 young oaks in the Bois de Vincennes, near Paris, which it has been recently necessary to cut down in consequence of the attacks of another insect of the same tribe (*S. pygmæus*). The practical directions to which it leads, in all cases where there is reason to suspect the presence of *Scolyti*, are very simple, and may be briefly expressed as follows.

" 1. The first thing to be done is to pare away the exterior rough bark with a cooper's spokeshave, or other convenient tool; this admits of a distinct inspection of the actual state of the trees, which, if there is no trace in the inner bark either of small holes in old trees, or of those superficial furrows which the *Scolyti* make for food in young trees (and which may be distinguished from the natural crevices in the bark by their dark-coloured and dead margins), may be pronounced to be in a sound and healthy state, and requiring no further attention.

" 2. If the inner bark exhibits either of the appearances above mentioned, the next thing is to ascertain whether the female has already deposited her eggs in it; and if it contains the larvæ of the *Scolyti*, to know which it is necessary to cut away portions here and there of the bark down to the actual wood and examine them; and if the existence of the larvæ be proved, the trees should be cut down and their bark peeled off, and every fragment of it carefully burnt.

" 3. Those trees which, though pierced with exterior superficial holes or furrows, have no larvæ in them, are such as have been attacked by the *Scolyti* for food only; and if they be carefully brushed over with coal tar, the smell of which is highly offensive to the perfect *Scolyti*, there is every probability that they will be secure from the future attacks of the females; and that the repetition of the same process in the spring for a year or two would enable them to resume their vigour and to become healthy trees; for the future fate of which, if at the same time the entire removal of all the trees actually diseased has been attended to, there would be no need of apprehension. It is in this way, as we are informed by Mr. Spence, that a great number of the young elm trees on the boulevards of Brussels, brought into an incipient state of debility by the attacks of the *Scolyti* for food, but not yet attacked by the females, were treated on the spring of 1836 with every prospect of a successful result, though of course some years must elapse before any absolute deductions can be drawn from the experiment."

In conclusion, we cannot but regret that the assistance of some competent person was not required by the Commissioners of Woods and Forests, previous to the wholesale and indiscriminate felling of the trees in Kensington Gardens, the ornament of the metropolis, which it will require so many years to replace, where sound and unsound trees of other kinds have been cut down to the ground. Let us hope, now that the preceding observations have led the way to a more precise acquaintance with the subject, that the axe will be laid more sparingly to the trees which still remain.

SCOMBEROIDÆ—the Mackarel family. The seventh in order of the fifteen families into which Cuvier arranges the *Acanthopterygii*, or spinous-finned fishes, and one which in the number of its genera and its species, the countless myriads of its individual members, the vast numbers of them that are caught, and the excellent qualities of the flesh of very many, may be reckoned among the most interesting and valuable of all the inhabitants of the ocean. They are all fishes of great power in the water, swimming with incredible energy, generally at no great depth, and often appearing at the very surface, where many of them display a brilliance, variety, and change of colour, which defy all powers of description. Inhabiting thus near the surface, they are fishes which breathe much more than those that live at a greater depth, and thus they die more speedily when taken out of their native element than those fishes which have a slower action of the system, and inhabit further down. It is a pretty general law too, that fishes (at least bony fishes) which have rapid action and breathe much, cannot be kept so long after they are taken out of the water, as those in which the action is more moderate. The mackarel family agree with the law in this, and none does it more than the common mackarel. No fish, obtainable in any thing like the same quantity, is better than mackarel when perfectly fresh, but there are few that sooner become tainted and unwholesome.

No sea that can be named is without one or other of the members of this numerous family, and there are seas in which a great variety of them are to be met with. But even the outline of their history would fill volumes, and therefore we can do nothing more than indicate the leading genera, and mention one or two of the species which are most interesting to British readers. The family contains in all fifteen leading genera; but in many of these the species differ so much from each other, or are so numerous, that Cuvier, who had no disposition to make any wanton increase of divisions in any part of the system, found it necessary to subdivide them into more than thirty subordinate genera, in addition to these leading ones.

The general characters of the family are: the surface of the body smooth, the scales small, the muscles of the posterior part of the body, and the caudal fin especially, very powerful. There is one part of their muscular structure which is worthy of attention, as showing the peculiar organisation of a fish which is formed for getting rapidly through the water by muscular action alone, without much assistance from the resistance of raised posterior edges to the scales. The flakes, as they are vulgarly called, are thicker; that is, they measure more in the direction of the length of the body than they do in fishes that have large scales, and especially than those which inhabit lower down and have less powerful action in the water. This admits of a greater length of the individual muscular fibre; and thus the contraction and bend resulting from it are more rapid and more extended than if the fibres were shorter and there were a greater number of them in the same length of the body of the fish. Some members of the family are without any air-bladder, and others have one, which is one of the many proofs that this organ, whatever may be its use, is not absolutely indispensable at any particular depth in the water, or for any particular rate of swimming. We shall now barely enumerate the genera.

Scomber (Mackarel properly so called). This, which is the typical genus of the family, is subdivided into eight; the first of which is,

Scomber (the common mackarel). This is a fish which every body knows; and in the elegance of its form, and the beauty of its colours, it is equalled by few fishes. It of course partakes of the distinguishing characters of the genus, the most obvious of which are, the form of the second dorsal fin and the anal; these have some of their rays nearest the tail detached and forming a series of processes which get the name of false-fins. The characters more peculiarly descriptive of the mackarel itself are: the body spindle-shaped, or thick at the middle, and tapering to both

extremities, but especially to the tail, and being what may be regarded as the model of a swift fish, just as the form of a falcon is the model of a swift bird. There are no scales on the ventral fins; the two dorsal fins far apart, the anal under the second one, and the false fins or finlets extending from both to the bases of the caudal, or nearly so. The tail is a little forked, and the two lobes of the fin stand diverging from each other, and are much pointed. The fin is not very large, but its form remarkably fine; and though the body tapers toward its base, the thickness from side to side gives it much muscular strength even there. It is indeed quite a study for such as are fond of the very beautiful and instructive science of animal mechanics; and in it, as in other cases, we find that the maximum of energy depends upon form, not upon mere mass. To describe the colours, or any of the other particulars, would be superfluous; the adaptation of the mackarel to very rapid motion in the water is the part of its appearance which contains the valuable lesson.

When the old notion of the migration of fishes over long distances from one part of the world to another was in fashion, the mackarel was included in the catalogue of migratory fishes. It was not then considered that the migrations of animals from latitude to latitude were produced by the action of the seasons upon them, and that, as there is very little seasonal action in the sea, there can be no need for such migration on the part of the fishes. The mackarel is, upon ordinary occasions, a discursive inhabitant of the deep waters, where the bottom is too remote from the action of the sun and air for being fit for hatching the roe of a fish. Therefore, for the very same reason that the salmon ascends the rivers, and herrings and many other fishes come toward the shores at certain times of the year, the mackarel comes into water more shallow than that in which it finds its food at other times. Then, as we cannot suppose that the water over the deep where the bottom is barren of life can furnish such a supply of food as over the shallows where the bottom is fertile, the mackarel and other fishes, which come periodically toward the shores in shoals, must live much more dispersedly in their deep sea haunts. There is something very beautiful in this even in so far as use to man is concerned. Man could not fish the breadth and depth of the great ocean for those fishes which find their food there, and thus a very large portion of the waters would be a waste to him, in spite of the utmost exertions of his industry. But the fulfilment of the law of nature brings these fishes toward the shores, one at one season and another at another; and thus the fishes are, as it were, constrained by the law of nature to fetch the treasures of the deep to those places where man can derive advantage from them; and the great vigour of action which fits them for their labours in the ocean, enables them to find food upon the more fertile because more shallow places, in shoals far greater than fishes of less energy of action could exist.

The time at which the mackarel fishing commences, or, at all events, is most productive on the different parts of the British coasts, shows pretty clearly whence the fish come, and of course that is the place to which they retire when they take their departure. The sea on the east coast is not deep enough for them at ordinary times, and that on the north is too cold. The Atlantic is therefore the pasture to which they retire when the spawning upon the coast is over. When they make their appearance on the shores, it is at first on the south-west; and they appear there in the greatest number, and the fishing continues longest. From the south-west of Cornwall to the northern isles, the time which they take to travel is nearly five months, and comparatively few reach the latter locality. Their appearance is not, however, strictly geographical; for the character of the bottom in the offing appears to have a considerable influence upon them. The water over the sandy shallows of course gets first warm, and this tends to mature the spawn, and consequently the fish not only first approach the land in such places, but are earlier in the finest condition.

There is another circumstance worthy of notice in the seasonal economy of these fishes. At the time when they come to the shores, the fry of those fishes which spawn in the winter or early in the spring, is very abundant, literally swarming to a thousand, or, probably, many thousand times the number which could come to maturity with a due balance of the system; and then the surplus goes to feed the mackarel, and the other discursive fishes that come from the deep water during the summer. From the difference of time between their appearance on the southern and the northern coasts of Britain, it is of course impossible to lay down any precise time by the calendar for their spawning, though perhaps about midsummer may be the average time for the British shores. They are not the most prolific of all the fishes certainly, but still they are very prolific, the produce of a single roe amounting to about half a million; and it will be borne in mind that, in the case of a fish, the bringing of the eggs to maturity is all the labour that devolves on the parent, the hatching of the eggs being produced by the elements, and that generally, if not always, after the parent fishes have retired to other parts of the water. As on all parts of the coast which they frequent, they spawn in the very warmest part of the season, the spawn is very soon hatched; and in about the period of two months the fry are understood to grow to the length of four inches or thereabouts, and they soon after retire from the land. Mr. Yarrell is of opinion that one principal article of the food of mackarel on the coasts of the channel is the fry of the sprat; and it is by no means unlikely that this fry, and also that of the pilchard and the herring, are eaten by them in great numbers; but in the case of all these fishes, there is enough and to spare.

Mackarel, as being in all probability the most seaward and discursive fishes which come regularly and in vast numbers to the shores of Britain, and afford a most valuable fishery, offer many inducements for going into a general inquiry respecting the relative dependence of the sea, and of the fishes of different places, depths and distances from the land, upon each other; but the subject, though one of great interest, and not only worthy of, but imperatively demanding far more attention than it has hitherto received, is much too extended for our limits, and indeed for being taken up with advantage as a part of the discussion of any other subject. We must therefore confine ourselves to a few notices of the fishing, the substance of which we shall take from Mr. Yarrell, as the latest and best authority upon the subject; and as drawn from the personal observation of others in all cases which his own observation did not reach, and where he himself has not stated the fact to be otherwise.

The following extract will show the numbers, and the fluctuation of the prices. "In May, 1807, the first Brighton boat-load of mackarel sold at Billingsgate for forty guineas per hundred, seven shillings each, reckoning six score to the hundred, the highest price ever known at the market. The next boat-load produced but thirteen guineas a hundred." Then for the contrast:—"Mackarel were so very plentiful at Donn in 1808, that they were sold sixty for a shilling," one four hundred and twentieth part of the price of the first boat-load at Billingsgate just the year before. "At Brighton, in June of the same year, the shoal of mackarel was so great, and one of the boats had the meshes of her nets so completely occupied by them, that it was impossible to drag them in; the fish and nets, therefore, in the end, sunk together; the fishermen thereby sustaining a loss of nearly 60*l.*, exclusive of what the cargo, could it have been got into the boat, would have produced. The success of the fishery in 1821 was beyond all precedent. The value of the catch of sixteen boats off Lowestoffe on the 30th of June, amounted to 5,252*l.*; and it is supposed that there was no less an amount than 14,000*l.* altogether realised by the owners and men concerned in the fishing on the Suffolk coast. In March, 1833, on a Sunday, from Hastings, boats brought on shore ten thousand eight hundred mackarel; and the next day, two boats brought seven thousand fish."—Yarrell's British Fishes, vol. i., p. 125, 126.

The mode of capturing fish, which sometimes fetch so very exorbitant a price, and are at other times caught in such numbers, and sold so cheap, is a matter of considerable interest. The method of capturing them in the wholesale way, and out at sea, is by means of drift-nets, that is, nets which are allowed to drive with the current of the water, in the same way as is done in the capture of herrings on the grand scale. They are also both caught in the same way in the net, that is, in the meshes, and not by having the net drawn round them, so that the individual mackarel are caught each in a mesh, in the same way as herrings are, and not by enclosing the shoal as is done in the case of pilchards. The net is twenty feet in depth and six times as much in length, well buoyed up with floats against its own weight and that of the fish, that it may entangle, but it has no weights at the bottom. A number of these nets are often tied together, and the boat remains at the end of the drift-rope, or head-rope of the net, to serve as a sort of anchor. They are usually shot in the evening, and drawn once, and shot again during the night, or left undisturbed till the morning, according to circumstances; the management of a fishing ground being a matter of local experience, which none ever do so well as those who have been regularly trained to it. When the net is drawn, a capstan is ready in the boat for the purpose of hauling it home, and the fish are either rowed to port in the boat, or the boat remains on the station, and another vessel removes the fish, according to circumstances. This is the method of fishing on those parts of the mackarel grounds which are most distant from the land. Nearer the shore a kind of seine is employed with smaller meshes than those of the draught net, and the net is worked by the crews of two boats, whose object it is to surround the fish, and secure them in the bight of the net. Mackarel are also taken by hook, and this indeed is the usual mode upon those parts of the coast where mackarel are not very plenty, and where, in consequence, the fishing is not carried on upon a large scale, or very systematically. Mackarel are so very voracious, that the kind of bait used for them is not a matter of much consequence. A slip of mackarel itself, with the shining skin on, a bit of red cloth, any thing, in short, that makes a conspicuous appearance in the water will do, and it is all the better if the fishing-boat is kept in rapid motion, and that the surface of the water or the state of the atmosphere is such as not to admit too much light. A "mackarel breeze," which just breaks the surface into ripple without any long waves, is understood to be the most advantageous, and if it is accompanied by a "mackarel sky;" that is, an atmosphere dappled with clouds something resembling the colours of a mackarel, so much the better. Under these circumstances, the mackarel seldom fail in taking the bait, and if they take it, they are sure to be caught; for, whatever the bait may be, they take it so greedily, that they are sure to be fastened on the hook beyond all possibility of extricating themselves. It is generally necessary to use a weight as a sinker on the line, or rather on a sort of head line to which that carrying the hook and bait is attached, and floats at some distance in rear of the weight. We may remark in passing, as rather a curious instance of uniformity of words among fishers, that the shoal of mackarel, herrings, and all other fishes which come to the shores in great numbers for their seasonal purposes, is pronounced as if it were written "school," both in Cornwall and in Caithness.

The muzzle of the mackarel is very much pointed; the lower jaw is longer than the upper, and the teeth are in a single row in each jaw, conical in their shape, but having their points inclined toward the pharynx. The whole structure and curvature of the mouth show that these fishes take their food only as it swims in the free waters, and never on the banks. The pectoral and ventral fins are both in advance of the dorsal, the vent is opposite the beginning of the second dorsal; and the finlets behind both the second dorsal and the anal are few in number. The grand colour of the back is rich green, mottled with blue, and with transverse bars of dusky white, which are generally said to be straight in the males, and wavy in the females. The males have, also, the gill-covers longer and the body thinner in proportion to its length than the females; but the proportions of the parts of the body to each other are much the same in both. The colours of the lower sides and under part are not very easily described, and they speedily change after the fish is exposed to the air. Silvery, with clouds and reflections of golden bronze, of many varying shades, may be described as the general colour of those parts.

Scomber colias (The Spanish mackarel) is a rare fish on the British coasts as compared with the common mackarel. It is a thicker fish than the common mackarel, with the eyes larger and the gape wider, but the teeth not so large. The under part is beautifully mottled with golden and silvery metallic lustres interspersed with yellow spots. It is by no means rare in the seas of the south of Europe, and great quantities are taken on the coasts of the south of France.

Scomber lar (the lar mackarel) is a native of the Pacific, and fished for by the inhabitants of several of the islands which spot that ocean, especially by those of New Ireland. It is larger than the mackarel of the European seas, and an exceedingly beautiful fish in its colours. The upper parts are mottled with

red spots and lines of golden-yellow upon a rich green ground; and the under parts are silvery with a fine rosy tint. In the season vast numbers of them approach the shores.

Thynnus—Tunny. This, though sometimes caught on the shores of Britain, is a rare fish with us; but it is very plentiful in the Mediterranean, and has been known and celebrated from the remotest period of antiquity at which we have any mention of fish by particular names. It has many qualities to recommend it, being very handsome, very large in size, and in much estimation as food. The characters are: the body resembling that of the mackarel, but thicker across in proportion to the length; the fore part of the body having a sort of mantle composed of numerous scales; the first dorsal extending nearly to the second, and becoming much lower toward the posterior part; the anal fin in rear of the second dorsal, and both of them divided into numerous finlets toward the tail; and the sides of the tail with a distinct keel.

The tunny is altogether a much thicker and stouter fish than the mackarel. Pennant saw one, which had followed the herrings into Loch Fyne, killed at Inverary, the weight of which was four hundred and sixty pounds; and specimens larger than this have been mentioned. The length of the one in question was seven feet ten inches, which were very large dimensions for a fish of the active and discursive habits of the tunny. But the tunny is, properly speaking, an inhabitant of warmer seas than those of Britain, and of course makes its appearance there only as a stray, diverted from its proper track by the prey of which it is in chase and not in quest of spawning ground, as is the case with the mackarel.

During the greater part of the year the tunnies are discursive through the ocean, but in the summer they resort to the shores in vast shoals; and all along the north-coast of the Mediterranean, and in the island of Sicily, the tunny fishery is carried on with much activity, and the flesh of the tunny, both in the recent state and salted, forms a considerable part of the food of many of the people, and no small part of the wealth of those who reside on the coasts. The months of May and June are the great ones for this fishery, and they are looked forward to with much expectation.

There are two modes of fishing, the one by temporary nets shot from the fishing-boats, and the other by fixed ones. Confederacy is necessary for the working of both, as the fishes are very timid when they approach the land. They range along the shore at no very great distance, so that the place and direction of the shoal can be seen by sentinels placed on the heights. The boats then advance uniting their nets, and forcing the fish into the shallow water, from which they are taken by means of a large tunnel net. The large ones are, however, always killed in the net; but the small ones are carried on shore. The fixed nets are placed parallel to the shore, at such a distance as that the fish shall come between. There are cross nets, which have small openings, the passing of which gradually brings the fish into close array, until they are in the last enclosure of the net, which is emphatically called the "chamber of death." In this they are secured; and it has a net at the bottom, the raising of which brings the whole shoal to the surface, where they are despatched, by beating them on the head with poles. When taken in such quantities, the greater part are cut in pieces and salted, or part are often pickled much in the same way as we pickle salmon.

When raw the flesh of the tunny has a colour nearly as red as that of beef; but it becomes paler when boiled. The flavour is much famed, but the consistency is much harder than accords with our notions of fish of the first quality, being more so than even that of the sturgeon, though the tunny is the better flavoured fish of the two. It is dressed in a great variety of ways.

The spawn is deposited about the same time of the year as that of the mackarel. It is speedily hatched, and by about October the fry, which are then nearly two pounds in weight, quit the shore for the deep water. The tunny has a family likeness to the mackarel, but it is shorter and thicker in proportion; the head is rather short, the gape not very wide, and the teeth small and in a single row, but exceedingly sharp. The inside of the mouth and the tongue are very dark-coloured, the first dorsal fin folds down into a sort of groove on the back, and there is a spine in advance of the second one. The upper part is dark blue, with the scales on the mantle lighter; the under part is greyish white, with silvery spots, which are produced up the sides; and the sides of the head are white. The first dorsal, the pectoral, and the ventral fins are black; the caudal fin is dusky, the second dorsal and the anal are flesh-coloured, with silvery reflections, and the finlets are yellowish with black tips. The caudal fin has always fewer rays than that of the mackarel, and the number varies in different individuals. There is another tunny, still more southerly in its habitat than the tunny of the Mediterranean, which may be noticed, which is

The Bonito, or Striped Tunny (*T. pelamys*). This is, like its congener, a very roaming fish; and though it does not appear regularly in the British seas, or resort to the British shores to spawn, yet occasionally occurs as a stray, following and feeding upon the smaller fish. The shape is nearly the same as that of the tunny, but the size is smaller, the length rarely being more than two feet and a half. The colour of the upper part of this species is steel blue; the sides dusky; and the under part whitish, with three dusky stripes from the pectoral fin to the posterior part of the fish, parallel to each other and to the outline of the under part, and terminating backwards at the lateral line. The dorsal fins and the anal one are concave in their margins, and the finlets are enlarged at the tops, so as almost to reach each other at the extremities, though their bases are at some distance apart. The lobes of the caudal fin are very long, and placed so nearly at right angles to the axis of the body, that the tail is but slightly concave in its posterior margin. The flesh, as is the case in all the fishes which are powerful swimmers near the surface in the wide seas, is very red and full of blood.

The bonito occurs in the Mediterranean; and there are, indeed, two species which get the name, the chief difference between which seems to be, that the teeth in the other one are much larger, and the sides are marked with dusky bars across. It is in the ocean that these fishes, and some of the other large members of the mackarel family reside. The flying fishes are the grand object of their pursuit; but they catch very indiscriminately at any thing that moves in the water; and thus they are often captured by the sailors, to whom they afford a very welcome and acceptable mess, though their flesh is dry, and not of

the very best flavour. The fishes are not very particular in their own eating. The only ground of selection appears to be what they can swallow, in preference to what they cannot; and it is even said that, in the absence of animal food, they will eat the seaweed which floats in the eddies of the ocean. The bonito is among the rarest of those fishes of the warm seas that occasionally straggle to our shores. There are a few more of the subordinate genera of the great genus mackarel, which resemble the tunnies in some particulars, and differ from them in others; but their habits are all nearly the same. We shall therefore proceed to notice another of the leading genera.

Xiphias (Swordfish). This is a fish of so much celebrity, that it has got a nominal place among the stars as a constellation; and certainly, numerous as are the inhabitants of the ocean, there are none of them more deserving of celebrity than the members of this genus. Cuvier divides them into four sub-genera; but our limits will not permit us to go into the details of these. Several of them abound in the Mediterranean, and a stray of at least one of this is occasionally found on the British shores, while numbers occur in the open sea, still further to the north. There are others which are more confined to the tropical seas; and they attain a very large size, and may fairly be designated terrible fishes, for bulk, armature, action, and every other attribute that can render a fish entitled to the name.

In their internal organisation, the extreme smallness of their scales, in the crests on the tail, and in the vast power of the caudal fin, these fishes have a considerable resemblance to the tunnies; but in other respects they are distinct. Their most remarkable character is the production of the upper jaw, in an instrument formed like the blade of a sword, with hard spiny tubercles on each side, and nearly half as long as the head the body and the tail taken together. This consists chiefly of a prolongation of the intermaxillaries and the vomer, supported by the ethmoides. It is the only weapon which these fishes have, for though they have some small teeth on the bones of the pharynx, they have none on either of the jaws, and they have no tongue properly so called. The produced jaw is, however, a truly formidable weapon, for they can not only plunge it to the hilt in the body of the very largest marine animal, but can drive it through the planking of a ship, and into the timbers, until it breaks in two with the violence of the concussion. When such an occurrence takes place, those on board the ship, even though of considerable burden, are said to feel a shock, similar in kind if not in degree to what is felt when a ship strikes against a rock. The gills of the sword-fishes are peculiar; they do not consist of fringes in the form of the teeth of a comb, as is usual among the bony fishes, but each consists of two large parallel laminæ, with reticulated surfaces.

This peculiar form of the gills, which are so very important organs in the vital system, would lead us to suppose that there must be something in the habits of the fishes which renders this peculiarity of the breathing apparatus necessary; and when we come to examine the action of these fishes, we find that such is really the case. Mackarel themselves are swift in the water, and so are others of the family; but the sword-fishes dash along like thunderbolts in the water, and thus the impetus with which they deliver their weapon, is perhaps greater than that of any other animal. This extreme rapidity, and the rebound which must ensue when they strike against an animal or other substance of sufficient mass for offering resistance, would be serious to them if they had gills fringed in the usual manner; for the fringes would get entangled, the circulation would stop, and the fish would be strangulated. The laminated gills are not exposed to this; and so, possessing them, the fishes can drive away with safety.

It is not, however, for their curious weapon, their size, and their speed only that these fishes are so celebrated; for the flesh of them is excellent, superior perhaps to that of the tunny, though, like the flesh of all the driving about fishes, we may suppose that it is dry when dressed in the same way that we are in the habit of dressing the flesh of the soft fishes. The sword-fishes also offer the surplus of their number readily to the use of man; that is to say, they come to the shores in obedience to the grand impulse of nature during the summer months, and they keep so near the surface and are so large, that they are easily seen. It does not appear that they shoal in any considerable number, and they are rather sturdy for net-fishing, unless it were conducted upon a scale of magnificence and expense, which could hardly be done by such people as the inhabitants of the shores to which these fishes resort in the spawning season; and when they are in the wide sea, of course any fishing for these or any other of the mackarel family is out of the question. We shall now mention the sub-genera, but confining the few details which we have to offer chiefly to the one which is found in the British seas.

These sub-genera are;—*Xiphias*, the sword-fishes properly so called, of which we shall afterwards say something more at length; *Tetrapturus*, so called from four projecting crests, two on each side of the base of the tail, and which has the snout formed like a dagger, and each of the ventral fins only a single little lobe without any articulation; *Makiara*, which is known we believe from a single specimen only, is like the preceding in all respects, only it wants the rudimental ventral fins, but this may be merely accidental in the specimen on which the subdivision is founded, as it is known that the common sword-fish, the typical one of the genus, wears away the anal fin as it gets old, though that fin is complete when the fish is younger; and *Isteophorus*, which have the snout and the crests on the tail like the last, but the dorsal fin very high, and the ventrals long, slender, and each composed of two rings. The dorsal fin in these is said to catch the wind in the same manner as a sail, and thus to assist the fishes in their progress through the water. It may do this, and it appears to do it; and the fact that several members of the family can elevate and depress the dorsal fin at pleasure, shows that this fin has different uses upon different occasions. This is understood to be the sub-genus or section which contains the great sword-fishes of the tropical latitudes, in which latitudes they are very numerous in all the three oceans; but when we come to consider a genus of which the known habitat is the Atlantic, the Indian Ocean, or the Pacific, the field is too wide for permitting us to speak with confidence as to the details. It is generally supposed, however, that these are the ones that drive against ships with so much force, and leave part of their swords in the timber as proofs of the fact.

Common Sword-fish, (*Xiphias gladius*). This is the one which there is the greatest probability, (though not a very great one,) of meeting with on the British coasts; and it happens also to be the typical species, so that on both these accounts it is the one of which it is desirable to give a few details.

The generic characters are; the head triangular in profile, but drawn out into the lengthened sword of the upper jaw in the manner that has been already described; the thickest part of the body near the setting on of the head; one dorsal fin rising from the nape and continued for a great part of the length of the body, the outline of the anterior part concave, and that of the posterior part convex; no ventral fins; the tail with strong keels, and the rays of the lobes greatly produced; the gape not very deep, the lower jaw pointed; the jaws without teeth, and the sword-shaped portion of the upper jaw very long, and strongly supported at its base; the body covered with very minute scales.

The common sword-fish is very abundant in the Mediterranean, where it has attracted much notice from the most early times. As is the case with all the family, it is discursive, excepting at those times when it approaches the shores for the purpose of spawning; and although it would not, perhaps, be quite correct to apply the epithet "timid" to a fish whose armature enables it to defy all its fellow inhabitants of the deep, yet it is at all events a cautious fish. Though longest and best known to naturalists as a native of the Mediterranean, it often roams into the ocean, seldom, as it is said, upon the parallel, but either northward or southward, of the strait of Gibraltar. That this should be the direction which it takes in its wanderings, we might be prepared to expect, for in the sea, especially, we know of no animal that migrates longitudinally upon the parallel, neither do we know of any cause or inducement that they could have so to migrate; because in the sea, there is no change of climate upon the parallel, and nothing for which a fish could migrate, except toward the shore to spawn, and from it after that operation is over. Even in this case there appears always to be a movement in latitude, and in the case of the summer spawning fishes, this movement appears, in our hemisphere, to be chiefly toward the north. We have already pointed this out in the case of the common mackarel, and we believe it will be found that in the Mediterranean, the whole family resort much more to the northern shores than to the southern ones for the purpose of spawning. There are physical reasons why this should be the case, but our limits will not allow a full examination of them, and a partial one would be of little use.

From the time of the very earliest authentic notice of British fishes, the sword-fish has been included in the number, though only as an occasional straggler; but out in the ocean it is much more common, and ranges further to the north. Indeed, as an occasional fish on the coasts, it has oftener appeared on the Scottish than the English; and in latitudes still higher it is more common both in the open ocean and in the Baltic.

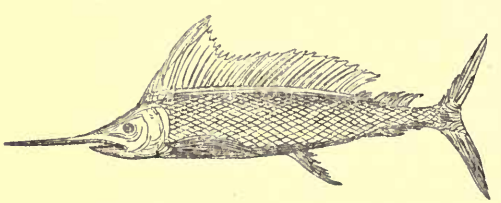
Its antipathy to the whale has been the subject of much description, and though there seems to be no reason for doubting the fact, the reason is by no means so apparent. That a sword-fish could "swallow a whale," is of course out of the question, and as little could it bite, as it has got no teeth in the jaws; and then though it may use the sword in "cutting up" large animals into mouthable morsels, the fact of its actually doing so has not been to any extent proved. We quote an account of the mode of attack on the whale by the sword-fish, and its auxiliary, the thrasher, given by Captain Crow, as having been witnessed from a vessel on its passage to the Baltic. "One morning," says he, "during a calm, when near the Hebrides, all hands were called up at three A.M., to witness a battle between several of the fish called thrashers, or fan-sharks, (*Carcharias vulpes*,) and some sword-fish on the one side, and an enormous whale on the other. It was in the middle of summer, and the weather being clear and the fish close to the vessel, we had a fine opportunity of witnessing the contest. As soon as the whale's back appeared above the water, the thrashers springing several yards into the air, descended with great violence upon the object of their rancour, and inflicted on him the most severe slaps with their long tails, the sound of which resembled the reports of muskets fired at a distance. The sword-fish, in their turn, attacked the distressed whale, stabbing him below; and thus beset on all sides, and wounded, when the poor creature appeared, the water around him was deluged with blood. In this manner they continued tormenting and wounding him, until we lost sight of him, and, I have no doubt they in the end completed his destruction."

Such is the account given by Captain Crow of what he saw, and of course we do not mean to call the seeing of it in question, because we think every man has a right to see all that he can see, and as much more as possible. We almost regret, however, that it has been quoted by Mr. Yarrell, because those who cannot draw distinguishing lines, will be apt to fancy that he saw it, and we are quite sure that Mr. Yarrell has too much good sense for seeing any such thing. In the first place we would ask, from what fulcrum, or *point-d'appui*, did the sharks deliver the blows with their tails, so as to give reports like muskets, when they descended on the whale? If the body of the shark was supported upon that of the whale, then the tail might strike; but if the shark made its stroke from the air, falling from the height of only a few yards, we know of no momentum that it could have, beyond that of its body, as a certain weight of matter falling from this trifling height, and that could not be very great. Then there is another trifling question connected with the conduct of the sharks; what part of their backs served as the fulcra from which they leaped out of the water? We of course do not mean to deny this statement, neither do we mean to deny that the shark in question can give double blows with the long lobe of its one-sided tail. All that we doubt is, that the leaping of the shark some yards into the air could much help the violence of its blows, because the force of a blow must always depend on the power of resistance in that from which it is delivered.

But supposing all that is said of the thrashers to have been seen, there is more of doubtful matter in this most marvellous infliction upon the poor whale. The sword fishes made "their gashes" upon the *under* side of the enormous brute, (we presume we may say "brute" as the whale is mammalia, not fish?) and the question to which we desiderate an answer is this: How were the attacks of these fishes upon the *under* side of the whale seen? A whale of

any dimensions, and especially "an enormous whale," is not the most transparent of all media ; and besides there are certain optical reasons why "ordinary" light will not reveal what goes on under water, to say nothing about under a whale, even at a very moderate distance. We still do not mean to deny that all which is stated was seen ; because some men see "visions," but they very generally have another gift along with this, they "dream dreams," and it may be that herein lies the whole explication of the matter, and our philosophy may lie on the shelf. The result of the whole is, that the account given by Captain Crow must be true, and yet we cannot believe it, though discounting it ; there is still enough of matter for marvel about the sword-fish. We would even go a little farther than this, and ask *cui bono?* in the case of the sword-fish attacking the whale. It is possible that there may be here some reasoning from the analogy of the sword among men. That sword, it must be admitted, conduces to no useful purpose—does not go to promote the real advantage of the human race one single iota ; for all the swords that ever were drawn never contributed so much to the well-being of the world as the growth of one single potato. This may be all very well with human beings, and must of course be very well, inasmuch as the most sainted and saintly of monarchs have generally been the most ultra patronisers of the sword ; but we are yet to learn that fishes have even the smallest chance of canonization on the same grounds, which may be very bad taste on the part of the said fishes, but not the less natural upon that account.

Whoever chooses to examine the figure of the sword-fish, must at once see that all its powers of motion are concentrated in the caudal fin, and that the chief use of the very high dorsal must be that of keeping the body of the fish steady to the line of its motion.



The prolonged snout forms an excellent cut-water, and the regular increase of the head gives that part nearly the form of the "solid of least resistance" in passing through water. In the anterior part of the dorsal fin the rays are stout ; and it stands on the thickest part of the fish, while toward the rear the rays are smaller and closer together, so that the fin is much more flexible. The absence of abdominal fins is against the fact of the fish having much motion in ascent or descent, and it seems doubtful whether the fish can use its weapon very vigorously or effectively at close quarters ; for an instrument of such dimensions would require to get a momentum, the acquiring of which must be had by a considerable "run" on the part of the fish. This also is against the notion of the wanton attacks on the whale, though still we do not mean to deny that these attacks are made. The pectoral fins are long, and placed lower down on the sides than they are in fishes which have abdominal fins. The anal fin is continuous in the young fish, but in the old ones the middle part of it, which has the membrane very thin and tender, is worn away, so that the portion near the tail is a mere finlet. The edges of the nasal weapon are finely toothed, the upper side marked with numerous striæ, the under side smooth but with a groove along the middle. The sides of the head are vertical, the eyes are round, the gill-covers, mouth and all the rest of the body covered with a rough skin, which is tuberculated in the very young specimens, but not in those which have attained any considerable size. The lateral line is hardly visible ; the upper part of the body is shaded with bluish black, and the lower part is silvery white. The food, or at all events the substances which the sword-fish shows a disposition to seize as food, are very diversified, but the substances that have been actually found in the stomach have never been of great size. Small fishes and floating mollusca are what have chiefly been met with ; but Captain Beechey, in his interesting narrative, mentions that "when in the Pacific Ocean, near Easter Island, as the line was hauling in, a large sword-fish bit at the tin case which contained our thermometer, but fortunately failed in carrying it off."

It is said that the sword-fish swim in pairs, and this is another ground for doubting whether they assemble in numbers to attack the whales ; and even a pair have rarely, if ever, been seen together in our seas. If we can believe the reports, they sometimes ascend the rivers ; for Daniel, in his "Rural Sports," mentions that a man, when bathing in the Severn, near Shrewsbury, received a mortal wound from a sword-fish. This, if true, is a very curious matter, as the wide sea, and not even the shores, or the shallows over the banks, are the natural habitat of these fishes.

In the Mediterranean, where they are much better known than in any other of the European seas, they approach the shores in May, and continue for about three months ; and the capture of the old ones, which are sometimes at least four hundred pounds in weight, is a matter of some enterprise. The fishermen have their boats provided with harpoon and line ; and the mast of a vessel, or a high cliff overlooking the sea, is taken possession of by the man who is on the look-out. When he makes the signal, the boats run to the spot, and the harpoons are launched, till one takes effect. The fish, when struck, darts off, though not so rapidly as the whale, neither does it plunge like that animal. But the sword-fish is more wary than the whale, and presents a much smaller object to the marksman, so that the hitting of it requires no little skill ; and it often continues to swim and struggle for several hours before they can completely subdue it. The flesh of the large ones, like that of most animals of rapid motion, is hard and dry, though wholesome, and not disagreeable to the taste ; but that of the young, even when of very considerable size and weight, is said to be excellent.

Centronotus. This is also a numerous genus, which is subdivided into four subordinate genera, *Naucrates*, *Elacati*, *Lichia*, and *Trachinotus*. The leading characters of the genus are : the first rays of the dorsal fins free, or without any membrane, and the ventral fins always present. Our limits will admit of a notice of only one species of one of the sub-genera.

Naucrates ductor—the Pilot-fish. The generic characters are : the scales small, one long dorsal, with

some pure rays in the anterior part, and four rays also in front of the anal; the sides of the tail with a keel, and the teeth numerous, but small.

The pilot-fish is one which has been long celebrated. The Greeks, who were always ready to throw in a little embellishment upon the very slightest grounds, regarded it as a sacred fish, and one which was of essential service to doubtful voyagers. Modern science has, of course, bereaved the fish of much of its reputed glory in this respect, by showing that the ship is pilot to the fish, and not the fish to the ship; but even now the pilot-fish is looked upon with a good deal of superstition.

It follows sharks as well as ships, and for the same reason, no doubt, in both cases, namely, for the refuse that it can pick up. The teeth of the shark have a cutting or mangling structure, and thus portions of its prey escape, which these comparatively small, but active and voracious fishes, readily seize. It appears, therefore, that the pilotage which this fish gives to the shark is very much akin to the providing which it used to be said the jackall made for the lion—the hope of sharing in the capture made by the more powerful animals. The stories which are told point, however, to something very different from this, and, as they are told and reported by those who are really the best authorities on the subject, we shall mention at least one of them. The stories which are told of the efforts made by these pilot-fishes to tempt the shark to take the bait which is thrown out in order to catch him, have some semblance of truth about them, because they approach and hover about the bait, though they are unable to take it on account of its size; but it must not be supposed that they in any way tempt the shark, either to his destruction or for their own personal advantage; and the last of these is the only one for which there could be anything like a rational ground, even supposing that the pilot-fish were actually possessed of speculation, which it evidently cannot be.

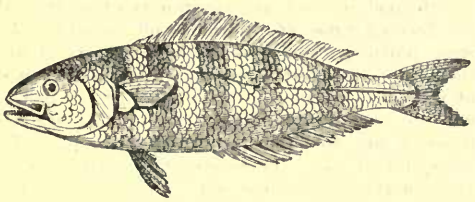
But the opposite accounts, namely, those of the pilot-fish attempting to keep the shark from the danger of the hook, have more of romance in them, and are sometimes told in a more circumstantial manner; so we shall quote one in the words of Colonel Hamilton Smith, whom Cuvier calls "très-savant naturaliste." It occurs in Griffith's Animal Kingdom, vol. x. p. 636, and is in these words:—"Captain Richards, R.N., during his last station in the Mediterranean, saw, on a fine day, a blue shark which followed the ship, attracted perhaps by a corpse, which had been committed to the waves. After some time, a shark hook, baited with pork, was thrown out. The shark, attended by four pilot-fish *Scomber ductor*, repeatedly approached the bait; and every time that he did so, one of the pilots, preceding him, was distinctly seen from the topsail of the ship to run his snout against the side of the shark's head, to turn it away. After some further play, the fish swam off in the wake of the vessel, his dorsal fin being long distinctly visible above the water. When he had gone, however, a considerable distance, he suddenly turned round, darted after the vessel, and, before the pilot-fish could overtake him and interpose, snapped at the bait, and was taken. In hoisting him up, one of the pilots was observed to cling to his side until he was half out of the water, when it fell off. All the pilot-fishes then swam about a while, as if in search of their friend, with every apparent mark of anxiety and distress, and afterwards darted suddenly down into the depths of the sea. Colonel H. Smith has himself witnessed, with intense anxiety, an event in all respects precisely similar."

This story of "the friendship of the fishes" outdoes all that Canning ironically said of "the loves of the triangles;" but we are constrained to suspect that there are circumstances in the narration which tend to invalidate the truth of it in the sober history of nature, though it may be all very well as a sailor's "yarn." In the first place, would a shark follow a ship attracted by a corpse which was not in the ship, but had been committed to the deep? In the second place, do sharks really follow ships, when there are corpses on board, more than they do at other times? and if so, by what particular organisation does a fish in the water continue to nose out the particular origin and direction of an effluvium, whatever that effluvium may be, which affects the air from a vessel in motion? In the third place, how was it known that the pilots would have interposed to prevent the shark from taking the bait, when they did not so interpose? And, in the fourth place, how far "down into the depths of the sea" did the pilots go to spend the time of their mourning for the loss of the shark? A satisfactory answer to these questions is the first desideratum toward a fair understanding of the manners and motives—no, *not* motives, for motives it can have none—of the pilot-fish; and when these have been all answered in the most full and satisfactory manner, it is only a beginning of the questions which present themselves, each more eager for an answer than another. These we cannot discuss.

We must, however, quote a passage from Mr. Yarrell illustrative of the partiality of the fish for ships, though he avoids the grounds of this partiality. "In the year 1831," says Mr. Y., "two specimens of the pilot-fish were caught on the opposite side of the British Channel; and more than one instance has occurred of their following ships into Guernsey. A few years since, a pair accompanied a ship from the Mediterranean into Falmouth, and were both taken in a net. In January, 1831, the Peru, Graham master, put into Plymouth, on her voyage from Alexandria to London, after a passage of eighty-two days. About two days after she left Alexandria, two pilot-fish, *Gasterosteus ductor*, made their appearance alongside the vessel, were constantly seen near her during the homeward voyage, and followed her into Plymouth. After she had come to an anchor in Cutwater, their attachment appeared to have increased; they kept constant guard to the vessel, and made themselves so familiar, that one of them was actually captured by a gentleman in a boat alongside, but, by a strong effort, it escaped from his grasp, and regained the water. After this the two fish separated; but they were both taken the same evening, and, when dressed on the next day, were found to be excellent eating. In October, 1833, nearly one hundred pilot-fish accompanied a vessel from Sicily into Cutwater, but they were not captured."

Discounting all the romance which has been coupled with the pilot-fish, there remains enough of reality about it to entitle it to no small degree of attention; and though it would be perfectly ridiculous to suppose that the fish has any attachment to the ship, or to those who are on board, yet the fact of a little fish following a vessel for more than two thousand miles is a curious one. It is also a fish of

some interest in another point of view. When recently out of the water it is very good eating, resembling very much the common mackarel. Its principal food consists of small fishes, in quest of which it appears to range extensively. It is said to be by no means rare off the south coasts of Britain during the summer months; but it rarely comes so near the land as even the remotest places where the regular fishing is carried on.



Pilot Fish.

The pilot-fish is generally about a foot long. The general colour greyish-blue, with a silvery lustre, and paler on the under part; the body is marked with five distinct blue bands, much darker than the ground colour, which completely surround the body, at right angles to the axis, and are of uniform breadth, and parallel to each other; there is also a trace of one obscure band on the head and another on the tail; the snout is blunt; the under jaw projects farther than the upper; the eye, which is one-fifth of the depth of the head, is twice as far from the posterior edge of the gill-cover as from the extremity of the nose, and the irides are golden yellow; the gape not very deep; the teeth small, but numerous, forming a band upon each jaw; and there are also teeth on the palatal bones, and one large one on the vomer and another on the tongue; the tongue is large, thin, and free; the scales are small, and of an oval shape, with the exception of a triangular spot at the base of the pectorals; the cartilaginous keel upon each side of the tail reaches from the last rays of the dorsal and anal fins to the extremity of that organ. Though this fish is very much distributed over the different seas, there are not many changes in its appearance arising from change of place; but it appears that the name has been sometimes given to more than one species.

None of the others of this genus are met with in the British seas even as stragglers, and therefore we shall pass them over very lightly. *Elacata* are very like the pilot-fish in many respects; but they have not the fore spines in advance of the anal fin, nor the cartilaginous keels on the sides of the tail. The members of this sub-genus are found chiefly in the American seas. *Lichia*, have free spines on the back, and also at the fore part of the anal fin, and they have an additional spine on the back in advance of the others, and curved forwards. The body is compressed, and there are no lateral keels on the tail. There are three species of the sub-genus, natives of the Mediterranean, and all held in much estimation as food. One of these, the *Vadigo*, which is the typical species, attains a length of four feet or upwards, and a weight of a hundred pounds; it is a thick fish, and has the lateral line in a curve of contrary flexure, like the letter ϖ. Another, the *Derchis*, has the lateral line nearly straight; the teeth small and arranged like velvet; and a black spot on the anterior part of the second dorsal fin and the caudal. A third, has the lateral line waved into zig-zags; the upper part of the body blue, and the under part silvery; and the teeth large compared with those of the others, and in a single row. Others, with the base of the forehead more abrupt, and the body more compressed, are found in the Indian seas, where they are well known to the fishermen.

Notocanthus. Of this genus there is only one known species; which, contrary to the general habits of the family, is found only in the seas of the very high latitudes. The characters are:—the body long and compressed, and covered with small smooth scales; the muzzle blunt, but projecting in front of the mouth; the teeth small and thickly set; free spines on the back only, and the ventral fins placed far backwards.

Seriola. The characters of this genus very much resemble those of the genus *Lichia*. Like that, they have a crooked spine on the back, in advance of the dorsal; but the first rays, instead of being free, as in that genus, are united by membrane. They have also a little detached fin supported by the spinous rays of the anal. The body is compressed, and without any keel or other armature on the dorsal line. There are several species of this genus, all found in the warmer seas. One in particular, the *milk perch* of the Coromandel coast of India, is held in much estimation for the superior quality of its flesh, which is white, and said to be of the most exquisite flavour. One species has been found in the southern seas, which has the first ray of the dorsal and the anal detached, and bearing a little fin.

Nomeus (the herdsman or shepherd). These fishes have many of the characters of the preceding genus; but they have the ventral fins very large, hwit their inner margins attached to the sides, which is sufficient to distinguish them from all the others.

The herdsman, which is a native of the American seas, has acquired a celebrity something similar to that possessed by the pilot fish, only it is much less discursive; and has not been observed to follow ships to the shores of Europe, or even into the wide expanse of the Atlantic. The set of the tides and currents in that ocean are, indeed, rather against the passage of American fishes eastward; and, consequently, few of them visit our shores. The colour of this fish is silvery, with black bands across the back; and it is the "banded mackarel" (*Scomber fasciatus*) of some authors, and the (*Gobius Gronovii*) of others. It is not rare upon many parts of the east coast of America, from the equator to pretty high latitudes; and it attains the size of the salmon. The set of the Gulf stream along the coasts of the United States, and the higher temperature of the water in that stream, cause a very general distribution of tropical fishes along the whole line.

Temnoden (open-tooth). This is a genus of which only a single species is well known; but it is very generally distributed, and that has caused it to be called by many names. It is found in the Mediterranean, on the coasts of the United States, of Brazil, of Southern Africa, and of Australia; and, widely as these localities are distant from each other, there does not appear to be the least elongated variation in it. It has been called the "leaping perch," the "southern perch," the "leaping gilt-head," and many other names; but its family characters are those of

the *Scomberoidæ*, and its generic ones are peculiar. There is no keel on the tail; the first dorsal fin is low and feeble, and the second dorsal and the anal are covered with small scales. The principal characters, however, are those of the mouth. The external part of both jaws is furnished with a row of large teeth, with sharp or trenchant points, and standing at some distance from each other. Within these, there is another row of smaller ones; and the vomer, the palatal bones and the tongue, are all thickly set with very minute teeth. So powerful an armature of the mouth, betokens voracity in feeding and variety in the food. The fish is a very active one, and springs to a considerable height out of the water.

Caranx. The fishes of this genus are well known on the coasts of many parts of Europe, and they are far from being rare on those of Britain. They are called "False Mackarel," or in Britain, "Horse Mackarel;" and they are taken much in the same manner, but are considered as being fishes of very inferior quality. The leading generic characters are: the body covered with small scales; the lateral line having a row of broad scaly plates, which are marked with a keel on the hinder part of the body. These scaly bands are very conspicuous, and extend to the origin of the central rays of the caudal fin, narrowing as they reach that part. The number of these lateral plates varies in the different species; and in some, the keel is drawn out into a spine upon each plate. There is one spine curved forward in advance of the first dorsal, and two free spines inclining backwards in advance of the anal. The abdominal fins are under the pectorals. There are two distinct dorsals, the front one short, and the second long, beginning opposite to the anal spines, and extending nearly to the beginning of the caudal; as also does the anal, which resembles the second dorsal both in form and in size, only the first rays are rather longer in proportion.

This genus is widely distributed; but, unlike the former genus, the species vary much in the different localities, and there are different ones in the same locality. Only one can be regarded as decidedly British, and we shall restrict the few particulars which we can afford to this one.

The Scad, or Horse-mackarel (*Caranx trachurus*). This fish is not a favourite article of food; and thus it is seldom taken in proportion to the numbers in which it actually exists, and rarely even in proportion to the numbers which are caught. We believe there are but few places in Britain where it is eaten at all, and none where it can be properly called a marketable fish; though they are called so in some places. Generally they make their appearance in parties which are not very numerous; but at other times, they are in immense shoals, and might be taken in vast quantities. A communication from Mr. Bicheno to Mr. Yarrell, is so graphically descriptive, that we shall quote it: "On Tuesday the 29th of July, 1834, we were visited by immense shoals of Scad, or as they are also called, Horse-mackarel. They were first observed in the evening; and the whole sea, as far as we could command it with the eye, seemed in a state of fermentation with their numbers. Those who stood on some projecting rock, had only to dip their hands into the water, and with a sudden jerk they might throw up three or four. The bathers felt them come against their bodies; and the sea, looked on from above, appeared one dark mass of fish. Every net was immediately put in requisition; and those which did not give way from the weight, were drawn ashore laden with spoil. One of the party who had a herring-seine with a two-inch mesh, was the most successful; every mesh held its fish, and formed a wall, which swept on the beach all before it. The quantity is very inadequately expressed by numbers, they were caught by cart-loads. As these shoals were passing us for a week with their heads directed up channel, we had an opportunity of noticing that the feeding time was morning and evening. They were pursuing the fry of the herrings, and I found their stomachs constantly full of them."—This is one of the very best accounts of a shoal of fish that ever was written; and it refutes the opinion stated in many of the books that the scad is a rare fish. They are found all round the coasts; making their appearance, in small straggling parties, as early as April; but not coming in their full numbers till the hot season. They are very vigorous swimmers, and run on the shores or shallows, and entangle themselves much more frequently than herrings. They do this, not by being caught in storms, which is said to be the cause of grounding in the herrings, but in eager pursuit of their food. The upper part of the scad is clouded with olive, and green and blue, passing into silvery on the under part and the sides of the head. The upper fins dusky, the lower very pale; a large spot on the gill-cover just over the temporal fin, and also the throat and bottom of the under jaw are black. When the fish are on the coast, they are very readily taken with hook and line. The spawning time is in the very heat of the summer.

Nearly related to this section of the family, if not actually belonging to it, there are numerous fishes of the tropical seas; but the history of them is very confused and imperfect, even among the professional zoologists; and therefore, it is by no means a fit subject for popular disquisition. There is a very high degree of interest about the fishes which range the wide ocean, and are endowed with powers that enable them to stem the vast swell of these mighty waters; but their pasture is co-extensive, and seen at so few points, that their history will be long in arriving at any thing like perfection.

Vomer (Ploughshare-fishes). This genus has been formed for the purpose of receiving a considerable variety of fishes, still having the family characters of the *Scomberoidæ*, but differing greatly in their appearance from the typical mackerel; and there is a gradation among themselves which made Cuvier feel it necessary to divide them into six sub-genera, placing those upon which the name is founded last in the order of arrangement. The progressive change in them is, that the lateral line becomes less and less armed with keels, plates, or appendages of any kind; the body more compressed and deeper in proportion to the length, and the skin smoother and more free from scales. Most of them, too, have part of the rays of the fins produced to a very great length; and the teeth are small, and thickly set together like smooth velvet. The earlier naturalists, who had but few opportunities of observing the fishes of distant seas, included all these in the genus *Zeus* or Jupiter, which has now been separated; and even that genus, restricted as it now is, has been very conveniently divided into five subgenera. This part of the family of the *Scomberoidæ* is, indeed, quite a puzzle, because

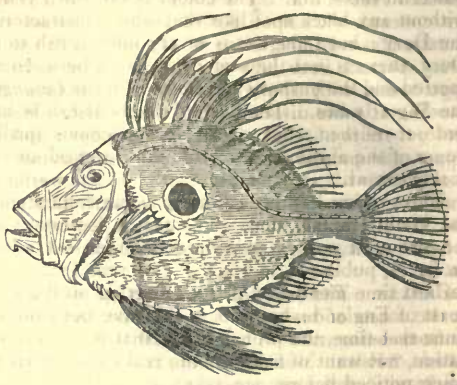
there are many of the prolonged appendages of which it is difficult to imagine the use.

There is even an intermediate sub-genus, which one can hardly refer either to *Caranx* or to *Vomer;* and there are two species of *Caranx*, both natives of the warm seas, the distinction of which is well worthy of attention. There are the *true* and the *bastard Carangus* of the West Indies, the mistaking of the one of which for the other is a much more serious matter than the mistaking of the scad for the mackarel. The true *Carangus* is a fish of a silvery colour, with a black spot on the operculum. It attains considerable size, reaching twenty-five pounds in weight; and it is an excellent fish for the table. The other one, which resembles this in many respects, but never has the spot on the gill-cover, is poisonous. If these had been fishes of the European seas, they would have helped to give more of romance to the fable about the marks of the Apostle's thumb and finger on the fish, when he took the tribute-money out of its mouth; for if, as could have easily been fabled in this case, the fish had been changed from poisonous to sanative at the same time that it got the thumb-mark, the whole would have made a capital monkish miracle.

The species which appear to be intermediate between the true *Carangi* and the *Vomers*, are East Indian. Some of them are entirely without teeth; and others, to which Cuvier has given the sub-generic name of *Citulus*, have the points of the second dorsal and the anal very much produced.

Vomer he subdivides into six, as we have said: *Alistus*, *Seyris*, *Blipharis*, *Gallus*, *Argyreasos*, and *Vomer*, properly so called. *Alistus* have the middle rays of the second dorsal without any branching, but articulated, and produced into very long filaments. *Seyris* have similar filaments, but the stems of the first dorsal are entirely concealed in the anterior margin of the second, and their ventrals are short. Some of them, of very singular shape, are found in the southern parts of the Mediterranean. *Blipharis* have the same lengthened filaments in the second dorsal and the anal as the preceding; and in addition they have the ventrals very long. Their body is very elevated, and their profile singular. One of them is the "cobbler-fish" of the West Indies—the *Zeus ciliaris* of Bloch. *Gallus* have the profile still more elevated, and the profile of the gape more oblique than the last; but in other respects they are nearly the same. *Argyreosus* has the profile more elevated still, and the first dorsal developed, and drawn out into long filaments in a manner very similar to the second. They have also the ventral fins very long. *Vomer* have the same shape in the body, but the fins are not produced into long filaments. All of these are fishes of most singular appearance; but very little is known of their natural history, or of the use which they make of their singularly produced filaments. They can at present be looked upon as little else than objects of mere curiosity; but there is no doubt that their singular forms are connected with a history equally singular if we could find it out.

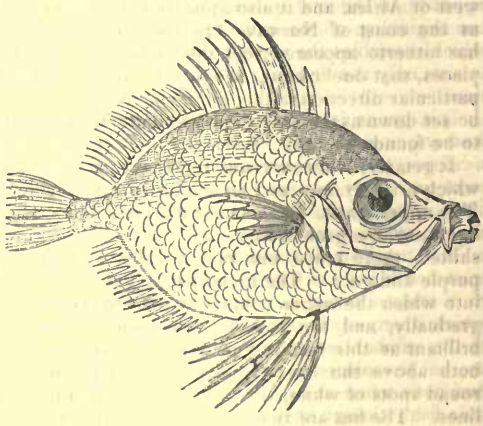
Zeus—Dory. This genus is one of more interest than any of the preceding ones, on account of the estimation in which the leading species is held by the ichthyophagic epicures. Some account of this celebrated species will, however, be found on looking back to the article Dory in this work; and that will render any farther notice in this place unnecessary. There is, however, a species of one of the other sub-genera, which has usually occurred on the British



The Dory.

coast, and we may give a mere notice of it. This is

The Boar-fish (*Capras aper*) which is the only known species of the sub-genera *Capras*. The generic characters are: two dorsal fins, but without any filaments to the rays of the spinous one as there are in the Dory, and without any spines at the base of either the dorsal or the anal; the body oval in the profile, and much compressed, covered with small rough scales; the mouth capable of being protracted and withdrawn to a greater extent than in the Dory. It is in consequence of the power of lengthening and shortening the snout that this species is called the boar-fish.



Boar Fish.

The body is shorter in proportion to its height than that of the Dory; and the jaws are more lengthened when the mouth is open; the teeth are small, and at some distance within the margin of the jaws. The eye is very large, and about its own breadth from the extremity of the mouth when that is shut. The nostrils are close by the anterior part of the orbit, and have a considerable opening; the first dorsal, the pectoral, and the ventral, all have their origin in the same straight line, at right angles to the axis of the body; the surface feels smooth when the hand is passed over it backwards, but rough in the other direction. It is a small fish, not above six or seven

inches in length; but it agrees with the rest of the genus in being of discursive habits, and a fish of much power in the water. The colour is brownish yellow, without any black spot like that which characterises the Dory; but though it is a very inferior fish to the Dory, there is not the same distinction between the spotted and the unspotted as there is in the *Carangi* of the West Indies. The flesh of the boar-fish is hard and not relished; but it has no poisonous quality. Some of the authorities mention that the odour of it is unpleasant.

This species has been known as an inhabitant of the Mediterranean since the days of Aristotle; and a figure of it was given by Rondeletius in his work on fishes, published in 1554. The year 1825 is the earliest time mentioned of its occurring on the south coast of England; but as several have been noticed since that time, the probability is that want of observation, not want of fish, was the real cause of its not being noticed before.

Lampris is the third of Cuvier's sub-genera of *Zeus*. As is the case with the preceding sub-genera, there is only one species of this; but authors have made amends, as far as they could, by bestowing upon this one a number of names. The characters are: the body oval and much compressed, covered with small scales; a single dorsal fin, elevated in the anterior part and falcate; the pectoral and ventral fins and lobes of the tail rather long; the sides of the tail with a keel; and the mouth destitute of teeth. The species alluded to is

The King-fish or Opah (*L. guttatus*). This is a very discursive fish, being found in the Atlantic and the Pacific; and in many latitudes, especially in the former. It is a common fish on some parts of the west of Africa, and it also appears as far to the north as the coast of Norway. On the British coasts it has hitherto appeared so indiscriminately in various places, that one cannot say that it comes from any particular direction, although the south and west may be set down as the coasts upon which it is most likely to be found.

It gets its royal name from the beauty of its colours, which are certainly as rich as one can well imagine. The upper parts, when seen with little reflection of light, are of a greenish colour; but as the position is shifted, there come out rich metallic reflections of purple and gold. The under part is greenish yellow, into which the richer colours of the upper part fade gradually, and the metallic reflections become less brilliant as this colour gets pale. Along the sides, both above the lateral line and below it, there are round spots of white, very well defined in their outlines. The fins are rich vermilion red, and the irides scarlet. The body, seen in profile, is of an oval form, or rather composed of two similar symmetrical curves, which meet in a blunted angle at the snout, and approach each other at the base of the tail, where the depth is not great. The greatest depth of the body is in advance of the middle of the length, and measures about half as much. The lateral line is much curved, rising near to the dorsal fin, opposite its base, and again descending toward the upper edge of the gill-cover. The fish is of huge size and weight, one specimen having occurred in this country measuring four feet and a half in length, and weighing one hundred and forty pounds.

Equula is the next sub-genus into which *Zeus* has been divided. They have only one dorsal fin, but that contains many rays, and the anterior ones are often very elevated. The body is compressed, and the upper and under lines are toothed in many of the species. The muzzle in all is protractile, and some of them are said to make use of it in capturing the small fishes and other little animals upon which they feed. They lie in a state of repose, with the muzzle drawn in to the utmost that it admits of, and when the prey comes within their reach, they shut the muzzle at it, and seize it with great accuracy. The species are numerous, generally of small size, and most of them inhabit the Indian seas.

Meue have the muzzle formed like *Equula*, but differ from them in many other respects. They have the body still more compressed, and the back nearly straight, which gives the outline of the under part a very great degree of curvature; and the position of the shoulder bone and the cavity of the body, throw the abdominal fins in advance of the pectorals. There is but one known species, a native of the Indian and Chinese seas. It is of a fine silvery colour, with black spots on the back.

Stromateus. These fishes have the compressed form of the genus *Zeus*, but the muzzle is blunt and not protractile, and their teeth, which are very small, are in a single row. The spinous rays of the dorsal are nearly concealed in the anterior margins; they have no ventral fins. They admit of subdivision into numerous genera. The greater part of them inhabit the warm seas, though there are some in those of Europe, which, however, are too rarely seen for having any thing like a popular history.

Kurtus—Hunch-back. These resemble the last mentioned genus in many points; but they have also many peculiarities. Their dorsal is much lower; their ventrals are large; and their anal long; the scales upon them are so minute, that they cannot be seen till the gelatinous parts shrink on drying the skin; they have a spine on the under part between the ventrals, and little sharp horns in advance of the dorsal, and a crooked spine immediately in front. They have a cavity formed by rays of the rib under the spinal column, in which the air-vessel is lodged. The typical genus is *Kurtus cornutus* of India; so called from a sort of horn, which occupies the place of the front cartilaginous projection in advance of the dorsal. This species feeds upon crustacea and shelled mollusca. In point of colour it is a very beautiful fish. The scales have a silvery lustre more perfectly metallic than is to be found in almost any other fish; and this is set off by fine contrasts. The pectoral fins are metallic golden yellow, bordered with red; the other fins are yellow with black borders, and having little metallic lustre.

Coryphæna is the last genus of the mackarel family which contains many species, most of them inhabitants of the warm seas; many of them fishes of large size and great beauty, and all of them possessing in a high degree that muscular power which is characteristic of the family. Some notice of the sub-genera, and also of the leading species, will be found in the article Coryphene; so that it only remains to notice one species which claims to be a British fish, though a very rare one. This species is

The Black Fish (*Centralophus pompilus*). The characters of this genus are: no teeth on the palate, and those in the jaws very small; a single dorsal, rising at some distance behind the occiput, and long, but not very high; no spines in front of the dorsal or the

anal; and the body covered with small scales. Only a few specimens are mentioned as having occurred in the British seas, and all in the west of Cornwall. They have been of different sizes, some only fifteen inches in length, and others two feet eight, the latter weighing nearly fourteen pounds. The skin of this fish is very tough and strong, and can be taken off like that of an eel. The flesh is of very superior quality. The snout is blunt and rounded; the gape small; the teeth very fine; the tongue large; nostrils double, and that nearest the eye the largest; the eye bright and prominent; the head flattened on the upper part; gills with five rays; body compressed, with the base of the dorsal fin on a ridge; the base of the dorsal about half the length of the fish; pectoral fins pointed; ventral confined by a membrane; tail forked. The whole body black, scarcely lighter on the belly, and very intense on the fins. The colour fades to blue, however, after the fish has been for some time out of the water. This disposition to change in the colour, has occasioned some perplexity in the description of the fish. In warmer seas it has a fine play of irridescent colours, which pass off, however, as the fish dies. These glosses of colour are common to the whole mackerel family, but they are more conspicuous in the Coryphenes than in any of the others. They are probably connected with the energy of the principle of life in these fishes, and the powerful influence which, considering how near the surface they swim, the sun must have upon them; but this connection between energy of life and play of colour, though a very curious subject, is one which has not been as yet much investigated.

The black fish is very swift and powerful in the water. One taken in a salmon net at East Looe in 1830, showed great power of action, and would have dashed its way through a net of weaker structure. What may be the numbers of this species in the sea, we have no means of ascertaining; but from the size which they attain, and the very superior quality of their flesh, it were very desirable to find out their haunts, if they do congregate in numbers in any part of our seas. It follows, of course, from the energy of their characters, that they are very rapacious; and it has been ascertained that they are miscellaneous in their feeding, eating not only small fishes and mollusca, but even sea-weed. Thus, if the places where they are in numbers could be ascertained, they could be easily taken with hook and line.

Such is a very abridged outline of the mackerel family, especially of such members of it as are found on the British shores; the full illustration would demand a separate work exclusively devoted to the subject; and, readily as most of the species show themselves, much remains to be done before such a work could be made worthy of its subject.

SCORPIO (Linnæus). A genus (or rather SCORPIONIDÆ, Leach, a family) of arachnidous insects, belonging to the order *Polymerosomata*, Leach, or *Pedipalpi*, Latreille (see ARACHNIDA), having the abdomen attached by its entire breadth to the thorax, furnished on the under side with two moveable comb-like plates, and terminated by an elongated and knotted tail, the extremity of which is armed with a curved and very acute sting. The breathing pores are eight in number, arranged four on each side along the belly; the arms (or palpi, very greatly developed) are of very large size, serving as instruments of prehension, and terminated by a large claw. The legs are eight in number, of moderate size, and much larger than the palpi. The eyes are eight in number, three on each side of the thorax, and two on the back. The "antennæ-pincers" are terminated by two fingers, one of which is moveable. The abdomen (including the tail) is composed of twelve segments. The use of the curious comb-like appendages has not yet been determined.

The scorpion is one of the most renowned amongst the obnoxious of the insect tribes. Fortunately for our country no species is found amongst us, although in Germany, and several other parts of Europe, it is too well known. This exemption is consequent upon our northern climates, since it is chiefly in tropical, or at least in hot regions of both hemispheres, that the various species are found, and in the former they occasionally attain a very large size. They reside on the ground in sandy districts, and hide themselves by day under stones, logs of wood, &c., especially in dark places, and often in houses. They run very quickly, and, when alarmed, throw their tail over the back, twisting it about in every direction, and using it both as an offensive and defensive weapon. They make use of their claws to lay hold of insects upon which they feed, and which generally consist of ground-beetles, cockroaches, &c., which they first wound with their sting, and then convey to their mouth. They are also especially fond of the eggs of spiders and other insects. They propagate in some localities so quickly as to become a constant cause of dread, even occasionally compelling the inhabitants to quit their abodes. These animals were well known to the ancients, and the zodiacal constellation of the Scorpion will convince us that a knowledge of these creatures must be attributed to the earliest periods of science. In the Egyptian mythology they are represented as the symbol of the genius of evil. Pliny has collected all the fables which ignorance and superstition combined had attributed to these creatures, and on the authority of Apollodorus he distinguished nine species. Nicander added another, and detailed the supposed medical virtues of the animal. The existence of scorpions with two tails is not entirely fabulous, since there exists in the Museum at Paris a specimen (a monstrosity, of course) in which this singularity of malformation is exhibited. The winged scorpions which Megasthenes stated that he discovered in India, and which were affirmed to be of a very large size, were in all probability nothing else than some large *Phasma*, or perhaps one of the gigantic exotic *Nepidæ*.

In France the *Scorpio Europæus* appears about the forty-fourth degree of latitude, in that zone where the almond tree and pomegranate are capable of cultivation, and nearly equal with the most northern limits of the olive.

There are few animals more obnoxious than the scorpion, especially in tropical climates, where it often attains to a very large size. In Batavia, where they are stated to attain the length of twelve inches, there is no removing any piece of furniture without the utmost danger of being stung by them. Bosman assures us that along the Gold Coast they are often found larger than a lobster, and that their sting is inevitably fatal. In Europe, however, they are by no means so large, so venomous, or so numerous. The general size of the European scorpion does not exceed two or three inches. Maupertuis, who made

several experiments on this species, found it by no means so invariably dangerous as had till then been represented. He provoked one of them to sting a dog in three places of the belly, and in about an hour afterwards the poor animal was greatly swollen, and became very sick. Afterwards it fell into convulsions, bit the ground, dragged itself along on its fore feet, and at last died, five hours after being stung. It was not partially swollen round the place which was wounded, as is usual after the sting of a wasp; but the whole body was sufflated, and there appeared only a red spot on the places where it had been stung. The experiment was, however, repeated upon another dog, even with aggravated cruelty, yet the dog seemed in no way affected, howling only a little when stung, and without showing the smallest symptom of pain. The same experiment was also tried by fresh scorpions upon seven other dogs and three hens, but not the smallest deadly symptom was seen to ensue. Hence it is evident, that although, in the majority of cases, the sting of this insect may not be greater than that of a wasp or hornet, yet, in certain cases, and under certain unknown circumstances, either connected with the state of the animal stung, or of the scorpion itself, a far greater efficiency is given to the sting.

The scorpions of tropical climates being much larger than the former, are probably much more venomous. Helbegius, however, who resided many years in the East, asserts that he was often stung by the scorpion, and never received any material injury from the wound; a painful tumour, however, generally ensuing. Seba, Moore, and Bosman, however, state that, unless speedily relieved, the wound becomes fatal. The *Scorpio occitanus* of Latreille, found in the south of Europe, Barbary, &c., has been experimented upon by Dr. Maccari, who allowed it to sting himself, and which produced alarming and painful symptoms. Moreover, the venom appears to be more active in proportion to the increased age of the animal. Volatile alkali, applied both internally and externally, is employed as a serviceable remedy. The Persians use, for curing the sting of the *Scorpio australis*, Linnæus, which they call *Agrab*, and the Indians *Gargonali*, scarification and quicklime; others make use of oil, in which several of these creatures have been steeped; and others bruise the scorpion, and apply it to the wound.

It has been a vulgar notion, that a scorpion enclosed in a circular space by burning charcoal, would sting itself to death. Maupertuis, however, and, more recently, M. Guérin, have combated this idea, observing, that in such cases the scorpion only runs about in a very unquiet state, and is at last killed by the heat. The Count de Sonneville is, however, stated by Latreille to have made the same experiment in the presence of a great number of persons, and the result has always been the death of the scorpion, produced by stinging itself. It is certain that their stings are sufficient to destroy their companions; for Maupertuis confined about a hundred of them in the same glass, and they soon came into contact with one another. When they began to exert all their rage in mutual destruction, there was nothing to be seen but universal carnage, so that in a few days there only remained fourteen, which had killed and devoured all the rest; and on certain occasions their malignity is extended even to their offspring. The female brings forth her young alive, and of the same form as herself, varying in numbers from twenty to forty; and Maupertuis states, that having enclosed a female in a glass vessel, she was seen to devour her young as fast as they were excluded, one only escaping by taking refuge upon the back of its parent; and this soon after revenged the death of its brethren, by killing the old one in its turn. Ordinarily, however, the female is much more solicitous concerning her offspring, bearing them about for several days upon her back, seldom quitting her retreat, and tending them for the space of a month, by which time they are sufficiently strong to take care of themselves. They shed their skins annually, and are not enabled to reproduce their species until they are two years old.

The species of this family are numerous. Herbst has published a good monograph of them, with coloured figures. Dr. Leach has divided them into two genera; *Scorpio*, having only six eyes, of which the *Scorpio Europæus* is the type; and *Buthus*, having eight eyes, of which the scorpion of Maupertuis (*Scorp. occitanus* of Amoreux) is the type. The former species does not exceed an inch in length, is of a black brown colour, the legs being fulvous, and the combs having nine teeth.

SCORPION-FLY. See PANORPA.

SCORPION (Water). See NEPA.

SCORPIURUS (Linnæus). A curious genus of annuals, bearing diadelphous flowers, and belonging to *Leguminosæ*. They are cultivated for the grotesque shape of their pods, which bear a strong resemblance to caterpillars.

SCORZONERA. A genus of perennial herbs, known in English lists by the name of viper's-grass. They bear composite flowers, and one of the species, *S. hispanica*, is cultivated for its roots, which are considered a dainty.

SCROPHULARINÆ. A rather extensive natural order, containing fifty-nine genera, and above five hundred and fifty species. A great part of Linnæus's *Didynamia angiosperma* is found in this order; capsular fruit and didynamous stamens being among the most obvious characteristics of the order. The genera are herbaceous (rarely shrubby) plants with round or square stems; the leaves are simple and without stipules, sitting, or with footstalks, and sometimes decurrent; in situation opposite or whorled, seldom alternate.

The enflorescence is variable, axillary or united, usually spicate, racemose, or in panicles; the calyx is free and persistent; the corolla hypogynous, often bilabiate, personate, and deciduous; the stamens are definite (two to four), didynamous, rarely equal, exserted from the tube of the corolla; the filaments are free, and the anthers two-celled; the germen is formed of two carpels, the style one, and the stigma obtuse. The fruit is capsular and dehiscent, two-celled, and from two to four valved. This order is divided into two sections; the first includes those genera which have *four* anther-bearing stamens, and the second those genera which have only *two* anther-bearing stamens.

SCURVY-GRASS is the *Cochlearia officinalis* of Linnæus, a medical plant found wild on the sea-shores of Britain, and belonging to *Cruciferæ*.

SCUTELLARIA (Linnæus). A pretty extensive genus of herbaceous perennials, natives of many different parts of the world. They belong to the first order of *Didynamia*, and to the natural order *Labiatæ*.

The greater part are hardy, and when brought into the garden are planted in the open borders.

SCUTELLERA (Lamarck; Tetyra, Fabricius). An extensive genus of hemipterous insects, belonging to the suborder *Heteroptera*, and family *Pentatomidæ*, having, as the generic name implies, the scutellum very large, and entirely covering the dorsal portion of the abdomen and the wings. The habits of this group are similar to to those of the *Pentatomæ*, *Corei*, &c. The species are generally of large size, and often very brilliantly coloured. They are, for the most part, exotic. The genus has been much subdivided by Hahn, Laporte, and Burmeister. The type is the *Cimex maurus* of Linnæus.

SCUTIGERA (Latreille; Cermatia, Illiger). A curious exotic genus of centipedes. See Chilopoda.

SCYDMÆNUS (Latreille). A genus of minute coleopterous insects, belonging to the section *Pentamera*, and constituting the type of the family *Scydmænidæ*, in which the antennæ are straight, thickened at the tips; the maxillary palpi very long and thin; elytra covering the entire abdomen, thus differing from the *Pselaphidæ*, with which they have been supposed to be allied. They are found in moss and in damp situations. The type is *Scydm. Hellwigii* of Latreille. Kunze and Denny have published good monographs of this curious genus.

SCYLLÆA (Lamarck and other modern authors). Is a naked mollusc, its body elongated, very much compressed, convex on its upper side, and provided with a narrow-channelled foot; the head is distinct, with two large ear-shaped tentaculæ divided at the external side; the mouth opens with two longitudinal lips, armed with a pair of very large semilunar lateral teeth; the organs of respiration are in the form of little tufts irregularly disposed on the appendages of the skin. Only one species is at present known, and it is extremely common in the Atlantic Ocean.

SCYLLARUS (Fabricius). A genus of macrourous decapod crustacea, probably constituting the type of a distinct family, having the body very broad and flattened in front, and the lateral antennæ converted into a large flattened and horizontal crest on each side, with the sides deeply notched; the legs are all simple, the anterior not being formed into a claw as in the majority of the crabs and lobsters. These curious crustacea are found in the ocean of tropical and moderate latitudes, where they burrow in the bottom of the sea, whence they come forth when the sea is calm in search of their prey. They swim with a leaping motion. They are eaten as shell-fish on the southern shores of France, and the flesh of *Scyllarus orientalis* is said to equal that of our choicest lobster. The type is the *Cancer arctus* of Linnæus. There are a considerable number of species.

SEAFORTHIA (Dr. Brown). *S. elegans* is a New Holland palm, introduced to our collections in 1822, and thrives in light sandy loam and heath mould.

SEAL (Phoca or rather Phocidæ, the seal family, as they admit of division into many sections, sufficiently distinguished from each other for being accounted separate genera). A very numerous family of aquatic mammalia, breathing air like the rest of the class and having warm blood, capable of living on land, where they often resort for the purpose of reposing, or basking themselves in the sun, but having their principal habitat in the water, and their bodies adapted for motion in that element rather than upon the land. Considered as regards their structure, their principal habitat, and their motions, they hold a place intermediate between the land mammalia and the *Cetaceæ*, or whales. As they have all the three kinds of teeth, they, in this part of their structure, resemble the land carnivora, and they have not a little of the sagacity and research which characterise these animals. Cuvier has, accordingly, placed them along with the morces, as the last group of the placental carnivora, and immediately preceding the marsupial animals. Perhaps it may ultimately be found, that their characters are sufficiently distinct from those of all the other mammalia, to entitle them to rank as a separate order; but their place in the system is a matter of minor importance, so that the animals themselves are properly understood.

The members of the seal family are among the most numerous of all mammalia that attain any thing like an equal size; and the herds of bisons, antelopes, and other ruminating animals which congregate in numbers, are really nothing to those of the seals. On some parts of the British coasts, especially the more northern ones, they are plentiful; but in other places they literally swarm. Estuaries and straits are their favourite grounds, evidently because the fishes, which are more dispersed in the open seas, congregate in greater numbers in the currents of these narrow places. The fishes not only congregate there in passing from the one sea to the other, but they are generally more plentiful in such places as constant residents. The reason is obvious: those small animals upon which such fishes as do not eat other fishes feed, are most abundant in the runs of water in these places; and this, of course, brings both the fishes which feed upon the small matters, and those which feed upon the fishes that do. In the British Islands for instance, seals are most abundant in the streams, and the friths or straits between the islands; and they give the preference to places where there are rocks surrounded by the water, banks alternately covered and exposed, and lonely and covered shores. Not that they are timid animals, for though very watchful, they are not timid; but they love places where they can enjoy themselves in the sun or in the air, and get quickly into the water in case of any alarm. We have mentioned that they sleep on the banks, but they are never all asleep at the same time. There are always sentinels; and when they give the alarm, the whole shuffle into the water as fast as they can. Sounds appear to alarm them more than sights do; for one may row or sail close to the place where dozens of them are basking without any notice being taken; but, if a shout is set up, they are instantly in motion. A very cruel mode of capturing them, founded on this, is, or at least at one time was, practised on some of the rocky shores of Britain. The places where this dry-land fishing was carried on, were generally those where a steep but not very high breast of rocks ran in the middle of a beach, towards which it sloped at both ends. The seals, when they came to bask, shuffled up the sloping ends of the rock, and then lay upon the top in considerable numbers. The breast of the rock was set with large sharp pointed hooks, which were the traps for the seals. A man came as near to the rock as he could come without alarming them, and fired a musket, at the report of which, they scrambled over the breast of the rock, in order to reach the water, and numbers of them were taken on

the hooks; from which the people removed their lacerated bodies at their leisure.

But though seals have long been familiar to the inhabitants of the coasts of most countries, their natural history was long exceedingly obscure, and still is so in many respects; and the species, which are naturally numerous, have been rendered still more so by the description of them from single museum specimens; in which the same species was often described as if it had been many, in consequence of the variations of colour, from age, place, and season. Indeed a seal, immediately out of the water, is not of the same colour as one which has been exposed to the air till it is completely dry; and in the former state, the shade of colour depends a good deal on the position of the light in which the animal is seen. In endeavouring to class them, we must therefore leave colour out of the question, and attend to differences of structure only. The most obvious structural difference, is the presence or the absence of external ears; and accordingly, this has been taken as the foundation of two sub-genera,—the name *Phoca*, seal, being restricted to those which have no external ears; and the name *Otaxia*, eared-seal, given to those that have them. It does not appear, however, that any thing important can be founded on this external distinction; for, as we have said, the common seal of our own shores hears very well, and it belongs to the division which have not external ears.

The different lengths of the muzzle have also been made grounds of distinction; and probably, with better reason than the presence or absence of the external conchæ of the ears; but still the differences of habit which depend on the peculiar development of this part, have not been ascertained, and therefore, it can be regarded as little else than a part of the detached description of the species.

The teeth vary a good deal; but then the variation is so gradual that it is not easily made the ground of a clear distinction, which shall carry a difference of habit along with it; and without this as its natural distinction, is of very little value.

All the members of the seal family have the three kinds of teeth, incisors, canines, and cheek teeth, but the cheek teeth can in no instance be considered grinders. Their crowns always consist of tubercles more or less developed and separated from each other, and never have a grinding surface, or one so well calculated for bruising, as the tuberculated teeth of the land carnivora. The canines, too, though large and powerful, are not so completely wounding or killing teeth as those of the land animals; they have the curvation backwards more sudden and nearer the point, and thus they have a great deal of the character of prehensile instruments. In some the incisors are six in the upper jaw, and four in the under; in others there are six above and only two below, and in others, again, there are four in each jaw. The canines are two in each jaw, and never wanting in any of the species. The cheek teeth are sometimes four in each side of each jaw, sometimes five below and six above, and sometimes six in both. There is another distinction of the teeth which is probably of more importance than any of these; and that is the form of the roots, though the differences in this respect are generally accompanied with differences in the crowns. In those which have the crowns most trenchant, or with the tubercles most completely developed and detached at their points, there are generally several roots or fangs: while in those that have the crowns more simple, there is, generally speaking, only one root. The chief difference in the habits supposed to be connected with this difference in the general character of the teeth, is that the trenchant teeth with several roots indicate more of a terrestrial habit, or nature, at all events, and those with the single rooted teeth more of an aquatic one.

But, notwithstanding these slight distinctions in the form of the teeth, the food and manner of feeding in the seals are very much alike in all the species. It has been said that some of them eat the more succulent kinds of sea-weed, which may be true, as some fishes which feed generally upon animal substances do the same. But there is little doubt that the staple food of the seals is fish, captured alive in the free waters, an operation in which they are very expert, as any one may see, who chances to observe seals hunting salmon, when the latter are on their march upward in the estuary of a river.

M. F. Cuvier has investigated the anatomical structure of the seals with very great attention, and in as far as classification can be founded on that, his divisions appear to be unexceptionable. But it must be admitted that every classification of this kind is in its very nature imperfect, as it does not reach the habits of the animals, which of course can be studied only in living nature. In this, comparatively little has been done; for though seals are objects of no small commercial interest in the higher latitudes both of the northern hemispheres and of the southern, those who go to capture them pay no further attention to them than endeavouring to kill the greater part of their numbers, which are all valuable for the quantity and quality of their oil, and the use of their skins as leather or as fur.

He makes seven subgenera of the genus *Phoca;* and the characters of these are pretty well defined, though it is not always easy to adapt the species to them. These subgenera are *Calocephalus, Stenorhyncus, Pelagius, Stemmatopus, Macrorhinus, Arctocephalus* and *Platyrhyncus.*

Calocephalus. These have the cheek teeth with one large point in the middle of the crown, with one small one in advance of it, and two still smaller in the rear. The cranium is enlarged and rounded at the sides, and flat on the top, and only has a few rugosities in place of an occipital crest. The teeth are, in the upper jaw, three, four or six incisors, two canines, and ten cheek teeth, or five on each side, and in the lower jaw, four incisors, two canines, and two cheek teeth. Almost the whole of this group are inhabitants of the European seas, and the north part of the Atlantic, and the higher the latitude they are the more numerous. Jan Mayen and the other small islands near the polar sea literally swarm with them, and in the season ship-loads of them are caught in a very short time. The species of this section differ considerably from each other in appearance, but there is much similarity in the habits of the whole of them. The membranous sides of their feet are not extended beyond the points of the toes on the hind feet, and not so far on the fore ones. The toes gradually diminish in length to the inner one, and the outer ones on the hind feet are considerably larger than the others. From this, and also from the position of these feet, and their being of the same length as the tail, properly so called, they have the same

appearance as if all the three formed a broad swimming tail with its action upwards and downwards in the vertical plane. And, as a swimming apparatus the three have more varied motion than if they altogether formed one lobe. As each of the three parts has its separate articulation of bones and apparel of muscles, it can of course move independently of the others, and yet all the three can act in concert whenever the necessity of the animal requires such a motion. From this compound structure of their principal swimming apparatus, the seals have far more command of themselves in the water than the fishes or the *Cetacea*, in both of which the swimming organ, though differently formed in the different species, is single. In merely forward motion, the advantages of the compound apparatus are not felt; and, on a stretch, both fishes and *Cetacea* can swim faster than seals; but the seals can sport about in all directions in the water in a manner which no fish or whale can; for motion in every possible direction appears to be equally easy to them.

Their eye, which appears to be the organ of sense upon which they have their chief dependence when in the water, is adapted to this varied power of motion. There are some peculiar modifications in the general structure of the eye, which we can better explain when we come to speak of the organisation of the family generally; but we may mention that there is great muscular power in the iris of the eye; that the pupil expands to a broad disc when the light is very faint, and that it contracts toward a vertical line, as in the eye of the cat, when the light falls strongly upon it. From this structure in action, we may suppose that the seals chiefly ascend or descend upon the fishes that form their subsistence. All this section of the family, and they are the only ones of the manners of which we know almost any thing, are very sagacious animals, cautious in case of danger, but easily tamed, and capable of playfulness and attachment, which is inferior only to that of the dog.

Stenorhyncus. This section are distinguished by the great elongation and the slenderness of the muzzle, which is the foundation of the name. Their cheek teeth have one prominent point in the middle of a conical form and curved backwards, and there is a smaller point in advance of this, and another in the rear, which are also rounded in these sections, and separated from the others by notches so deep that, seen sideways, each has the appearance of being three separate teeth. These teeth have only single roots, the claws on the toes are very small, and altogether the animals have a much more aquatic air about them than the common seal.

Pelagius. This division have the muzzle elongated, but very much enlarged toward the extremity, and the profile of the forehead is very much arched. The upper incisive teeth have furrows or grooves across their crowns, but the under ones are simple. The cheek teeth are thick and conical, with only very small tubercles in front and rear of the main point of the teeth. The claws on the hind feet are sometimes altogether wanting. They have no external concha to the ear; and, as is the case with the common seal, the females have four mammæ on the belly.

Stemmatopus. Only one species is known as belonging to this division of the family, the mitred seal or crested seal of authors. Its most remarkable external character is a membranous appendage to the upper part of the head, which is erectible at the pleasure of the animal. The cheek teeth are flat and broad, and have only a single root to each. They enter but a little way into the gums, and have their crowns striated rather than formed into tubercles. Their brain is large and well developed; they have no external ears; their muzzle is straight and blunt at the extremity; and their tongues, like those of the common seals, are short and cleft at the points.

Macrorhinus. This section, like the preceding one, differs much from the common seal, especially in the teeth. They have the fore teeth conical and inclined backwards in the same way as the canines, only they are smaller in size. The roots of the cheek teeth are simple, and much broader than the crowns, which make them have something the appearance of nipples projecting from the central part of the root. Some of the species are the sea elephants of authors.

Arctocephalus. These, as the name implies, have the head formed something like that of a bear, and they have on this account been called sea-bears; but the name is improper, as the animals have nothing in common with bears properly so called, whether of the sea or of the land. They have the head flattened, the muzzle narrowed, the four middle incisors of the upper jaw divided by a deep furrow in the top, and the under ones with a sort of ridge in the front and the rear. The cheek teeth have single roots, upon which the crowns appear only as tubercles on the tops of the roots; of these there are three, the middle are the largest, and the others very small. The fore legs are placed far backwards: the webs of the hind feet are longer than the toes, and terminate in five lobes. Only one species is known.

Platyrhyncus. These have the head much arched and elevated, and the muzzle flattened. Their incisive teeth are pointed, and the hinder tubercle upon the cheek teeth is wanting. In other respects they very much resemble the members of the preceding genus. They have been called sea-lions, which is of course as incorrect as the names of land animals which have been given to some of the others.

Such are the subdivisions of the seals according to the careful observations made upon them by F. Cuvier, but so little is known of some of the species, that no arrangement can be any thing like perfect. We shall now proceed to say something of the general structure.

The seal family occupy so very peculiar a place in the system of nature and occur in such numbers, that a knowledge of their structure becomes a very desirable, and indeed an indispensable, matter. In respect of their locality and their habits, they are neither sea animals nor land animals; for they are equally fitted for making both their habitation. They are not amphibia in the full sense of the word, that is, they are not capable of carrying on all the functions of life equally in the land and the sea, in the air and in the water. If we take this view of them, they may be said to be incapable of living wholly in either. They must breathe the free air, as is the case with all animals which have lungs; and although it is not necessary that they should come to the land to breathe, they must rise to the surface of the water always when they perform that operation. On the other hand, they are quite incapable of finding their food on the land, or in the air, because they are so completely and exclusively formed for swimming that

they cannot so move upon the land as to be able to catch a single article of food there.

The other flesh-eating mammalia which they resemble the most are the otters; but still there are great differences between them. The otters are truly and properly land animals, which hunt in the water for the principal part of their food, but they always bring it to the land to be eaten; and upon emergency they can find the whole of their food upon the land, and are in the habitual practice of so finding part of it. The seals, on the other hand, always eat their food in the water, as well as catch it there; and though they come on land occasionally, they make no nests, burrows, or other dwellings upon it, as is done by all animals which claim the land as their habitual and proper home. The females suckle their young upon land, and it is understood that, generally at least, they bring them forth in the caves just by the margin of the waters; but even there the bare rock or beach is the only nest which they require.

In order to fit them for their aquatic mode of life, they can do with less frequent breathing than any of the other mammalia, the whales themselves perhaps not excepted. For a long time it was supposed, and the popularity of Buffon's writings tended not a little to extend and prolong the erroneous supposition, that in the seals the *foramen ovale*, or internal communication between the chambers of the heart, which is open in the fœtus of most if not all of the mammalia, remained open through life; and that, by means of this foramen, they could carry on the circulation of the blood without breathing. There were two mistakes in this matter, one of them structural and the other physiological, and both of rather a curious nature. In the first place, the foramen does not remain open, and in the second place, though it did, that would not enable the circulation to go on in a healthful manner. We can draw no analogy from the *fœtus in utero*, as to the economy of the animal after it is born and thrown wholly upon the action of its own system. The blood of the fœtus may circulate any way, because the fœtus does not aërate its own blood. That operation is performed before the placental nourishment enters the body of the fœtus; and thus, though there is a circulation in the systematic arteries and veins, there is none in the pulmonic. But when the umbilical cord is divided, and the animal has to find air for its own blood, the case is very different; and though blood were to pass from artery to vein, or from vein to artery through the foramen ovale, that would no more alter its character than passing in or out at a door alters the character of a man. Cuvier is of opinion that a pretty large venous cavity, which is found in the liver of the seals, enables them to continue longer without breathing; and though we know not in which way the blood may be treasured up there, yet it is not impossible that the portion of the blood which is unfit for the purposes of life, until the air has acted upon it, may be stored up in this. At all events, the seals can remain much longer under water without coming up to breathe than one would readily suppose to be the case with animals of common energy, if there were not some peculiar apparatus or modification in their circulation. But what this modification may be is another matter, and one upon which it is by no means easy to get direct information: only we may rest assured that it is not because the foramen ovale remains open.

True to its compound habits, the seal is an animal of compound structure, or, at all events, of compound appearance. The form of its body still retains much of that of the land animal, while the shape and the organs of motion adapt it for the water. The covering of the body is also that of a land animal, and not of a fish, or even of a whale. All the seals are covered with hair; sometimes the greater part of it is hard or bristly, but laid smoothly on the skin, and having a polished or shining appearance. This hair is, generally speaking, more or less flattened, and tapering to the point. It gets wetted, as is proved by the fact of the difference of colour when immediately out of the water, and after being some time on land; but it has no tendency to get in any way twined or matted by the water, neither does it take such a hold on the water, as in any way to impede the motion of the animal. Besides this, many of the seals have the body under the long and shining hair covered with very close, soft, and delicate fur, which is often used for ornamental purposes, and has this advantage over the fur of land animals, that it is much less injured by getting wet.

The arms and fore-arms of the seal are very short, and wholly concealed under the skin of the shoulder and breast; and the fingers, which are five in number, are united by membrane into a sort of paw or paddle, which is of considerable use to the animal in swimming, and their chief organ of motion when they shuffle along upon land. The hind legs are still more concealed, and have less of independent motion than the fore ones; but the toes are more webbed, and they are altogether more efficient in swimming. The motion of the seal along the beach is, in fact, a swimming motion; the paws strike backwards, instead of being planted like those of a walking animal. Thus, when the seal moves along a stony beach, the backward stroke of the paws often throws the stones to some distance behind; and this has given rise to the vulgar notion that the seal retreats like a Parthian, discharging its missiles on the enemy. Whatever may have been the fact in the case of the Parthians, this throwing of stones and gravel behind it is not intentional on the part of the seal. Indeed it is a disadvantage; for all the effort which is spent in throwing the stones is lost to the animal in making its way; and if one wishes to capture a seal upon land, stony and shingly places are those in which the attempt is most likely to prove successful. It is but very seldom, however, that a seal can be taken in this manner; for it is so vigilant, and generally so near the water, that it is launched before one can come up with it. The adventure of Captain Macintyre and the *Phoca* in Scott's "Antiquary," the mention of which was so annoying to the pride of the soldier, is extremely well told; but as a real occurrence, is not the most likely,—though, if the passage of a seal to the water is interrupted in the way there represented, there is little doubt that it would show fight, and readily wrench a stick out of the hand of its assailant, and make off with it to the water, as there stated.

The skeleton of the seal resembles that of the land mammalia much more than their external shape would lead us to suppose. The size of the brain demands a corresponding capacity of the cranium. In the spinal column, the spinous processes are much shorter than they are in land mammalia, as much less motion in the parts of the spine is required than in

animals which have much action in walking, running, and leaping. The ribs are fifteen on each side, ten true ones, and five false. The sternum is made up of eight pieces of bone nearly straight, and the last one longer than any of the others. The neck of course has the normal number of seven vertebræ; and there are fifteen dorsal ones for the articulation of the ribs. There are five lumbar vertebræ, with very short processes, four sacral ones, and twelve caudal. The pelvis is long and straight, and the *os pubis* is articulated in nearly the same manner as in man. There are no clavicles, so that the animals have no cross motion of the fore paws, and cannot use them as claspers in the way that they are used by the whale. The head of the humerus is well formed, and that bone itself is longer than the corresponding bone of the posterior extremity. The bones of the fore-arm are very dark, and the carpus and tarsus consist each of seven bones.

Of the senses of the seals, it is difficult to speak with much precision. Their sight is probably the most acute of the whole, and the one upon which they have their chief dependence in the finding of their food. On land they are, as we have already said, quick of hearing; but how and to what extent that sense may serve them under the water it is not easy to say; but from the structure of those parts which are considered as the organs of hearing in fishes, it is difficult to draw any conclusion as to how the ear of the seal, being as it is, a quick ear on land, may be useful to it when under water. We must, however, just notice the organs.

In respect of the sense which is called touch, and which appears to be composed of the sensitiveness of the surface of the body and of the muscular sense jointly, the seals must be dull. None of their extremities, or indeed any part of their skin, can be looked upon as the peculiar seat of such a sense; and sensibility of the skin would be a very inconvenient faculty in animals which are exposed to so great alternations of temperature as the seals experience in their ordinary habits. In their transitions from water to land and the reverse, they do not appear to feel the least uneasiness; and in the polar seas they do not appear to be in the slightest degree affected by the utmost rigour of the atmosphere, or the most rapid passage from one extreme of temperature to another. It does not appear that the hairs upon them are, in the general covering of the body, possessed of the same degree of sensibility as the hairs of land mammalia. Many naturalists have, however, come to different conclusions respecting the long bristles, or whiskers, which are near the mouth. These are, in some of the species, jointed, or formed with nodosities, something resembling those of the antennæ of some beetles. They have their roots in a sort of cylindrical capsule of horny consistency at the bottom, and meeting there with some small vessels connected with the muscles, and also with a fine membrane, which lines the whole of their internal surface; and the opinion is, that the bristles are, through the medium of this, a sort of organs of touch. These bulbous roots of the bristles, especially in the fine membrane with which they are lined, are closely connected with many ramifications of the second principal branch of the fifth pair of nerves; and this is another reason, and rather a powerful one, for concluding that they are organs of touch: the more so that it is pretty well ascertained that the whiskers of all land animals which have such appendages in the form of bristles are of this description. But still, when the seals are in the water we cannot suppose that the sensations communicated by means of their bristles can be very acute.

The tongue of the seal is much better adapted for being an organ of taste. In the common seal it is about three inches long, and one inch and three quarters broad at the base. The os hyoïdes, or base of the tongue, is well formed, and amply supplied with muscles. In that species, and also in most of the others, it is cleft at the point, furrowed in the posterior part, and beset with papillæ of different sizes, which are understood to be the proper organs of taste.

The sense of smelling is much less perfect than in the land carnivora; and to have given this sense in any very high degree would have been giving a power which would have been of comparatively little use to the animals in that part of their personal economy in which alone senses are required, namely, the finding of their food. The nostrils are also shut when the seal is in the water, and there are two rather powerful muscles which work them; the one has its origin in the upper jaw-bone and the bone of the nose, and, proceeding obliquely downwards, is inserted in the "wing," or external and flexible lobe of the nostril. When it contracts, it of course distends the opening of the nostril; and when it relaxes, it allows that to be closed, so as completely to exclude the water. The other muscle, which is considerably thicker and stronger than this one, has its origin in the upper jaw-bone, near the alveole of the teeth; it passes along the substance of the upper lip, forming a plexus, in which the bulbs of the hairs of the whiskers are included, and then it is inserted on the inner surface of the wing of the nostril; so that, when it contracts, the nostril is closed with considerable force. It is often said in the books that there is a valve for closing the nostril of the seal, but there is no valve save the flexible edge of the nostril itself, which is worked by its muscles in the manner that we have described.

Of the hearing of the seals we have already spoken. Their internal ears have nothing very particular in their structure, and are tolerably well developed; and the presence or the absence of the external concha, though it of course modifies the hearing, and the distance at which the animal can hear, does not appear to be a matter of the very first importance.

Sight is, as we have said, obviously the leading sense in these animals, and therefore the eye merits more of our attention. It is an eye fitted for a double purpose or action; that is, it has habitually to be exercised in the water in the general economy of the animal; and it also has to act occasionally in the air. There is no eye which can be said to have, upon the whole, to perform both these offices so equally. The eyes of the whales, though no doubt in part fitted for seeing in the water, are very secondary organs in the economy of these animals, as they do not guide them to their ordinary prey, and cannot do so, from the particular situation which they have in the head. The eyes of the otters, also, are used in the water, but always at small depths, where there is abundance of light, and where any terrestrial, or rather aërial eye, could see perfectly well as long as its owner could remain below the water. The seals

have to use the eyes deep in the water, and when there is very little light, or indeed none, or next to none, as when the surface is very much roughened, or covered by ice with snow over it, which last must exclude the light. Yet the seals do not hybernate at those times, even in the long night of the arctic winter; for they are careful to keep breathing-holes in the ice, and, while an animal continues to breathe, it must also eat.

While the eyes of the whales are remarkably small for the size of the animals, those of the seals are very large. In this they follow a very general law among animals, whatever may be the element in which they live. If they depend chiefly upon the eye, and especially if they are feeders in the night, or in places to which little light can come, we invariably find that they have the eyes very large. This is the case with owls, and other nocturnal birds, and also with those nocturnal mammalia which find their food chiefly by sight. It holds even in the sea. The surface-fishes usually have the eyes small; and they get gradually larger and larger, till, when we come to those which inhabit the deeps, and yet are active, feeding upon other fishes, their eyes are very large, of which we have an example in the *stargazers*. It must not be understood that we mean to say that the large eye has the sense of vision in greater perfection than the small eye, for sensation is not a quality of matter, but a function of life, and therefore the acuteness of it has nothing to do with the size of an organ; and we find that, in equal lights, if they be strong ones, the small eye has the better of the large one, especially in the power of enduring a continued exposure to the light. But in faint lights the large eye has a greater field of view, and thus finds the object more readily than a small one does, and it also admits more light. The large eyes of the seals, therefore, are well adapted to the imperfect light in which they have to find their food.

The eyes are placed very near to each other, and thus they indicate that the animals follow their prey upon the forward view, as is done by the nocturnal quadrumana, which also have the eyes very near to each other. The form of the eye-ball is nearly spherical, the vertical diameter in the common seal being an inch and a half, and the horizontal diameter an inch and a third. This is in accordance with the form and action of the pupil, which closes to a vertical line. The sclerotic coat of the eye is composed of a fibro-cartilaginous membrane of considerable thickness, very hard and firm in the fore part round the cornea of the eye, and also in the posterior portion, but soft and rather flexible in the part intermediate between them. The structure of the coat, which may be considered as forming the basis of the eye, is peculiar; Blumenbach and some others have supposed, and certainly with much probability of being correct, that the flexibility of the central zone of the sclerotic admits of an adjustment of the focus of the eye, by means of which the animal can see equally well in the water and in the air. The cornea of the eye is flat, like those of the eyes of most aquatic animals, there being less distinction of light from a flat cornea than from a convex one of the same surface. This cornea is about three quarters of an inch in diameter, and thicker at the sides than in the middle. The crystalline lens is spherical, like that of fishes, and about half an inch in diameter. All the parts of the eye are, indeed, very well formed, and the muscles with which it is supplied are of considerable power. The lachrymal gland is very small, as the eye does not require to be lubricated with the secretion of this gland when the seal is in the water. From its equal adaptation to the air and the water, the eye of the seal is an important one by means of which to study the physiology of eyes generally, but our limits will not permit us to pursue it farther. We shall therefore cast just a passing glance on the geographical distribution of these most curious animals.

There is no sea on the surface of the globe in which seals are not to be met with,—not in the breadth of the great oceans indeed between the shores, though they are capable of taking journeys of considerable length. They are no where so abundant as on the shores of the dreary lands in the high latitudes, and near the margins of the ice; and in the north they form an important article in the domestic economy of the inhabitants of those inhospitable climates. In the equatorial seas the seals are solitary, or seen at the most in pairs. In the temperate latitudes they assemble in groups, but not in very large numbers; but in the high latitudes of both the north and the south, the herds of them are so numerous, beyond all counting, that the most active fishing can hardly have any effect in thinning their numbers. Though they are less known in the high latitudes of the southern hemisphere than in those of the northern, it is probable that, taking all the longitudes into account, they are upon the whole more numerous, as they have the complete range of the parallel, which is not the case in any latitude of the north. Those of the three great divisions of the sea are chiefly different from each other, and they have been employed as the basis of a popular mode of division, which has the advantage of connecting the species with their habitats, without any formal description. There are the seals of the North Atlantic, the seals of the North Pacific, and the seals of the South Seas; among which latter there are of course no longitudinal distinctions, as there are no lands to separate the seas from each other, and give them and their productions different characters, as is the case with the North Atlantic and the North Pacific, where the great current in the north parting the former, and the comparatively small one in the latter, give quite a different character, and bring the arctic winter farther to the south in the Pacific than in the Atlantic.

In all the seas in which they are found, the seals frequent the shores only at a certain season of the year, and appear to disperse themselves more generally over the waters during the remaining portion of it, which is usually much longer than that in which they throng to the shores. Those of the south resort chiefly to the dreary and inhospitable isles which lie off the southern extremity of the American continent, though they also come in considerable numbers to the shore, especially the south-west, which is much broken by inlets of water and little isles with channels between. The south of Africa is rather warm for their coming to it in any considerable numbers; but they resort in formidable array to the south part of Australia, and especially to Bass's Strait, where the islands are favourable for their basking, and fish are abundant for their food. In the northern seas they resort to the shores generally in the high latitudes; but there also they prefer the islands to the mainland. Among the Aleutian islands, and in all the

basin which lies between these islands and Behring's Strait, the seals assemble in vast multitudes; while those of the North Atlantic seek both the shores of the northern islands and the borders of the ice.

When they resort to the land there are some differences of habit among them, especially among those of the south. Some resort to the open sandy beaches; others to the rocks which are surrounded by the water, and others again to the coarse herbage which often extends to the margin of the water. Fishes are understood to form the principal food of all the species; but they also eat polypi and other floating animals, and even sea-birds, such as terns, petrels, and the smaller gulls, which are usually very plentiful in the great haunts of the seals, and resort to them for nearly the same purpose as the seals do; only they eat the smaller fishes, while the seals prefer the larger ones.

Seals are not easily killed by means of cutting instruments; for though the wounds bleed copiously, the labour of killing them in this way is great, unless some of the more vital parts are wounded. But the great development of the brain renders them much more vulnerable in the head than in any other part; and the quickest way of despatching them is by beating them on the head with heavy clubs. This is extensively done by the seal-fishers at Jan Mayen, where the animals are found in such numbers, that the men can knock them on the head till they are absolutely wearied with the slaughter; and in the best time of the season they very speedily fill a boat, or even a ship with a valuable cargo. The seal-fishing commences earlier in the season than the whale-fishing; and when the fishing vessels that resort to "Old Greenland," that is, to the vicinity of Spitzbergen, arrive too early, they bear away to Jan Mayen for the seal-fishing. Sometimes the "seal club" is exercised to no small advantage on the caverned shores in the north of Britain. These caves penetrate to such distances into the rock, that they are quite dark for a considerable way. The seals resort there to take their siesta; and the people watch their time, enter the cave with torches and clubs, and the seals, alarmed and nearly blinded by the glare of the torches, become an easy prey. There is of course a great deal of scrambling on these occasions; men and seals rolling over each other on the slippery stones; and sometimes a seal will wrest a club from the owner, and bear it off in triumph to the water.

In early times, when navigation consisted of little more than coasting and crossing the narrow seas, the seals, as well as the *Cetacea*, were far more numerous than they are at present; and their numbers came into lower latitudes. But the fishery which was carried on at first by the Dutch, and latterly by the British and the Anglo-Americans, has greatly thinned their numbers, and confined them within much narrower bounds than they previously were. Any one will readily understand that seals are much more likely to have their numbers thinned in this way than fishes; because they produce only one or two young ones at a time, while the fishes produce thousands or even millions. What man can capture by all his arts of fair fishing in the sea is not missed in the multitude of his finny prey; but it must tell in the case of the seals. Seals are also far more wary and sagacious animals than fishes; and thus, when they are greatly molested on one ground, they are very apt to shift to another. Hence those of the North Atlantic became so much thinned, that adventurers, chiefly English or American, have sought for them in all the inhospitable regions of the south. Those fishing expeditions to the south, having originated in a more enlightened and liberal age than those of the north, have tended to increase our knowledge of those remote seas. These discoveries indeed have done little more than show that there really is nothing to be discovered except a few wild rocks covered with snow for great part of the year; and affording resting places for seals and sea-birds only. But this is something, as it prevents waste of time, which would otherwise be occasioned in seeking that which is not to be found. Mr. Weddel, of the brig Jane of Leith, carried discovery into a higher latitude than it had previously reached in those seas. On the 20th of February, in 1823, he reached the latitude of 74° 15′, which is higher by two hundred miles than any other navigator has penetrated into the antarctic ice. No land, however was seen in that longitude (about 35° west), to the southward of New Georgia, which is a distance on the meridian of about 1500 miles. As the seals are among the rocks, or in the more shallow waters, small vessels answer best for this fishery; and in all coasting fisheries, or other operations in the water along-shore, small trim vessels are always the safest and the most manageable. The complement of men is about twenty-four; and the proper outfit of an expedition costs from 4000*l.* to 5000*l.* The vessels are strongly timbered and double planked. The rigging of the vessels is also very simple, but very substantial. They have generally a smaller vessel, about forty tons burden, which can be stationed near the shore as a general rendezvous for the fishing-boats, which are usually six in number, and constructed in the same manner as whale-boats. A good deal of experience and skill are required in choosing the ground; and when the proper spot has been selected, the vessel is moored in a safe place, and the apparatus for boiling the oil erected on the beach. The small vessel thus acts the part of a tender between the boats and the station. The seals are chiefly surprised and knocked on the head while on the rocks; and when this is over for the time, they are skinned and cut in pieces, which are stowed away in the small vessel. A load of the small vessel consists of about two hundred seals, which yield from eighty to a hundred barrels of oil. When the vessel arrives at the part where the boiling is carried on, the cargo is delivered and boiled, the flesh of the seals after the oil is extracted serving for fuel.

This fishing is one of great hardship, and often of great peril. The ships are sometimes out for three years, and all the time in a sea which is any thing but *Pacific*, while they are often at the distance of thousands of miles from any supply or assistance. Still, when successful, it is profitable, both for the oil and for the skins. The species in most esteem for oil are the long-nosed ones, called sea-elephants by the fishers among the earless seals, and the maned seal or sea-horse among those which have external ears. But they differ much with the latitudes and also with the longitudes of the places at which they are taken. Those most in request for their fur are those which are popularly called sea-bears; but there are many species which get the name of fur-seals. Seal oil is accounted purer and better than that of

the *Cetacea*,' unless when obtained from the spermaceti, or half crystallised stearine; and the great markets for it are Europe and America. The three principal kinds of sea oil are whale oil, seal oil, and cod oil, the last obtained from the livers of the fish, and preferable to every other for the dressing of leather. We believe that, by some absurd custom-house law, whale oil is the only one of the three which is called *fish* oil, although it is not fish oil; and that, in some places at least, the others escape the annoyance, both of the protections and prohibitions which affect this. A good many of the skins are also brought to Europe and America, but the grand market for them and for all furs is China. The fur seals are also found upon the shores of the southern lands in May, June, July, and part of August; and they return again in November and December, at which time the females produce their young, which they suckle for about nine months. It is generally said that the seals swallow pebbles as a sort of ballast before they go to sea, and discharge them again by the mouth when they come on land; but the story is not in very good keeping with what we observe in nature, where our opportunities of observing are more favourable than they are in the case of the seals.

On the eastern coasts of Siberia, both to the northward of the Aleutian Islands, and between these islands and the Kurile chain, seals are exceedingly abundant; and their manners might be more easily studied in those seas than in any others. They there ascend the rivers to a very considerable distance after the fishes; and in some of our own rivers, a stray seal sometimes makes its appearance ten or twelve miles above the brackish water; but this is so rare, that the animal is shown as a curiosity, and its appearance is supposed to be of an ominous character. The pairing time in the North Pacific is about April, and the females have only one young at a birth. The milk of the seals is of very superior quality, and the women of the dreary shores of Kamtschatka and the neighbouring lands procure it as a medicine for their children. They cannot be regarded as the flocks and herds belonging in property to the people of these inhospitable lands; but they answer many very useful purposes. The skins serve for clothing, for boats, for sails, for tents, and for various other articles; the fat is made into candles, or burned in lamps; the flesh is dried and smoked for winter provisions, and the recent flesh is cooked for the table; that of the young in particular is said to be very good. Notwithstanding all these uses, the seals cost the people nothing but the capture, which is an easy matter in places where the animals are numerous. There is also no doubt that they could be brought into a state of complete domestication, so that their usefulness would be greatly extended; and where land is ill adapted for flocks, the sea might be made a sort of substitute.

We shall now notice a few of the principal species; first, of the seals properly so called, *Phocæ;* and then of the eared seals, *Otaxia*.

Phoca. The leading characters are: No external conchæ to the ears; the fore teeth with single trenchant points, and the cheek teeth always with more than one; the hind feet with pointed claws placed on the margin of the web by which the toes are united. As the specific distinctions are not very clear, it may, perhaps, be better to take these in the three geographical divisions:—First, seals of the North Atlantic; second, of the North Pacific; and third, of the South Sea.

Seals of the North Atlantic. These are the best known; but it is probable that, even among them, coloured varieties have been described as species, and species have been overlooked.

The common Seal (*Phoca vitulina*) must be considered as the typical one of the genus. It is found upon the shores of all the colder places of Europe; but it is most abundant in the currents and narrow waters, as we have mentioned generally of the family. It is usually about five or six feet in length, but some specimens are more than this. The colour is yellowish grey, mottled over with dusky spots; but it is not constant. The skin, and the short hair upon it, are yellowish; and the long hairs have a grey tint and shining surface. When the animal rises immediately out of the water, these hairs, which are flattened, are laid close to the skin, and completely conceal it; but as they dry they stand more detached from the skin and from each other, which varies the change of colour to a yellowish tint, on all parts from the ridge of the back where the hairs are closest. When they get very old, the hairs turn very pale grey, and in some cases almost white. Some individuals are also much darker than others, and almost black when they first come out of the water; and there are very great differences in the size and number of the spots. In short, there is no dependence in colour or any part of the description of these animals.

Common seals, though these may perhaps be classed among animals which are familiar in their manners, are yet very watchful and wary. When they are at rest on the banks, they very frequently raise up their heads to see if there is any chance of danger. In the estuaries, where there are banks in the mid channel dry at low water, though still surrounded, they take up their station there in great numbers; and they appear to be more suspicious of a boat than of a ship: for we have seen them remain quite undisturbed while a vessel sailed by close to the bank; and yet shuffle very speedily into the water if a small race-boat came within the same distance. Even in the case of the boat, they appear to make a distinction between one which is simply passing by, and one which is making for the bank on which they are reposing. They are also very expert at getting at their prey, and in escaping from any entanglement into which they may get in the pursuit of it. When stake-nets for the capture of salmon were allowed to be erected in the estuaries, the seals often found their way into the labyrinths of the nets, enjoyed a comfortable meal of salmon there, and got out again in perfect safety; and when they get enclosed into nets from which they cannot find a passage, they creep through below, or scramble over the top with much adroitness. They appear to be more partial to salmon than to any other fish, and in some places they follow them into the lakes, when these are not at any great distance from the sea; and to accomplish this they will stem the current of a very rapid river.

On the British shores they usually bring forth their young in June, which are either one or two in number, but never more. The places where this happens are the most secluded caves and holes in the rocks, in which the young remain for some time, the mother going into the water to find their own food, and returning to the cave to feed their young. They

have not the same power of clasping with the fore paws which is possessed by the whales. The young are often killed in the caves, and their skins are held in some estimation on account of the gloss of the fur. In former times both old and young were eaten ; but the flesh, especially that of the old ones, is coarse and dark coloured, and the flavour of it is rank and oily. There is perhaps no stronger proof of the great superiority of the staple animal food of the present times, over that with which the people of this country were formerly supplied, than the disuse of seals, porpoises, and other sea animals, for the table. In those days the sturgeon was held in such estimation that it was considered as a royal fish, and any stray one which now occurs gets a little credit probably for the high place which it once occupied ; but as food, the best that can be said of it is that it is tolerable, which is more than can be said of the mature seal. At present, seals are valued only for the oil and the skin ; and as there are but few places on the British coasts where they occur in such numbers as to render the capture of them a profitable occupation, they are left in quiet possession of the sea and the banks, except in some of the remote places, where they are more numerous, and where human labour is of less value. In most places the capture of them has fallen off, compared with what it was in former times ; and yet it does not appear that there has been any increase of the numbers, but rather the reverse. Besides the modes of capture, to which we have alluded when speaking of the family generally, dogs are, or at least once were, in some places, trained to catch seals.

Seals are much more easily tamed than almost any other of the wild mammalia that are found in the British islands ; and if they are taken young, and tolerably well used, they soon learn to know their keepers, and evince nearly the same attachment to them as dogs do. Of course, in order to be properly in their element, they must have access to the water, which is essential to their comfort, though not to their mere existence. They cannot of course accompany their masters on land journeys, but they are very constant on aquatic ones, and the watchfulness which is so apparent in them in a state of wild nature is capable of being turned to good account in domestication. F. Cuvier, whose observation of animals in the French Menagerie was equally close and accurate, paid considerable attention to a pair of live seals which were in that collection. They were very young, not exceeding three feet in length, from which circumstance, by the way, some of the French describers have set down three feet as the average length, as if seals had no right to be bigger any where than they were in the menagerie. From the observation of these, there seemed reason to conclude that a fluid is secreted somewhere about the head of the seal, which lubricates the body when the animal is in the water, in some such way as the bodies of fishes are lubricated by the mucous secretion. These animals did not show the slightest apprehension at the sight of the company that visited their abode, though they shuffled out of the way pretty quickly when there appeared to be danger that they should be trampled upon. The sounds which they uttered were very feeble barking, and when they were annoyed they made a sort of hissing noise, like that of a cat when suddenly offended. They never offered to bite, but they sometimes menaced with the paw ; and when they contended about their food, which they did sometimes, they used the paws, not in a very warlike manner, but merely to push each other away. These seals were, however, rather too far removed from their own natural element and economy for enabling one to form a correct estimate of the character of the species.

One seal, which had been captured young, and was kept for a considerable time by some artillerymen on one of the small islets in the Firth of Forth, would have afforded a better illustration if its history had been fully recorded. It was during the late war, when the rumoured invasion had caused the construction of little forts and martello towers on so many places of the coast, and Inch Colm was, we believe, the islet ; the bombardier corps of men had little to do in their lonely abode ; and so they tamed a seal, till it showed a very strong attachment to them. It went often to the water, but never showed the least disposition to go away. On the contrary, it made some demonstrations which had the appearance, on its part, of a wish that, as it was their companion on land, they should be its companions in the water. It used to snatch their canes out of their hands, and get into the water with them, where it displayed them to the owners with a good-natured air of triumph. If they made efforts to get at it and the cane, it would advance and retreat and play many tricks ; and if they took no notice of it, it would bring the cane on shore, but be off again before they could get hold of it. If they threw any piece of stick into the sea, the seal was instantly after it in the same way as a water spaniel ; and in short, all its tricks very much resembled those of the more playful varieties of dogs.

It did not sleep on the rocks, but in the little barrack which had been erected for the men ; and during the day it was very fond of getting into their beds. Its entrance into them was effected with tolerable expedition ; but to descend was a more difficult matter, as it was apt to tumble, and at last was killed by one of these falls. It is apparent to any one who looks at a seal, or a good figure of one, that the animal can climb much better than it can descend ; and that, though it can shuffle rapidly down a slope, yet it cannot descend perpendicularly from a height in any other way than by throwing itself down ; and the fall is dangerous, unless it be into water, which is its usual landing in a state of nature.

When the party came to Leith in their boat for a supply of provisions or stores, the seal was on the *qui vive ;* and after a few trips it seemed to understand, when the boat was getting in order, what was to be the result, for it capered about the boat apparently very much pleased, and when the boat rowed off, it swam along with it ; but, in order to show that it was the swifter of the two, it used to take a turn round the boat now and then, and come to the gunwale as if to show that it had performed a feat. When they landed at the pier and made the boat fast, the seal took its station in it, and kept intruders at bay until the men returned. It was altogether a very interesting creature, and, of course, its fatal accident was much regretted by its masters.

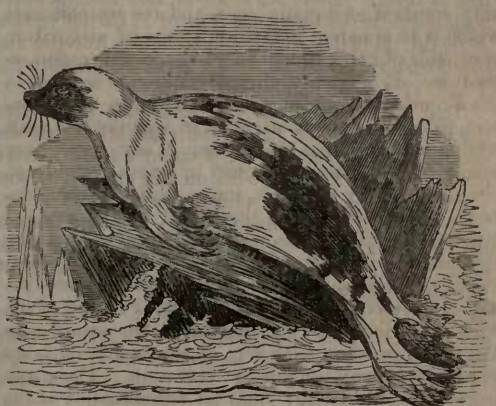
There seems little doubt that with proper attention, and not a great deal of it, the seal might be domesticated by the people who live on the shores where it is common. From the readiness with which the one alluded to brought sticks out of the water, there is little doubt that they might be trained to catch fish.

The otter has been so trained; and the seal is at least as intelligent as the otter, and it is an animal of much more gentle disposition. The milk of the females might also be used for domestic purposes; and, in short, it is highly probable that, by proper attention, a good deal might be made of the common seal.

The great Seal (*P. barbata*) is the only other species which comes to the British shores; and only to the remote northern and western isles, where it is a straggler more than anything else. It is much larger than the common seal, being twelve feet in length, and sometimes more. They are said to be found in pairs only, and not in herds like the common ones. The hair is coarse, and of a blackish grey or brownish colour, but it does not appear to be more constant in this respect than it is in the common seal. The following description is from Ross's First Voyage to the North-east of America; but the specimen does not appear to have been full-grown:—"Length from the tip of the nose to the extremity of the tail eight feet; its circumference behind the fore flappers seven feet five inches; weight eight hundred and thirty pounds; fore flappers measured in length eleven inches, in breadth six inches; hind flappers in length sixteen inches, in breadth two feet when expanded; the claws on the former were black, horny, and curved, those on the latter long and straight; fingers five, middle ones longest in the fore flappers; the body covered with thick, coarse, short, dark grey hair; the eyes about the size of an ox's, furnished with a nictitant membrane, irides dark hazel; the pupil elliptic, perpendicular; no external ears; the auricular apertures placed about two inches behind the eyes; the upper lip broad, rounded, fleshy, divided into two lobes by a deep sulcous division, which is black and naked; each lobe is provided with eight rows of strong white bristles, some pellucid, and curled at the ends; the lower lip thin, and pointed; tongue thick, pointed, and cleft; upper surface papillous; teeth, upper front six, truncate, small; tusks solitary, truncate; grinders three, the anterior one solitary; lower front four, imperfectly developed; tusks small and obtuse; grinders seven, the two posterior imperfectly lobed, the rest being small tuberosities, scarcely produced through the gum; the heart about the bulk of that of an ox, its texture strong; the foramen ovale obliterated (a point on which there is yet some discord among comparative anatomists). The aorta three inches in diameter, its coats two and a half lines in thickness; the calibre of the pulmonary artery nearly the same, the thickness of its coats one line; kidneys elliptic, lobes one hundred and fifty to one hundred and sixty; stomach filled with a greenish dark fluid; its inner coat lined with escarides one inch and a half long; they hold on with great tenacity, rendering it difficult to disturb them; the smaller intestines were inhabited thickly by leniæ, from one foot to four feet in length." Such is the circumstantial description given of this specimen; but the descriptions of the seals of the high latitudes given by different writers vary so much, that it is difficult to reconcile them.

This species is also called the bearded seal, from the mustachios on the upper lip. The middle toe on the fore paws is very long, and the inner one very short. On the young ones the fur is much softer than on the adults, and that on the under parts is partially woolly. The hair falls off to such an extent that the very old ones are nearly naked; the colour also changes so much with age, that the species is apt to be mistaken. Their chief abode is in the high latitudes near the polar ice; they come to land or to the margin of the ice very early, and in March or April the young are brought forth. One at a birth is understood to be the number, and they are often cradled on the floating ice. They are timid animals, and have not the watchfulness of the common seals. The Greenlanders esteem their flesh as an article of food and that of the young ones is said to resemble veal in colour, and not to be unpleasant in the taste. The people in the northern lands esteem them as being among the most valuable of all the seals.

Greenland Seal (*P. Greenlandica*). This species is found in the same seas as the last mentioned one, only it never rambles so far to the south as to be met with on even the remotest of the British isles. It is subject to still greater variations of colour than the last-mentioned one, and therefore the accounts of it are, if possible, more confused. It attains the length of ten or eleven feet, though smaller ones are more frequently met with. The colour is most commonly yellowish-white, with the muzzle and forepart of the head black or dusky, and the sides marked with large irregular blotches of the same colour. It is very generally distributed in the high latitudes of the North Sea; but the White Sea appears to be the only sea decidedly European to which it resorts, and its visits there are only seasonal. In the more northerly seas it is found throughout the year, and eagerly sought after both for the oil that it affords and for its skin; but it has been so differently described by authors who have met with it of different ages, and also in the sexes, which vary from each other in many external appearances, that it seems to have been made not less than half a dozen of different species, and to have been called by a whole dozen of different names. Even the number of teeth appears to vary at different ages, so that there seems to be hardly any permanent character about it. The general colour of the adult is the yellowish-white which has been mentioned, with the anterior part of the head, and a patch on each flank, nearly or altogether meeting on the upper part, of a colour varying from blackish-grey to almost entirely black.



Greenland Seal.

These markings, whether they incline more to grey or to black, are always very intense in the colour, and contrast boldly with the ground upon which they are placed. On the flanks they appear to be made up of a congeries of spots, which completely run into each other in the centre of the patch, but which are

nearly insulated at the borders. The young are more inclined to white all over, but with a shade of ash-colour, and numerous spots on the under part of the body. These spots are but faint in the young, and vanish altogether in the full-grown animal. The teeth also vary at different ages; but the law or the causes of their variation have not been made out. The pairing usually takes place in June, and the young are produced in the end of March or the beginning of April following; so that it is ascertained that in this species the period of gestation is nine months, which is probably the case in most of the others. The produce is one, or at least very rarely two. The food is understood to consist of fishes, crustacea, and of those floating animals which are met with in such numbers at places where there are currents in the sea.

The hooded or crested Seal (*P. cristata*). This is another species about which there has been no small confusion. The most remarkable characteristic of it is the hood or crest, which is attached to the head, and capable of being not only erected, but of being extended so far as to cover over the muzzle. This singular appendage is, however, found in the mature males only, and is wholly wanting in the females and the young, which has led to the consideration of them as different species from the males. The young are entirely white; but in the old ones the feet and the muzzle are black, or, at all events, very deeply coloured. It is more plentiful toward the western parts of the Arctic Sea than toward the eastern, and arrives in very considerable numbers in Davis' Straits. The males are understood to be polygamous; and the females have only a single young one at a birth, which they are understood to drop on the ice about the month of April.

Many other seals have been mentioned by authors as inhabiting the Northern Ocean and the European seas; but it is probable that many, if not the whole of them, are only coloured or accidental varieties; and even if they are really species, so little is known of their manners, and they are so much alike, in as far as they are known, that there is no popular interest in them. There is, however, one species which requires notice as being the type of F. Cuvier's genus *Pelagius*, as being chiefly found in the Adriatic and the Greek seas, and as being in all probability the *Phoca* of Aristotle and Pliny. This is

The Adriatic Seal (*P. monachus*), also called the hooded seal, the monk seal, the Mediterranean seal, and other names. It is rather a small species, grey, marked with yellowish on the upper part, and yellowish-white on the under. The whiskers are long and stiff; and the claws on the hind feet are merely rudimental. As is the case with the other seals, this species is subject to very considerable differences of colour.

2. Seals of the North Pacific.—The portion of that ocean which narrows toward Behring's Strait, has been already noticed as one of the great haunts of the seal tribe; but they have not been examined with much attention to specific differences. They are not confined to the extreme parts of the ocean, but are found along the coast of America, and about the islands till they range so far as to meet the seals of the south; but they are less numerous near the equator than in the high latitudes. We have already mentioned the advantages which the inhabitants of the islands and shores of that sea derive from the seals; but, with the exception of the Russians in Siberia, there are not many fishers from the nations of the west that resort to a place so very remote. The names given to the seals, of which specimens have been obtained from these parts of the world, are all doubtful; and the principal distinctions among them are those of colour only. Those which have been met with in the extreme north are of a white colour, closely mottled over with small blackish spots; those which have been obtained from the Kurile Islands, which may be considered as the south of the polar portion of that sea, are exactly the reverse, or black covered over with white spots; and those of the Aleutian Islands are yellowish-white without any spots, and the young are said to be all over as white as snow. Notwithstanding these varieties of colour, it does not appear that there are any very marked specific differences.

3. South Sea Seals.—The seals of this part of the ocean have a much wider range than those of the north, and several of them are of more ample size. The largest of them, and the one which is most widely distributed, is

The long-nosed Seal (*P. proboscidea*), which is also called the sea elephant, and various other names. It is sometimes found thirty feet long, and eighteen in circumference at the thickest part. It is generally of a bluish-grey on the upper part, but it is also met with, though more rarely, of a brown colour. The canines in the lower jaw are large, strong, and considerably bent, but projecting outwards. The bristles of the mustachios are long and coarse, and twisted like a kind of screw; the eyes are large and prominent; the fore paws are large and strong, with only five rudimental claws on the posterior margin of each; the tail is very short, and only partially appears between the hind paws, which latter are broad and flat. The most singular character of this species is, however, the proboscis, which is peculiar to the male, and appears on it only in the pairing season. This is a cellular enlargement of the point of the nose, soft, and barely perceptible in ordinary states, but capable of being extended to the length of nearly a foot, by the power which the animal has of injecting blood into the cells. But though it has the position of a proboscis, it has none of the action, and can be looked upon in no other light than as a mere appendage, similar, in season at least, to those which are found on the heads of some gallinaceous birds, especially turkeys. The hair upon these animals is exceedingly coarse; and in some seasons they get exceedingly fat, and a single one, when in the best condition, will yield a butt of oil. They also contain a great quantity of blood.

They are found in all places of what are called the South Seas; but always in the greater numbers the higher the latitude. They are the principal seals that are met with on the coasts of New Holland and Van Diemen's Land, and on those of New Zealand; but in both situations it is on the south or polar shores that they are principally to be met with. The Falkland Isles, the New Orkney, and Shetland, and all the dreary isles near the southern ice, abound with them, and so do the numerous isles along the western shore of South America; but they are never as far to the north as the Isle of Juan Fernandez. They are represented as being migratory with the seasons, moving northward in the winter and southward in the summer, which are of course at the opposite times of the year to the same seasons in our hemisphere.

Their food consists in great part of the cephalopodous mollusca which float in such numbers in those seas; but they are also said to eat sea-weed, the *Laminaria gigantea*, or great sea-belt for instance—at all events, they form a sort of bed for their young with this weed upon the sandy shores. During the first four months of the year they are dispersed through the ocean, and not to be met with on the shores; and for the rest of the year they are alternately on the land and in the water. They are heavy, mild-tempered, and unsuspecting animals, by no means so watchful of danger as the seals which are to be found on our shores. They allow the fishers to come close to them on the rocks, and fell them on the head with clubs; and those which do get into the water, launch themselves so slowly, that they are generally killed by the men who wait for them in the boats. They have another resemblance to the gallinaceous birds, besides the seasonal appendage to the head. The males are polygamous, each one having a number of females in his train, forming a sort of marine seraglio; and when two males encounter each other at this season, a fierce battle of gallantry ensues, in which, as is usual among animals in such cases, the females desert the conquered, and join the train of the conqueror. The young are one or two at a birth, produced about July or August; and the females suckle them for two or three months. When they migrate it is usually in herds of from a hundred and fifty to two hundred, the pugnacious disposition of the males ceasing with the season of which it is more immediately characteristic. The interest which is attached to these animals for their oil, is nearly as great as that which was attached to the Greenland whale before its numbers were so thinned as they are now, or the animals driven so far into the polar ice as to render the fishing equally uncertain and dangerous.

Animals which have long seasonal migrations are seldom so liable to changes of colour as those which are more local; and hence it is probable that these large seals of the south do not vary so much as the seals in the north. Still there appear to be very considerable differences; and they probably have been called by various names—generally by those of sea-lions, sea-wolves, and others equally out of keeping with the true characters of the animals. But some members of the other genus, or subgenus, have also been called sea-lions.

The long-necked Seal (*P. Weddellii*). This is also an inhabitant of the South Sea, and a much more polar one in its locality than the preceding. It has hitherto been met with only in the high latitudes of the south, indiscriminately on the shores of the barren lands and the margin of the ice. In some respects it makes a slight approach to the eared seals; and it has a rudimental external concha to the ears; the body is round and very thick at the middle part, but it tapers to the head, which is small, and has the muzzle much pointed; the fore legs are short, and the hind ones are drawn nearer to each other, with five short lobes at the extremity; and the claws are very small or altogether wanting; the hair is short, shining, and laid flat to the skin; the colour pale grey on the upper part, sprinkled over with small whitish spots; and the under part of it is yellowish. It grows to the length of seven or eight feet. Very little is known of its manners, however, as it has not been met with except in the extreme latitudes near the ice; and resting upon that rather than the land. Its value to the seal-fisher is far inferior to that of the great seal which is so widely distributed over the southern ocean; because the places in which it is found are much more hazardous, and the animal itself is smaller and less productive of oil. The native locality of this seal was not very well known until Weddell penetrated so far to the southward; and each of the specimens (of which, however, there were very few) had a separate name. It is probable that the one described by Sir Everard Home, in the Philosophical Transactions for 1822, and upon which F. Cuvier founded his genus *Stenorhyncus*, is identical with this one; in like manner as it is probable that all the sea-elephants which have been mentioned as found at different places, and differently named, are really identical with the one which we have described. The seals of the South Sea are, however, an intricate portion of Nature, and a long time will be required before they are properly understood.

Otaria, or Eared Seals.—The distinguishing characters of these which are the most essential to be borne in mind are: the possession of an external concha, which surrounds and covers the opening of the ear; the fore feet merely swimming paws, or fins without the slightest vestige of claws, and placed at the middle of the length of the body; the hind legs placed near to each other with strong straight claws, and their swimming lobes very much produced; the incisives trenchant, and the cheek-teeth strong and conical. They are often called bear-seals, or sea-bears; and they are the species the skins of which are in request as furs. They are found in all the three divisions of the sea to which we referred in speaking of the seals; but they are especially abundant in the South Sea; and there are either a number of species there, or they are prone to run into varieties.

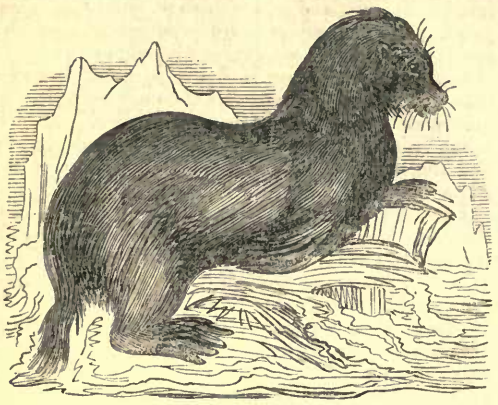
1. North Atlantic.—There is only one eared seal in this part of the world, and it is confined to the high latitudes, being rarely if ever found to the south of Greenland.

Common Sea-Bear (*O. Fabricii*, or rather *Groenlandica*). This species is small, and, with the exception of having external ears, it has as many points of resemblance to the earless seals as to the eared seals properly so called; and hence many naturalists have felt disposed to consider it as confined to the Pacific and the South Sea. It is not, we believe, met with upon any part of the coasts of Europe, or upon those of Spitzbergen or Nova Zembla, but rather in the western part of the Arctic Sea, and chiefly on the west of Greenland. The fur is of a brown colour, there is no mane on the neck, and the swimming flaps of the hind feet are very long. It is doubtful whether some of the species which are found in the North Pacific have not been mixed up in the descriptions which have been given of this one.

2. North Pacific.—The eared seals are far more numerous here than they are in that part of the North Atlantic in which they occur; but it is doubtful whether they have not been to a certain extent confounded with those of the south. They are particularly called sea-lions or sea-bears, without much regard to the distinctions of species.

Sea Lion (*O. Stellerii*). This species has obtained a number of names, being the sea lion of some and the sea bear of others, the only title that it has to either of these epithets being the mane upon the neck. It has indeed something of the voice of a lion, or at any rate it makes a loud and bellowing sound;

but it has none of the propensities of the savage king of brutes. It is met with along the whole west coast of America, though most abundantly toward the north. It grows to the length of eight or nine feet.



Sea Bear or Lion.

The colour of the fur is brown, and the mane consists of a band of frizzled hair down the middle of the neck, having no resemblance to the mane either of a lion or a horse. The head is of mean size, the ears are short, the muzzle also is short, and it turns up something like that of a pug-dog. It can climb to a very considerable height on the rocks, though its fore paws are very short. It is very abundant among the Aleutian Islands, by the natives of which its flesh is held in much estimation. It is a very timid and harmless animal, notwithstanding the mane and the roaring.

The males are partially polygamous, but they have seldom more than two or three females in their train. The period of gestation is nine months, and the young are produced in May or June. Notwithstanding the partiality of the Aleutians to the flesh of these animals, they have at all times a rank and disagreeable scent. Though they are found along the whole line of the west coast of America, they are yet to be regarded as properly animals of the North Pacific, and not of the South; for as one proceeds westward their numbers diminish, and they are not found higher than 56° of south latitude.

Californian eared Seal (*O. Californiana*). There is a little obscurity about this species. As described it is smaller than the former; covered with uniform smooth yellowish-brown fur, and with the mustachios small; the muzzle is very pointed; the fore paws are much larger than the hind ones, with five rudimental claws and enlarged membranes; the hind feet are slender, with three claws on the middle toes of each, and rudimental ones on the exterior and interior; there are five lancet-shaped lobes of membrane which extend nearly half a foot beyond the points of the claws; the tail is very short. The habits are wholly unknown.

Sea Bear of Steller (*O. Krachenninikofii*). This is the "sea cat" of the Russian, whose almost unpronounceable name it bears; and to whom we are indebted for a good deal both of real history and romance respecting the sea on the coast of Siberia. The length is eight or nine feet in the very largest specimens; and the muzzle is longer and the teeth more powerful than in the sea-lion. The old ones are blackish with grey spots on the upper parts, and the young are bluish-grey. In the old ones the fur is grey at the points, and has altogether a bluish tinge; the feet are naked and black in the colour. They are found chiefly in the northern parts, where they shift their locality with the seasons. They collect in the greatest numbers toward the mouth of the rivers, so that the fishing for them is more on the continents than the interjacent islands, though they are also pretty abundant on these at some times of the year. They have a most offensive odour; but still they are sought with great eagerness for the sake of their fur. The fur of the undropped young, which is of a beautiful bluish-black, is the most esteemed; and the females are caught in vast numbers in order to procure it. The males are polygamous, each having ten, fifteen, or more, females in his train; and, as one might expect under such circumstances, the males fight desperate battles of gallantry. The females show very great attachment to their young; but it is said that the very old and infirm ones are expelled the society of the more vigorous.

3. South Sea.—The eared seals of the South Sea are more numerous and varied than those of the north; and some of them are of much larger size. One of the largest and most characteristic is

The Sea Lion of Forster and others (*O. jubata*). This species is said to grow to the length of five-and-twenty or thirty feet, and to measure sixteen or twenty in circumference where thickest. It is thus among the largest animals in the family. It appears to vary considerably in the different parts of the wide sea of which it has the range. The body is cylindrical, thick, and usually very fat; the head very small in proportion, and formed something like that of a large dog; the nose a little turned up and truncated at its extremity; the upper lip extends beyond the lower one, and is furnished with five rows of stiff hairs for mustachios; these are very long, and black in the young animals, but hoary or white in the old; the ears are conical, and not more than half an inch in length, and they are formed of very stiff cartilages; the eyes are large and prominent, and have the irides greenish; the fore paws are flat and black, with only the mere rudiments of claws; the hind ones have five very small claws upon each; the tail is conical and short; the fur upon the body is soft and generally of a yellowish colour; the female has no other covering than this upon any part of the body; but the male has a very conspicuous mane, or rather a covering of rough and coarse hairs along the whole upper part of the body; this is of a tan colour, not unlike the general hue of the mane of the lion; but all the rest of the body is covered with yellowish fur of a soft silky texture like that on the female. This species is said to eat sea birds when it can catch them, and even some seaweeds, as well as fishes, which are its principal food.

This is an exceedingly valuable animal, and the capture of it is pursued with much avidity. The flesh, though not the very best of animal food certainly, can be eaten, especially that of the young. The oil is abundant and excellent, and the fur is much in demand. It is also very widely distributed over the Pacific, being found in almost every latitude of that ocean, from near Behring's Strait to the extremity of America; but it appears to belong to the middle latitudes rather than the high ones in either hemisphere. The females make a sort of nest for

their young of the dry herbage on the beach. Notwithstanding the size and strength of this species, it is by no means a vicious animal; on the contrary, it is rather gentle and timid, except in the pursuit of its prey. In every point of view in which we can consider it, it is, in fact, one of the most interesting animals that inhabit the ocean.

Forster's Sea Bear (*O. Forsterii*) is a much smaller species than the one last mentioned; but it is one which is very widely distributed, and of which the fur is held in much estimation. It is found both in the high and the middle latitudes of the South Sea, in the most southerly isles that have been discovered, on all the rugged shores at the southern extremity of America, on the island of Tristan d'Acunha in the South Atlantic, on Van Diemen's Land, and the south of New Holland, on New Zealand, and all the islands which spot the south of the Pacific.

The length of this species varies from four to six feet. The body is slender, the head round, the opening of the mouth small, the eyes large, the ears conical and pointed, the fore paws free, with naked membranes, smooth on the upper side and furrowed on the under; the inner toe is the longest, and all the others are gradually shorter and shorter; the covering consists of two coats of hair, the one a very close, soft, and silky fur, of a reddish-brown colour, and the other of long, stout, and shining hairs, which are brown mottled with grey. The fine fur varies in colour in different individuals, and at different ages and seasons; it is thicker and longer on the neck and back than on the other parts; and it is the finer and shorter which is so much valued as fur. It is the proper South Sea seal-skin of the English furriers; and, as the long hairs are all carefully pulled out, it is remarkably even on the surface. It is also used in the manufacture of hats, often in producing what is called "short nap beaver;" but it is weaker than beavers' fur, and we believe does not either felt or retain the colour quite so well. It is said to be a wary animal, with a very acute sense of smelling, and therefore it is not easily captured. But it is so valuable for the fur, that every stratagem is put in requisition for obtaining it. As is the case in most of the other species, this one is subject to considerable variety, or else there are different species bearing a pretty close resemblance to each other.

Little eared Seal (*O. Pusilla*). This species, which is the sea wolf of some authors, is not above four, or at the most five, feet in length, and two feet in circumference at the thickest part, even in the very largest specimens; while the majority of those met with are said not to exceed two or three feet. The head is round and a little depressed, and the muzzle very short; there are six incisors in the upper jaw, the two exterior of which have very much the form of canines; the mustachios are very long; and the ears, which are straight, are an inch and a half in length, which is more than those of any of the larger species; there are only four incisive teeth in the upper jaw; the neck is very thick for the size of the animal; the inner toe on the fore paws is very long; but the claws are very short and almost cornated in the skin; the hind feet are covered with fur on the upper part, but have the skin naked on the under; there are three well defined claws on the three middle toes of each of the hind feet; but the lateral ones are hardly perceptible; and the membrane by which the toes are united is divided into five very long lobes, which extend far beyond even the most perfectly developed claws; the fur is soft and shining, and of a brown colour with a tinge of iron-grey; it is darker on the head and brighter on the back than on the other parts; on the ridge of the back it passes into bright grey, and into whitish on the belly. The young have the colour more inclining to blackish; and the adults are subject to considerable varieties of colour. This species is found in lower latitudes than many of the others, and occurs in considerable numbers about the southern extremity of Africa. But it has been differently described by different authors, and therefore there are some doubts as to its real characters.

Pernetty's little Sea Lion (*O. molossina*) has the body slender, the head round, and the muzzle truncated so as to give it something the appearance of a bull-dog; the nose is rather prominent, and separated from the upper lip by a furrow; the upper lip closes over the under one, and the margins of both are covered with short stiff hairs placed closely together; the mustachios are disposed in four, five, or six rows over the greater part of the cheeks, and the hairs in them are four inches long in the parts most distant from the muzzle; these hairs are thick, flattened, and shining, and of a bright fawn colour; the eyes are placed at the distance of about two inches from the gape, and have the irides of a greenish colour; the ears are very thick, short, rolled together at the sides, nearly concealed with thick fur on the outsides, but naked within; the fore paws are short, and terminated by very large membranes, which are quite naked and of a deep black; there are only four rudimental claws on each of their feet; the hind feet are drawn close together, flattened, and have black claws about an inch long to the three middle toes, but mere rudiments to the lateral ones; the membrane on them is large and divided posteriorly into five produced lobes; the body and the upper surface of the extremities are covered with very close short fur; but the under sides are quite naked and of a bright and shining black, and the colour is reddish-brown, with a lustre like satin in the living animal; the tail is short, flat, and pointed; there are in all thirty-six teeth, the incisors divided into two lobes by a deep furrow. This species is found in the high latitudes of the South Sea, where it comes to the shores in abundance about the midsummer of the South Sea hemisphere, that is, in the end of December.

Crowned eared Seal (*O. coronata*). This species is not known as a living animal, but only from a specimen in Bullock's Museum. That specimen was very small; and hence it is probable that it may have been the young of some other, and perhaps well-known, species. All the feet are described as being furnished with much larger and more powerful claws than the majority, or indeed almost any, of the eared seals with which we are acquainted in the living state. Our reason for concluding that it was merely a young one is the blackness of the skin, for many of those that are brown, when full-grown, are black in the younger state.

Ash-coloured eared Seal (*O. cinerea*). This one is not uncommon about the southern and south-western shores of New Holland. It grows to the length of eight or nine feet, and is covered with thick and hard fur of an ochre-grey colour, longer and thicker on the neck and shoulders than on the under

parts of the body. It is very doubtful, however, whether this is entitled to be regarded as a distinct species, for it rather seems to be a colouring of age; for individuals having all the characters of this one with the fur finer and of a yellow sand-colour, have been met with in the very same places. It cannot be too often repeated that there is really no trusting to colour as a means of specific difference among seals either with external ears or without; for any one who sees a herd of a dozen or two of common seals on a bank upon any of our own shores, will find some on the distant view nearly black, some piebald, some brown, grey, and some white. It would, therefore, be of some use to the systematic describers of these animals, to take a hint from Benedict's description of the lady of his choice, and let their hair be "of any colour that it pleases heaven," for the habitual introduction of colour into all the descriptions is productive of more confusion than any other cause that can be named. It is highly probable that the white-headed seal mentioned by Shaw is nothing else than the one which is here described as ash-coloured. It is described as being about ten feet long; the only distinction of it from the other is the white on the head, and the description is merely that of an individual specimen, the native habitat of which is not known.

The Yellow-eared Seal of authors, which is described as being of a pale cream-yellow, and less than two feet in length, is, in all probability, a young one at some particular stage of its growth; and the same may perhaps be said of most of the small ones which have been added to the list of species from mere museum specimens, and upon museum authorities, without the slightest reference to nature.

Such is as complete an outline of both the genera of the seal family, as well as of their characters and habits, as our limits will permit us to give. Taking them in the whole, there are very few families of animals, either of the land or the water, that are more interesting; and although their teeth and their alimentary system generally class them with the flesh-eating animals, they have some approximation to the *Ruminantia* in an economical point of view. It is to be borne in mind, too, that all the advantages which are obtained from the seal family, come from the free bounty of Nature, without care, culture, or feeding at the hand of man; and hence, if the period shall soon arrive (and there is no natural cause why it should not), when culture shall add the shores to the solid land, the value of the seal family may be greatly increased.

SECALE (Linnæus). Is the generic name of the well-known cereal rye. It is remarkable for being the habitat of a parasitic plant which fixes itself in the ovary of the flowers. The seeds and seed-vessels affected, instead of becoming normally developed, are perverted in an early stage of their growth, and a lengthened club-shaped body protrudes from the husks instead of the grain; hence it is called spurred or horned grain; and when used as medicine is called *ergot of rye*. The presence of this fungus alters the qualities and properties of the grain, changing it from a wholesome to a hurtful food, and even a fearful poison. Like many other poisons, however, the ergot forms, when duly administered, a valuable medicine, being peculiarly serviceable in one of the most interesting and hazardous conditions to which women are subject; indeed it may be fairly said, that the discovery of the virtues of this little fungus has added a new article to our scanty list of specific remedies.

SECAMONE (Dr. R. Brown). A genus of tropical climbers, bearing pentandrous flowers, and belonging to the natural order *Asclepiadaceæ*. Some of the species are medicinal, and in our collections are treated as stove plants.

SECHIUM (Brown, P.) A native of Jamaica, where it is called Choko. It belongs to *Cucurbitaceæ*, and bearing large fruit is cultivated for feeding hogs. It was called *Sicyos edulis* by Jacquin.

SECURIDACA (Linnæus). A genus of West Indian twining plants, bearing fragrant diadelphous flowers, and belonging to *Polygalcæ*. They are stove plants, and succeed with the ordinary management.

SECURINGEA (Jussieu). A hard wooded timber tree called the Otaheite myrtle, although introduced into our collections from the Mauritius. The flowers are monœcious, and belong to *Euphorbiaceæ*. It is grown on light soil, and flowers freely in our stoves.

SEDUM (Linnæus). An extensive genus of mostly succulent herbs, generally found in the northern hemisphere. The flowers are decandrous, and belong to *Crassulaceæ*. From being frequently seen on the tops, or growing out of the interstices of stone-walls and rocks, they have acquired the name of stone-crop in English lists.

SELAGO (Linnæus). A genus of under-shrubs, natives of the south of Africa, bearing small didynamous flowers, and belonging to *Verbenaceæ*. They are easy of culture and propagation.

SELENITE. The mineralogical name for crystallized native sulphate of lime. The primitive form of selenite is a rhomboidal prism, and the crystals are commonly transparent. Very fine specimens are found in Cumberland.

SELINUM (Linnæus). A genus of uncultivated herbs, natives of Europe. They belong to the fifth class of sexual botany, and to the natural order *Umbelliferæ*.

SEMECARPUS (Linnæus). An East Indian fruit tree belonging to *Terebinthaceæ*. This is the marking-fruit of Indian authors, and so called because its stains are indelible, and it forms a natural ink. The fruit is not much esteemed unless roasted to remove its acridity.

SEMPERVIVUM (Linnæus). A genus of shrubs and under-shrubs, natives of the south of Europe. The flowers are dodecandrous, and belong to *Crassulaceæ*. Being mostly succulent, they require a light loose soil, and but little water.

SENACIA (Commelene). A genus of tropical evergreen shrubs, natives of India. They bear pentandrous flowers, and belong to *Pittosporeæ*. They are kept in the stove, and are easily propagated by cuttings.

SENECIO (Linnæus). An extensive genus of annual and perennial herbs and shrubs, chiefly natives of Europe and Africa. The genus is divided into six sections, each of which is separated into subsections. The flowers are composite, and among the species we find some highly ornamental, and many only worthless weeds. The *S. elegans*, and the *S. vulgaris*, common groundsel, are instances.

SENSITIVE PLANT. Is the *Mimosa sensitiva* of Linnæus; the irritable properties of which are so well known, even to those who know no other plant, that no description is necessary.

SEPIA (Linnæus). A naked mollusc, universally well known by the familiar name of the cuttle-fish, and the dried calcareous internal support is used as a dentifrice. They are abundantly found in all climates, and many of them attain a considerable size. Under the article CEPHALAPHORA, this genus is more amply described.

SEPIDIUM (Fabricius). An extensive genus of coleopterous insects, belonging to the family *Pimeliidæ*, having the antennæ filiform, the fourth and following joints being obconical, the thorax depressed, with the lateral margins dilated, and with a dorsal channel. The species are destitute of wings, and are found in sandy and uncultivated districts, in the warmer parts of the old world; several species are found in the south of Europe. They are of a moderate size and black colour.

SEPIOLA (Leach). A species of naked mollusc of the genus *Loligo*.

SEPIOTENTHIS (Noblet). A species of naked mollusc of the genus *Loligo*.

SEPSIS (Fallen). A genus of small dipterous insects, belonging to the family *Muscidæ*, having the body of a moderately elongated form; the legs long and slender; head globular, antennal joints small, with the terminal seta naked; palpi filiform. These are active little flies, generally of a shining black or bronzed colour, which are to be observed in summer upon various flowers and leaves in the sunshine, where they appear to delight in keeping their wings in a constant but moderately slow vibration. Some of the species exhibit various remarkable variations in the structure of the legs and some other parts in the opposite sexes. The type is the *Musca vibrans* of Linnæus.

SEPTARIA (Lamarck; SERPULA POLYTHALAMIA, Linnæus). A very long testaceous tube gradually attenuated to its upper end, and interiorly divided by vaulted separations, seldom complete, the extremity of which is terminated by two slender tubes without any interior partitions. This sheath, no doubt, incloses a bivalve shell at its end, but we have never seen a perfect specimen.

SEPTAS (Linnæus). A remarkable genus, in so far as it is the only individual genus which constituted the fourth order of the seventh class of Linnæan botany. Every member of the flower has seven divisions. Jussieu has placed it among the *Sempervivaceæ*.

SERAPIAS (Linnæus). A genus of south European herbs, belonging to *Orchideæ*. Like others of the order, the flowers are curious, and the species are so hardy, that they bear our winters with but a little covering.

SERICA (Mac Leay). A genus of coleopterous insects, belonging to the family *Melolonthidæ*, having the antennæ nine-jointed; the body ovoid, as though inflated, and often silky or exhibiting various changeable reflections of colour; all the tarsal claws are bifid, and the thorax is much broader than long. These insects are of small or but moderate size; they reside in the perfect state amongst vegetables, of which they devour the leaves, the larvæ probably feeding upon the roots like those of the *Melolonthæ*. The type of the genus is the common English *Serica brunnea*.

SEROLIS (Fabricius). A remarkable genus of crustaceous insects, belonging to the order *Isopoda*, and family *Cymothoidæ*, having the body depressed and nearly circular, composed of transverse segments, four of which constitute the abdomen; the head is large, with the eyes placed upon tubercles, and situated upon the summit of the head. This genus is composed of two or three species of crustacea, inhabiting the southern extremity of South America, and in the form very nearly approaching to the extinct tribes of *Trilobites* (which see). The type of the genus is the *Cylaothoa paradoxa* of Fabricius.

SERPENTINE. Under this name are placed some of the most picturesque rocks which ornament and protect the British shores. Serpentine derives its name from the variety of tints which it exhibits, varying from a bright red to a vivid green. Some of the varieties admit of a fine polish when employed for ornamental purposes. Serpentine is seen in its highest beauty on the coast of Cornwall, where it forms the greater part of the Lizard promontory, and presents a series of natural arches and columns. At Portsoy in Banffshire it is associated with granite, and in other cases it is incumbent on beds of porphyry.

SERRATULA (Linnæus). A genus of herbaceous annual, biennial, and perennial plants, mostly natives of Europe. They belong to *Compositæ*. Their English name is sawwort, and one of them, the *S. tinctoria*, is useful to dyers.

SERRURIA (Dr. R. Brown). A fine genus of evergreen shrubs from the Cape of Good Hope, and allied to *Protea*, and of course belongs to the same order; they also require similar treatment, and are well worth a place in every collection.

SESAMEÆ. A natural order containing four genera, viz., *Tourettia*, *Martynia*, *Craniolaria*, and *Sesamum*. Of these genera there are eight species. The flowers are didynamous, and the plants are innocuous, and are used for both food and medicine. They are chiefly remarkable for the abundance of bland oil contained in their seed, which is as sweet as that of olives, and is expressed in the Levant and other eastern countries for domestic use.

SESBANA (Persoon). A genus of tropical plants mostly annuals, two of them are shrubs, one of which was called *Æschynomene* by Linnæus. They belong to *Leguminosæ*. The species are potted in sandy heath mould, and require the hottest part of the stove.

SESELI (Linnæus). A genus of annual, biennial, and perennial herbs, chiefly natives of Europe. They belong to *Umbelliferæ*; none are in cultivation.

SESIA (Fabricius). A genus of lepidopterous insects, belonging to the family *Sphingidæ*, having the wings horizontal, somewhat unclosed when at rest, and always more or less hyaline, and denuded of scales; the tongue is long and spirally rolled up when unemployed; the antennæ serrated in the males, and simple in the females, with a small bundle of scales. These curious insects have more the appearance of bees and wasps than lepidopterous insects; the abdomen is very thick and hairy, being terminated by a fan of scales. The caterpillars resemble those of the typical *Sphingidæ*, having the body long and furnished with a dorsal curved horn near its extremity. They feed upon the leaves of various plants, and undergo their transformations under ground. The perfect insects fly with great agility, frequenting exposed situations in woods where various low spring flowers are in blossom. There are two British species; *Sphinx bombyliformis* (the narrow bordered bee hawkmoth) and *S. fuciformis* (the broad bordered bee

hawkmoth). They are of comparatively rare occurrence.

SESUVIUM (Linnæus). A succulent genus of plants bearing icosandrous flowers, and belonging to *Ficoideæ*. The species require to be placed in dry porous soil, and to be sparingly watered.

SETARIA (Beauvois). A genus belonging to the *Gramineæ*, found in hot as well as in cold countries. The *S. Germanica* is agricultural, and the *S. Italica* is economical.

SHADDOCK is the *Citrus decumana* of Linnæus, an East Indian tree of noble port, and bearing very large fruit, the largest indeed of all the citron family. Though far inferior to the orange for the table, or to the lime or lemon for medical purposes, it is a most useful fruit in those warm countries of which it is a native. Their appearance when on the tree is magnificent; a richer scene cannot be imagined than a grove of shaddocks, limes, mangos, guavas, &c., as may be seen in many places on the coast of Coromandel. The juice of the shaddock is fugitive, and therefore the fruit cannot be kept any great length of time, especially if laid on any hard substance. They are usually slung on light nets in cool air.

SHALLOT is the *Allium Ascalonicum* of Linnæus, a high-flavoured species of onion. Its offsets, by which it increases itself, are planted in the autumn or in early spring, and in the course of the summer a numerous addition of new offsets are produced.

SHARK (*Squalus*, or rather *Squalidæ*, the shark family). A numerous, powerful, and celebrated family of cartilaginous fishes, with fixed gills, forming, along with the rays (see Raia), the second of the three families into which Cuvier divides the cartilaginous fishes, and the first of those that have the gills fixed, and openings in the sides for discharging the water when it is no longer fit for the purpose of breathing.

Selachii is the name which Cuvier gives to the whole family, including the sharks and rays as subfamilies; and as the sharks are the typical fishes, we shall here mention the particulars in which they and the rays differ from other fishes, and agree with each other, and with the true fishes that have the gills fixed.

They have the ordinary bones of the jaws wholly wanting, or at least only rudimental; and the bones of the palate, and post-mandibular bones, are the only ones furnished with teeth, and serve the purpose of jaws—very formidable, and indeed terrible ones in some of the species. One bone unites the rudimental jaw bones on each side to the cranium; and serves for the tympanic, the temporal, the jugal, and the preopercular bones in ordinary fishes. The *os hyoïdes*, or bone of the tongue, is attached to this single bone, and bears branchiostizial arches for the gills, which, however, are not so conspicuous to internal observation as those of the fishes that have the gills free. There are also gill-arches, but all the three pieces which usually form the skeleton of the gill-cover in fishes, are wholly wanting. They have all pectoral and ventral fins, the latter placed as far back as the vent, indicating that they are fishes of forward motion, rather than ascenders and descenders of the water. The habit is true to this part of their structure; for almost the whole of them swim near the surface, and all move rapidly through the water.

The gills are not free at the posterior edge as in other fishes, but fixed so that there is a separate current between every two, and then either all pass off by separate openings, or are conveyed to a common canal. Besides the gill-arches, to which the inner edges of the gills are attached, there are cartilaginous arches embedded in the flesh opposite the exterior edges, and it is by means of these, probably, that the operation of breathing is carried on. This kind of breathing apparatus may, at first consideration, appear to be less perfect than that of the fishes with free gills; but in reality it is the very reverse; for it is equally powerful and far more safe. Fishes which have the gills free can be drowned or suffocated, if the water enters their gills the wrong way; and thus they cannot remain in a current with their heads downwards. It is not, of course, any thing in the water that causes this; for the water is exactly the same, and the application of it must tend to produce the same effect on the blood of the fish, whether it enters the gills the one way or the other. But when the gills are free at the one extremity, a current of water entering the wrong way entangles the fibres, presses them against the arches, and of course stops the circulation of the blood in them. This cannot happen to those that have the gills fixed; and thus they can breathe the water with equal safety, let it enter which way it will. This gives to these fishes a power of endurance in the water which other fishes do not possess; and the power is not given them in vain, for they make vigorous use of it, not confining themselves to particular latitudes, but careering over the widest oceans, and braving the utmost turbulence of the waters,—better tempered to the perils of the deep than any other inhabitants of the sea.

There are other circumstances besides their security in breathing which assist them in this respect. Their cartilaginous bones make their bodies joint all over; so that they can yield every way to the muscles, and are perfectly secure from fracture. Their skins are also much firmer than those of the bony fishes, and thus give firmer insertion to the muscles. They are, in fact, a sort of intermediate between animals articulated on the internal skeleton, and on the external crust, and they thus partake of many of the advantages of both kinds of organisation. Their muscles are also differently constructed, as any one may see by comparing the flesh of a cod or a mackarel with that of a skate. In the two former, as well as in every bony fish that could be examined, whether with spinous fins or not, the flesh is always in flakes; whereas in the skate it is in long fibres. These fishes, by having their motion rather in the flexibility of the skeleton than in the articulation of it, and in having the muscles thus formed, are capable of moving upon any and every point of the body as a centre, while the motions are as powerful as they are varied.

But there are still other circumstances connected with the physiology of these fishes, which tend to give them additional powers of remaining in the sea, and being active and discursive in it, through the greater part of the year. Their mode of reproduction does not consist in the bringing forward of a vast roe and milt at one season, which demands a resort to peculiar grounds, where these may be deposited—an operation which exhausts all the other fishes very much. In some the young are hatched internally, and in all they are so fecundated. Those, too, which are excluded in the state of eggs, are each charged with the rudiment of a perfect and independent life;

and that life is far more secure than the life in the egg of a bird or an oviparous reptile, to which it bears, in some respects, a considerable resemblance. The shell or covering of the egg, in these fishes, is of a horny consistence, tough, strong, and not liable either to be broken or torn; and it is generally furnished with claspers or tendrils, which twine round the stems of sea-weed, and other fixed substances, where the eggs remain at a sort of anchor, until they are hatched. These eggs are, we believe, chiefly brought forward in pairs,—the ovoviviparous ones being hatched, one in each oviduct; and the oviparous ones receiving their horny covering there, in the same manner as the eggs receive their carbonaceous shell. The egg is usually of an oblong form, with the tendrils, one at each of the four corners; and those which are at the end to which the tail of the fish inside is to be directed, after it is formed, are stronger, and have more of a prehensile structure than those at the end where the head is to be situated. Near the head of the embryo fish there is a small longitudinal opening in the horny covering of the egg for admitting water; and at the opposite end there is a similar one for allowing the water to escape. Thus, the fish inside the close and firm case, has a supply of water as soon as it is capable of profiting by it. Near the head, too, there is a part where the horny shell is more easily disrupted than in any other; and when the proper time arrives, this gives way, and the fish comes forth a free tenant of the waters. But the transition from the one state to the other is not instantaneous, but gradual; for when the young fish comes out of the egg, it carries with it, in a capsule connected by a kind of umbilical peduncle, a portion of the same vitellus which had supported it within the covering. The general economy of the young shark (or ray) is, therefore, the same in principle as that of the spawning fishes; the case, or "purse," as it is called, when found empty on the beach, or floating, being the addition. Young salmon, for instance, remain "on the egg," and are supported by the vitellus, just in the same manner as young sharks are, only they are in vast numbers, in the sand or gravel, where they have been deposited by the parent fishes, and there is no protecting case to the young fish; whereas the young shark is not alone upon the waters, but provided with a case which affords it protection against the water, and also no doubt against enemies; for it is not likely that many fishes will feed on the eggs of sharks and rays, considering the strength of their covering; whereas many fishes, birds, and other animals, eat the eggs of the spawning fishes.

There is one other point connected with the economy of the young shark in its case, which is worthy of notice, as showing how perfectly the adaptations of nature are, even in what appear to us to be the most minute particulars. The young of the spawning fish is in the free water, and it has the free use of its mouth and its gill-covers, so that it can breathe in the same way that the full-grown fish breathes, from the commencement. It is different with the young shark, pent up as it is in its case, with the body bent, and the head confined. The water, too, gets access to it only by one small opening in the case, and it escapes by another. Hence, it is impossible that the young shark in the case can breathe in the same manner as a fully developed one does after it is in the sea. The case can clearly give it no assistance in breathing, as the case has no vitality. But the animal thus confined is placed in circumstances so different from those in which it is afterwards to act as the most independent and discursive inhabitant of the water, that it requires some assistance. The difference between the two states of the shark or the ray is not so great certainly as that between the state of a tadpole or a larva living in the water, and the batrachian reptile or the perfect insect living in the air; for the medium of breathing is different in them, and only the mode is different here. Therefore the desideratum is not a different kind of breathing apparatus for the two states, but a modification of the same apparatus. This is found to be provided in all the young of the sharks and rays that have been examined in the case. This consists of a filament of the substance of the gill, projecting from the gill opening, and containing a vessel (or vessels?) in which the blood is exposed to the action of the water; and thus the same purpose is answered without the action of the internal gills. When the shark or the ray comes into the free water, those fibrous appendages would be as inconvenient as they are necessary when it is in the case; and they are accordingly very speedily absorbed.

One can hardly fail in being struck with the resemblance which there is in these supernumerary gills in the selacian fish, while in the case, to the gills which those reptiles and insects which spend the first stage of their animated existence in the water have while they remain there. In them the gills are no part of what is to be the permanent structure of the animal, they are mere external appendages developed for a temporary purpose; while they answer that purpose, the proper organs which are to be prominent are either undeveloped or dormant; but they are formed or become active as soon as they are wanted. Just so in these fishes, the internal gills remain in a great measure inert, until the animal comes into the free water, and requires their use.

This provision in the young shark or ray appears, after it has been explained, to be so very much in accordance with the general action of nature, that one looks upon it as a thing indispensable, and therefore of course. But this is only *after* the explanation has been given; for before then, some naturalists of no mean name or industry considered these appendages as characteristic of a species of shark, which had been met with only in the small specimen which had them, and to which they gave the name of *Squalus ciliaris*.

This shows how necessary it is for every one who puts his hand to the subject of natural history, more especially in the *finding* of new species or varieties to which tyros in the matter are exceedingly prone, to inform himself well upon all points of physiology, both immediate and collateral; for it is highly probable that very many of the obscure species in general, which rest upon no surer foundation than a single museum specimen, would be found entitled to no such distinction, if their physiology and place and relation in nature were rightly understood.

The *Selacii*, but especially the sharks as the typical subfamily, being thus formed by nature for the most powerful exertions, and being exempted from some of the severest duties that devolve upon other fishes, may fairly, on the principle of the general analogy, and even without a distinct knowledge of their habits, be presumed to have a very energetic and important part to play in nature.

Now though the sharks cannot be said to be the monarchs of nature's productions in the ocean, as the *Carnivora* are on the land, or the birds of prey in the air, yet they are unquestionably, in some of the species at least, the most powerful, the most active, and the most sanguinary of the fishes. The only inhabitants of the water which have so much the mastery of them as to be able to make a meal of a large shark of the most formidable species, are the great-toothed whales; and they are mammalia, not fishes. We must therefore assign to the sharks the rank of the "monarchs" of the fishes, or rather perhaps the "tyrants," for, as these names have been applied in the animal kingdom, they are perfectly synonymous; and the only attribute of kingship to which they have any claim is power—the power of gratifying their own appetites by eating up the rest. As monarchs stand among men at the present day, they would of course account this as a very undesirable and repulsive kind of royal endowment or dignity; and they would be right in so doing, while those who thus attempted to narrow them and rob them of the very jewels of their diadems, even in words, would be very wrong and very wicked; but still the kings of beasts and of birds, which have worn their honours from times very remote, tell an unfavourable tale of the kings of those very early times; for likeness in disposition and conduct is the only ground that we can see or imagine for applying the name to the animal. Be that as it may, these monarchs of the fish take more after the birds of prey than they do after the carnivorous mammalia; for the females among them are always larger and more powerful than the males.

The deadly weapons of the shark family are not confined to the teeth, formidable as these are, for some of them have the snout drawn out into a toothed weapon, more formidable than that of the sword-fishes of the mackarel family. Indeed, it seems to be the shark which is so armed, and which is sometimes called the "sea-sword," and not the sword-fish, which is described as making its gashes upon the whale. This is reconcilable both with the nature of the fish and the seas in which it is found. The tail of some of the sharks is also a most formidable weapon; and the fins and even the skin of the animals are of a cutting or wounding nature, from the hard tubercles with which they are beset. They differ so much in the details, however, that no general description can be so framed as to meet them all; and they are so many that a full detail of them would greatly exceed our limits.

We may mention, however, that the teeth of these most active and voracious fishes are of two distinct kinds, both wounding teeth, if of sufficient size for the work; but the one kind better formed for tearing and laceration than the teeth of any other animals, whether of the sea or the land; and the other kind more adapted for keeping their hold. The first kind consist of single blades, of a sort of triangular shape, standing upon one of the three sides as a base, and having the side which is directed toward the central line concave, and the other one longer and convex. These two edges are thinned off for cutting, and at their junction they form a sharp point. They are also toothed like a saw along both their edges, the points of these secondary divisions being all turned in the direction of the principal point of the entire teeth, and all trenchant in their edges; so that the utmost ingenuity of savage man, when he forms his weapons so as to tear and torture as well as kill, could invent nothing more adapted for his revolting purpose than this kind of tooth in the shark. And, wherever the animal is furnished with this terrible weapon, it is never given in vain; for the murderous disposition of the owner always corresponds.

The other kind of teeth consist of one principal blade, formed something like the point of a broad arrow, but curving outwards towards each side at the base, and having a small trenchant tubercle on each. The teeth of this latter form are curved backwards toward the opening of the gullet.

Neither kind are rooted in the bones, and the cutting teeth especially are supplied with muscles, so that each tooth has various motions independently of the others, or the whole may move in concert according to circumstances. One can indeed imagine nothing more terrible than those teeth, when they are mustered row upon row, to the number of six rows, all at work upon the victim, and plied by the strength of a most active animal, from thirty to thirty-five feet in length, and weighing nearly three quarters of a ton.

Yet terrible as these teeth are, and well as they are fitted for inflicting the most fearful lacerations, they and the animal that is furnished with them are true to the general character of the class—they are still the teeth of a fish; and their grand action is prehension and swallowing, not killing and dividing their prey. As is the case in fishes generally (though not quite universally), the stomach of the shark is fitted for performing the whole work of assimilation without any preparation of the food by the mouth. If it can be obtained without a struggle, the largest prey that the shark can swallow, and its gape is no stinted one, goes to the stomach entire. Large fishes, seals, the bodies of various animals of considerable size, human bodies—an entire one and part of another, nay, even the body of a horse (so say the reports), have all been found entire in the maw of the most formidable of the shark family.

The whole are not indeed of this very terrible character; but the greater part are, and the peaceable ones are comparatively few, though many have the teeth small, and the majority have them not of the lacerating character. We must therefore take one brief survey of them in the order of the arrangement. In this we shall follow Cuvier, who makes four sections or principal genera—sharks, hammer-heads, angel-fishes, and saw-fishes. The ray follows as a fifth, and completes the family of the *Selacii*, but we have already noticed it in the article above referred to.

The last then of the four now mentioned contain only a single genus each; but the sharks, or family of the *Squalidæ*, consist of twelve subgenera, *Scyllium*, *Carcharius*, *Lamna*, *Gallus*, *Mastelus*, *Notidanus*, *Selachus*, *Centracionus*, *Spinax*, *Centrina*, and *Scymnus*. Many of them, however, are very little known; and they are so many that we can only notice such as are found in the British seas, or are otherwise of very great interest.

Scyllium. The members of this genus are generally called "dog" fishes on the British coasts; and indeed there is a great disposition to name the whole of the family that occur with us to common observers after some one or other of the varieties or species of the canine race. The characters of the genus *Scyllium* are: the head short, the muzzle blunt, the nos-

trils near the mouth, and continued by a groove to the upper lip, thereby forming a sort of valves; the teeth of the prehensile description only, without any of the serrated or lacerating ones, but with sharp points and a tubercle at each side of the base; the gill-openings five on each side, the last ones opening over the pectoral fin; the first dorsal rising on the mesial line about half-way between the snout and the extremity of the tail, and in rear of the ventral fins, the second dorsal in rear of the anal, the caudal narrow at the tips, and the principal lobe on the under side of the tail. The males with claspers to the ventral fins, as is general in the family, but the females without these appendages.

The fishes of this genus, and indeed those of the greater number in the family, are social at certain times of the year, and pursue their prey in packs. They are found chiefly near the rocky shores where there is sea-weed. They are more common on the warmer shores than on those of Britain, and on the south coasts of England than on those of Scotland. They are oviparous, and deposit their eggs in small numbers at intervals among the aquatic plants. Their flesh is little esteemed, and thus they have small interest in the eyes of any persons but naturalists.

In treating of the shark family, and indeed of most of the cartilaginous fishes, it is necessary to use some caution, and not speak too particularly about the size. There are differences, no doubt, in the average sizes of the different species, and very great differences; but there does not appear to be any thing positively to limit either the size or the duration of any of the family, as their bones do not become indurated; and thus there seems no reason why their enlargement should cease altogether. This precaution is, however, necessary in a general point of view only; for of course we may allude to the size either of the largest or the average as met with in any particular locality. There are three species of the genus found on the British shores, one very plentifully in some places, another much more rarely, and the third is very rare, or, which amounts to the same, it is rarely seen. They are all called dog-fish; but none of them is the dog-fish so plentifully found in the northern parts of the British seas. Wherever they come, they get very little thanks for their appearance; for they are of no value themselves, and they are so voracious that they drive the more valuable fishes off the grounds, and so strong that they are apt to break the nets. Where there is fishing with lines, they are apt to plunder the hooks.

Small spotted Dog-fish (*S. canicula*). This is the one which is most common on the British shores, especially those of the channel; but, as Mr. Yarrell justly observes, it is not very easy to decide whether the comparative "small" should be applied to the fish or the spots. Cuvier calls it the "large" one, and the other the small; in this he follows the other continental naturalists, and the comparative size can be much better judged of in the Mediterranean than in our seas. The snout of this one is much shorter than that of the other; but the body and tail are longer in proportion to the thickness. The ground colour of the upper part is reddish, mottled with reddish-brown spots of a shade considerably darker, and the spots on the fins larger than those on the body; and the ground colour passes gradually into white on the lower parts of the sides and the belly, the middle of which is without any spot; but there are spots on the lower fins, though not so numerous as on the upper ones. There is a sort of "grain" or granulation on the skin, but the tubercles which form it are very minute and inclined backwards, so that the roughness cannot be felt if the finger is moved in the same direction as the points slope.

Large-spotted Dog-fish (*S. catulus*). This appears to be about the same size as the former; but the spots are much larger and more conspicuous, and they are of two colours, the larger ones nearly black, and the smaller ones paler than the ground, which in the upper part is not so red as in the other species. The snout is larger and more pointed. This species is much more rare than the former.

Black mouthed Dog-fish (*S. melanostomum*). This is common enough in the warmer seas, but exceedingly rare on the British shores. It is a more handsome fish in the colour of the body than either of the other two; and the head is more tapering and the snout more elongated. The upper part is brown with darker spots, surrounded by margins of lighter, and also variously clouded. The inside of the gape is black, hence the name. Mr. Yarrell is the first who has noticed it as a British fish, on the correct information of Mr. Couch.

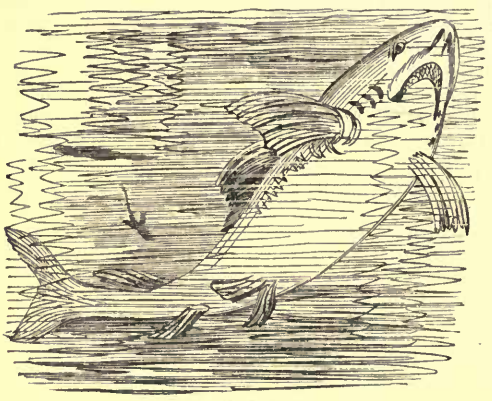
There are several more species of this genus mentioned; but they, or indeed the ones that we have noted, are not of much interest to a general reader.

Carcharias (Sharks properly so called). The generic characters of these are: the jaws and head depressed; the nostrils near the point of the snout; the teeth pointed and trenchant, often toothed in the edges in the manner described; first dorsal and pectoral fins large, the dorsal behind the pectorals, but before the ventrals; the second dorsal much smaller; the caudal varying so much in the different species as not to form any part of the generic character.

This is the genus, some of the species of which are so much dreaded, and dreaded with so much reason, in the warmer seas, though the more formidable of them rarely, if ever, visit so high latitudes as those of Britain. The species are so very numerous, that the details of them would extend to a very great length. All that we can do, therefore, is to notice one or two of those which have the best authenticated history.

We must premise, however, that though the arch-destroyer of all the sharks has been mentioned by the writers on British fishes as having occurred sometimes on the one part of the coast, and sometimes on the other, yet the fact of its having actually done so is not yet clearly established. The tremendous powers of "the white" shark, and the fearful effects of them in those seas in which it abounds, have become, as it were, the story of all sharks; and when the appearance of a shark is rumoured on any part of the coast, the rumour is very apt to become the whole history of the white shark, before it travels half its round; and some one is generally found ready enough to record the romance along with the reality. That the white shark *may* have been in the British seas, we do not mean positively to deny, for the powers of the animal are quite adequate to carry it into any sea, or fairly round the earth: all that we contend for is, that up to the present time there is no direct and conclusive evidence of its so appearing. We must, therefore, give our short notice of this formidable species as an inhabitant of other seas, in which it is seen but too frequently.

White Shark (*C. vulgaris*). The body is long, covered with a hard tuberculated skin, of a brownish-ash colour on the upper part, and whitish below. The head is large, the muzzle not very long, and depressed, and pierced with numerous pores. The tongue is short and rough. The upper jaw furnished with six rows of triangular teeth, with both their trenchant edges nearly straight and toothed; and the under jaw with four rows, sharper in the points than the others, but not so thin, and therefore not so trenchant. The pectoral fins very large, and the first dorsal elevated, with the ends of all the three broader than their bases, and squared over, or slightly concave. The ventrals small; and the second dorsal and anal, which are opposite to each other, not very large; but all the four of similar shape and termination as the larger body fins. The caudal fin forked, with two powerful and widely divergent lobes, the upper one larger than the under. The irides with a pearly lustre. This is the description of the fish as it appears in the Mediterranean, and therefore that in which it is most likely to appear, if it should stray to the shores of the British seas. As a probability, if not a proof, that the descriptions of it as a reputed British fish, have been mixed up with that of some other species, probably the Porbeagle (*Lamna Cornubica*), we may mention that there are inserted the words, "pectorals triangular," "first dorsal rounded," which are true of the porbeagle, but not of the white shark.



White Shark.

In the tropical seas the white shark attains the length of thirty or thirty-five feet; and the mouth of one of this size is a fearful chasm. It is deeply cleft, and the opening is made almost to a circular aperture between three and four feet in diameter. This will account for the large animals that have been found entire in the maw of this monster of the deep. The French call this species *Requin*, which is usually said to allude to the vast number of victims which the jaws of the shark send to their final "rest," or prepare for their "requiem," or song of last repose. Whatever of truth there may be in this, the shark is terrible upon the sea; and scenes of death and destruction are said to be those in which it is most in its element. We question the accuracy of those statements which impute to the shark the power of "scenting the battle from afar," or even what is said of its smelling putrid substances when miles off; but it is very generally stated by nautical men who have been engaged in the warm seas, that the shark enjoys the scene of carnage; and that unscared by all the terrors of the battle, it adds a new terror of its own, more revolting, if possible, than any of those perpetrated by man. The sharks career about from vessel to vessel, swallowing or mangling the bodies of the fallen, the dying and the dead—all, in short, who by accident get into the water; and adding its share to the spilt blood with which the surface of the sea is clouded.

When the slave trade was carried on with all the horrors of "the middle passage," at which, even in the recollection, our blood runs cold at the present time, it afforded a formidable stock on which to graft all the horrors of the accompaniment of the shark. There was, of course, enough, and more than enough of the horrible in the abominations of the trade itself, without this addition; and as the sharks are careering about the tropical seas in all directions, there was every probability that the poor unfortunates who had expired in the "gross intolerable air of the floating engines of wholesale murder," were swallowed by the sharks the moment they were cast into the sea, yet it by no means follows from this that the sharks had any means of distinguishing between a slave ship and any other ship whose keel might divide the waters of their seas; but there is little doubt that the sharks, in common with all the other races of discursive fishes which roam the broad waters, would follow that from which they had been once fed, in the expectation of being fed again; and thus a very little addition of romance would suffice to bear out all that was alleged of them.

It would be foreign to our purpose, however, to enter into the details of the history of the white shark, whether romantic or real. They are to be found in the narrations of the voyagers; and all that we need to add is, that the powers of this shark, and the propensity which it has to put those powers into operation, are quite equal to all that has been alleged of it; and thus, all who have a thirst for believing which is not absolutely insatiable, may find ample scope for it within the limits of the real history of these animals. There is but too much reason to believe that legs have been lopped off, bodies cut in twain, and members swallowed entire by these fishes; and some of the most melancholy instances have been those in which the commander of a vessel, in probably an overstretch of that kind of authority which such have on the high seas—and we readily admit that they need a good deal, and no little promptitude and decision in the exercise of it—have made immersion in the sea at the end of a rope the punishment, and have drawn up half a human body instead of the whole.

The teeth of the shark are well calculated for performing all the feats that have been recorded of it. We have already mentioned their arrangement, and we shall now notice their size. In the largest sharks that have been examined, that is, in those about thirty-five feet long, the teeth stand fully two inches clear of the jaw, and the base is nearly of the same extent. They are serrated in the edges, slightly concave toward the mesial line, exceedingly hard and white, and having their principal individual motion toward the mesial plane, though they cut and tear in their motion both ways. In the young fishes there is only one row, and the teeth composing it are partially inclined toward the throat; but they increase with age till the adult number of six above and four below has

been produced. Whether this is the ultimate number which they never exceed, or whether the new rows are produced external or internal of the former ones, are points which have not been ascertained, though it is generally supposed that the inner rows are always the last produced. Some have gone so far as to say that the supplemental rows are produced for the purpose of supplying any deficiency that there may be in the external or primary row; but this is not at all probable, as the whole of the rows are in general equally perfect. Whatever may be the number of the rows, the teeth in the inner one have always more of the swallowing character and less of the tearing than those of the external rows; and there is every reason to believe that the teeth continue increasing in size as the animal itself increases.

From this armature, and also from its great muscular power and the texture of its skin, the shark has few enemies of whom it can be in much dread. The skin of the shark is so hard and rough in the texture, that no animal would be fond of biting it, while it bites and also strikes very powerfully. The great spermaceti whales are the only animals which can master it; and it makes a powerful resistance even to these. This resistance is not, however, ultimately successful; for a shark seventeen feet in length has been found in the stomach of one of these whales. There are other enemies of much smaller size, which are perhaps more annoying to the sharks than these powerful whales, namely, various descriptions of *entozoa*, which infest their alimentary canal. It is probably the annoyance given by these internal tormentors which sometimes forces the sharks on shore in great numbers, though single ones often run themselves aground in the eagerness with which they pursue their prey. Their eagerness for food is so extreme, that they will leap out of the water, Commerson says, to the height of twenty feet in order to seize a temping bait. The large ones follow the pretty general law of fishes in eating the smaller ones of their own species. Hardly any substance, indeed, comes wrong to them, so that it is animal matter and in mass enough. Seals, fishes, and mollusca are indiscriminately eaten, the last of which of course are only the larger ones without shells, which are so very abundant in the various seas. They, in fact, perform the same office in the water as the more powerful of the carnivorous animals perform on the land—namely, that of arch-scavengers; only as the element in which they display their powers is much more extensive, their powers of motion are far greater both in energy and continuance. As is the case with the predatory mammalia too, the most formidable of them, of which there are several species, or, at all events, varieties, known by the common name of white sharks, are confined to the warmer latitudes. Some of these have the pectoral and dorsal fins pointed, the posterior rays very short, and the terminations concave, and have the colour more inclining to grey than it is in the typical white shark. It is also more or less spotted; and the tail and caudal fin, and indeed the whole appearance is intermediate between the typical white shark and the genus *Scyllium*.

Sharks, though most of them inhabit near the surface of the water, are remarkably tenacious of life; resembling in this respect, and also in the length of time that their flesh will keep, the bottom fishes with bones more than the surface ones. This is, in part at least, owing to the different structure of their gills, which prevents the shrivelling and stoppage of the circulation, which are the causes of death. This tenacity of life has caused the sharks to get a sort of romantic credit for qualities which they certainly do not possess. The larger ones are, as we have hinted, apt to swallow the small ones of the same species; and on opening a large shark small ones have been found alive in the stomach. From this it has been inferred that the mother takes the young into the stomach as a place of safety. But the stomach of a shark is about the least safe place into which any animal can get, and whatever substance is conveyed there may always be considered as conveyed for the purpose of being eaten. It is not so much of the white shark that this maternal tenderness is alleged, but of the blue one, which comes into higher latitudes, and is better known.

The Blue Shark (*C. glaucus*) is also a formidable animal, though much less so than the white shark. It is very common in the Mediterranean; but it appears seasonally on the south coasts of Britain, and occasionally ranges as far as the extreme north. When it appears on our shores it is seldom more than six or seven feet in length, at which age it has three rows of teeth in each jaw. From this circumstance, one would conclude that it is not then nearly full grown; for the teeth are supposed to increase in number, much in the same way as in the white shark; as the number of teeth is the same in both jaws at this, which may be considered as the middle age of growth, it seems to follow that both jaws get additional teeth at the same rate until the under one has got its complement, and then the farther additional ones come in the upper jaw. These extra rows, as it were, which the upper jaw contains, appear to act along with the rough surface of the tongue in the operation of swallowing.

The teeth of the blue shark differ a little in their form from those of the white one. The sides toward the mesial line are more hooked than those of the other, while, in the cases where there are only three rows, three or four at the middle of the row have more the character of swallowing teeth. The body is longer in proportion to its thickness than that of the white shark; the snout is also proportionally longer; and the fins are differently shaped. The first dorsal is not very high; it is rounded in the fore part; and very low in the hinder. The second dorsal is small and low. The pectorals are long and falchion-shaped, with their curvature directed backwards. Their anterior margin originates under the fourth breathing hole, which holes, as in the other members of the genus, are five in number. The ventral fins are placed about midway between the positions of the two dorsals, and the anal midway between the last dorsal and the caudal. The caudal has the upper lobe much longer than the under one; and the membrane of a portion of it toward the point is enlarged into a sort of truncated flap. The under part is nearly as white as in the former species; but the upper parts, the head, the irides, the upper fins, and the upper surfaces of the pectorals, are clear slate-blue. In the young specimens the teeth are very small; but they become more formidable in the full-grown ones.

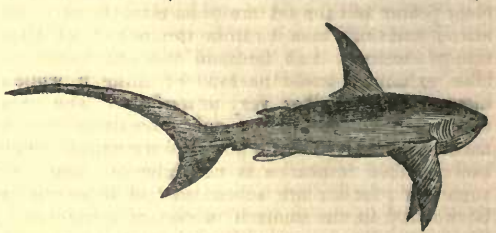
We quote the following notice of it by Mr. Couch, from Mr. Yarrell's second volume. "The blue shark is migratory, and I have never known it to arrive on the coast of Cornwall before the middle of June; but

afterwards it becomes abundant, so that I have known eleven taken in one boat and nine in another in one day. The injury they inflict on the fishermen is great, as they hover about the boats, watch the lines (which they sometimes cut asunder without any obvious motive),"—fishes never have *any motives*, obvious or lateral,—"and pursue the fish that are drawn up. This indeed often leads to their own destruction; but when their teeth do not deliver them from their difficulty, they have a singular mode of proceeding, which is by rolling the body round so as to twine the line about them for its whole length; and sometimes this is done in such a complicated manner that I have known a fisherman give up any attempt to unroll it as a hopeless task. To the pilchard drift-nets the shark is a still more dangerous enemy, as it is common for it to pass in succession along the whole length of the net, cutting out, as with shears, the fish and the net that holds them, and swallowing both together."

On the fishing-grounds in the northern parts of the British seas, these sharks are not so destructive, because a stray comes only now and then. When one makes its appearance on the coast, however, it causes much more alarm than the same recurrence does on the coasts of the Channel; and the report of there being one puts an end to bathing in the sea, at least for a considerable time. It is not probable that any appear of such size as to be capable of swallowing a human body; but there is no doubt that they could and would inflict terrible bites. The rumour is, however, always less or more mixed up with the notion of the white shark, and this gives it a terror which does not naturally belong to it.

The time and manner of the coming of this fish into the British seas is a tolerably good means of judging of the movements of those fishes which it follows, as well as of its own movements. It always follows the surface fishes when they shoal toward the land; and so it must follow them from the warmer latitudes rather than from the deep water.

The Fox Shark (*C. vulpes*). This fish is also called the "Thresher," from the use which it makes of its tail as a weapon both of offence and of defence. It occurs occasionally on the British coasts, but it is far from being common. It is a very roaming animal, and is found in higher latitudes than any of the two former species. Its gape is not so wide, or its teeth so formidable in proportion to its size, as those of the former sharks; but its tail is a most powerful weapon, and it is exceedingly bold and voracious. The snout is short and pointed; the body very stout; and the upper lobe of the tail-fin about the same length as the whole body and head. The pectoral and first dorsal are long and strong, and much falcated; the ventrals are small; and the second dorsal and anal little other than mere finlets. Both lobes of the tail are falcate, the lower one having nearly the same form as the pectoral fins, but shorter and very much pointed. The length of the largest specimens which have been found in the British seas has not exceeded twelve or thirteen feet; and that which is circumstantially described by Mr. Couch was "ten feet ten inches on the straight line, and ten inches more on the curve; three feet four inches round where thickest; solid at the chest; conical from the snout to the pectoral fins, and thick even to the tail, which organ from the root was five feet and a half long, and consequently more than half the length of the body (the head and tail included, of course); the eye prominent, round, hard, four inches from the snout; iris blue, pupil green; the nostrils small, and not lobed; mouth five inches wide, shaped like a horse-shoe; teeth flat, triangular, in two or three rows, not numerous; spiracles five; pectoral fins wide at the bases, pointed, eighteen inches and a half long. Measured along the curve, from the snout to the first dorsal fin, two feet five inches, the fin triangular; from the first dorsal to the second, fourteen inches and a half; this and the anal fin small, triangular; skin smooth; lateral line central and straight; breadth of the tail, including both lobes, thirteen inches; the upper lobe narrow throughout the greater part of its length; and on the lower margin, at four inches from the extremity, is a triangular process. Colour of the body and fins dark blue, mottled with white on the belly."



Fox Shark.

This circumstantial description, together with the figure, will enable the reader to form a tolerably correct idea of the appearance of this curious fish; and when he does so, he will not fail to see how well it is adapted for the part which it plays in nature. The body is obviously formed for speed and for the working of the tail jointly. The form and power of the pectoral fins and the first dorsal give it a firm hold on the water at that part; while the smallness of the fins on the posterior part of the body allow that to give free scope in all directions to the tail. Nor must we overlook the power of muscle, which is continued to the very base of the caudal fin. From the length, strength, and parallelness of the forward fins, the body can swing on them as on an axis; and as there are three of them, the plane of that axis admits of much variation. When the body of the fish has a hold of the water by means of the long fins, and the tail moves in the air, the force with which it can strike an object at the surface must be very great. "Mr. Couch," Mr. Yarrell remarks, "says it is not uncommon for a thresher to approach a herd of dolphins (*Delphini*) that may be sporting in unsuspicious security, and by one splash of its tail upon the water put them all to flight, like so many hares before a hound." Other authorities say that the thresher is in constant hostility with all the smaller *Cetacea;* but the "motive," as it is called, is not quite so apparent. That this fish should swallow dolphins is out of the question, for an ordinary dolphin is more than six times the volume of an ordinary thresher. From the one which Mr. Couch describes, as well as from the size and character of the mouth, it appears that the food consists of fishes of small size. The one in question was taken in a salmon-net; but young herrings were found in the stomach; and Mr. C. adds, that it appeared not to be able to cut its way out of the net, as the blue shark would very readily have done, and nothing is said of any kind of attack made by it upon the salmon.

Still, the fact of its not only astonishing the dolphins, but inflicting pretty severe chastisement on the whalebone whales, has been so often stated, that there appears to be no doubt that it is true, though, how it could feed on these very large animals, is another matter. But it may bear them a grudge upon other grounds as rivals in its feeding, for the small cetacea are great devourers of fish. We quote from "Griffith's Cuvier" the following passage, which probably relates to this shark, and which, from the authority on which it rests, cannot be doubted:—"When Colonel Smith was in Jamaica, the captain of a West Indian vessel happened to be upset in his boat, along with two boys, about two miles distant from the land of Montego Bay. This occurred in the night; and the three, with the aid of an empty keg and billets of wood, betook themselves to swimming. The boys soon disappeared one after the other; and the master, from the length of time during which he had been in the water, became quite exhausted and drowsy. From this state he was suddenly, and not very agreeably, roused by a tremendous blow on the breast, proceeding from a shark which darted against him from below. The man defended himself with his billet of wood, and fought the monster for a long time, until he was at last heard from the shore by some negro watchmen, who went with a canoe to his assistance, and brought him to land. The Colonel believes that he had then about forty wounds, but had lost no limb. The escape was attempted to be explained by the probable conjecture that the shark had already devoured the two boys, and had therefore become too unwieldy to bite with sufficient effect. The wounds were indeed mostly cuts inflicted with the fins of the fish. The Colonel visited the estate where the captain had been cured, a few days after his departure, and learned the circumstance from the medical resident who had attended him."

This could not have been the white shark, for its habit is to bite, or to swallow entire, so that it has no need to strike with the fins; and there was no evidence of a direct bite of any kind inflicted on the captain, or that the boys had been devoured by the fish. In fact, the characters of two different species have obviously been mixed up in this case, as they have been in very many others; and we are still in the dark as to the real purpose of the flagellation which the fox shark is said to inflict upon its more bulky neighbours. The analogy would lead us to suppose that the tail, powerful as it is, is a weapon, and not a feeding instrument. This is the chief use of all the weapons with which the bodies of fishes are furnished, with the exception of the furnishing of the mouth; and though this shark should advance, and apply this weapon, that does not in the least alter the character of it.

There are many other species or varieties of the genus *Carcharias*, but very little is known of their habits as different from the three that have been mentioned, and therefore they must suffice in the meantime.

Lamna. The best known species of this genus is the *Porbeagle*, of which we shall speak more particularly by and by. The generic characters are: the snout conical; the nostrils in the under side; all the gill-openings in advance of the pectorals; the first dorsal only a little in the rear of the pectorals; the rest of the body-fins small; the second dorsal and anal near the caudal; both lobes of the caudal large, the upper one not much longer than the lower, and margined on the posterior edge near the tip; and the teeth much more of a prehensile and swallowing character than of a tearing one; they have large triangular points, with a small lateral tubercle at each side of the base. They are known only, or chiefly, in the European seas, and not in the tropical ones, like the true sharks. They are not so formidable as these, but still they are ravenous fishes, swimming with much velocity, and growing to a large size.

The Porbeagle (*L. Cornubica*). The common name of this fish appears to be compounded of *Poresse* and *Beagle*—the former from its bearing a slight resemblance in shape to that well-known member of the cetacea, and the latter from the fact of these fishes being often found hunting their prey in packs. It is called *Cornubica*, from having first been correctly described from specimens taken on the coast of Cornwall. As a British fish, it is not, however, confined to the Cornish coast, but is fully as common on the northern shores as the southern. They are very discursive fishes, and, as they do not come into shallow water, they are seldom seen in proportion to their numbers.

The body is spindle-shaped, thick and round at the middle part, pointed in the snout, and tapering very much to the tail, where there is a lateral keel on each side advancing to some distance forward on the body; the head is furnished with numerous pores, which give out a gelatinous secretion for lubricating the skin; backwards the skin feels quite smooth, but forwards it is rough to the touch; colour blackish grey above, on the under part white; the pectoral fins moderately large, slightly fulcate, and of a black colour; the first dorsal high, broadly lancet-shaped, with a low prolongation backwards; the second dorsal nearly the same shape, but very small, and near the caudal; the ventrals very short, inclined backwards, and terminated in a straight line parallel to that of the body; the anal fin, under the second dorsal, very small and rounded; the caudal partially crescent-shaped; both lobes long, but the upper the longest; lateral line straight, and on the middle of the side; the gill-openings five in number, the last beginning at the anterior base of the pectoral fin, and bearing obliquely backwards; the eyes round, and deep blue; there are three rows of teeth in the mature state, but the fish grows rapidly, and thus is often found of considerable size with only two. The porbeagle is found chiefly in the currents near rocky places, and feeds on fishes of considerable size, swallowing entire those which measure as much as two feet in length.

Beaumaris Shark (*L. Monensis*). This is known only as a British, or rather as a Welch fish, and only two specimens have been met with, both of which are described by Pennant. They were both found at the same place, the Anglesey side of the Menai Strait. The snout is blunter than that of the porbeagle, and the pectoral and first dorsal still farther backwards, and more fulcate; the ventrals larger than in the others, and the second dorsal and anal rhomboidal; the tail more completely crescent-shaped; the lobes more tapering, the upper one larger in proportion, and more of the posterior edge margined toward the tip; the skin is nearly smooth, and lead-coloured. The habits of this species are of course altogether unknown.

Galeus. This genus, of which only one species is known, more nearly resembles the true shark than the one last mentioned does. The chief differences are, that this genus has air-holes, and the teeth are serrated in their outer edges only. It is a long and slender fish, attaining the length of five or six feet. It is not very common on any part of the British shores, and it occurs chiefly on the south. The young are produced, all at one time, to the number of thirty or more, in May or June, and they remain during the winter; but the full-grown ones leave the coast at that time. They are very voracious, but not nearly so injurious to the fishermen as the blue sharks.

The skin is smooth, the lateral line straight, the muzzle long and flattened, the nostrils near the mouth, and with valves; the jaws are semicircular, with small teeth nearly the same in both; the gill-openings small, and close together; the pectorals and first dorsal triangular; the other body fins rhomboidal; the upper lobe of the tail short, and at the extremity, the under one much larger, and divided into segments; colour bluish grey on the upper part, and greyish-white on the under. The flesh is not eaten; but, as is the case with all the shark family, a considerable quantity of oil is obtained from the liver. The *Common Tope* is the English name of this fish, and the systematic one is *G. vulgaris.* It is not a fish that is sought after by the fishermen, who give it very little thanks for its appearance.

Mustelus. With the exception of the teeth, which are pointed and flat like those of the rays, this genus very much resembles the preceding one. The body is of the same shape, and the fins are similar, with the exception of their terminal lines. The general air of the fish is different, however; and, if the expression may be used, there is a softness of character about it which the former does not possess.

There is only one species, though we believe the old and the young, which differ in colour as well as in size, have been described as two. This species is *Mustelus levis*—"the smooth weasel fish," though we believe that the Romans applied the term *mustelus* to any fish that was long and lank like a weasel, and at the same time very voracious. This fish is found occasionally upon all parts of the British coasts, but not, generally speaking, in great numbers. As is the case with all the fishes that hatch their eggs internally, it has no occasion to come to the shallow water for the purpose of spawning, but only in pursuit of the fishes upon which it feeds. It gets various names, such as "the smooth shark,"—"the skate-mouthed shark,"—and "the smoothed hound;" all of which are partially descriptive. It has been remarked, in the case of various land animals, that there is a relation between the armature of the mouth and the character of the skin. The bats, or hairless dogs, which are found in Egypt, have the teeth deficient; and, whether there be any deficiency in them or not, we find that the teeth and the economy of the skin have a sort of common character, which cannot be mistaken by any one who has paid even a little attention to the subject. No one, for instance, could mistake the hair of a carnivorous animal for that of a herbivorous one, or the reverse; and it is exactly the same in the case of feathers. There are physiological reasons why this should be the case, but this is not the occasion upon which to enter into the particulars of them. They are very valuable, however, inasmuch as they make one part of an animal the index to other parts, and thus greatly abridge the labour of learning. On this account it is gratifying to find a confirmation of this in the inhabitants of the water as well as those of the air. Nothing can be more clear and striking than the illustration afforded by the comparison of this shark with those sharks which have the teeth trenchant. The teeth here form a sort of pavement, with only small tubercles, directed inwards; and the skin is not merely smooth when the finger is passed along, but it is soft to the touch.

There is still another point of resemblance worthy of being pointed out. Along with the teeth of the rays there is in this fish an approximation to the same character of the flesh. The flesh of this species is certainly inferior to that of the rays, especially the true skate, but it is much better than that of any of the sharks which have even the most simple form of the true shark's mouth. It is probable that the character which the sharks have may operate in making their flesh feel less palatable than it would do if there were no such opinion afloat concerning them. We are told what a shark eats, and therefore the idea of a cannibal at second-hand mixes itself up with that of a shark-eater; and as shark is the family name, all the members of the family, whatever may be their food or their manner of feeding, come in for their share of the prejudice; and by this means, on all parts of the coast where the terrible history of the shark is known, there is a prejudice against such a fish as the present species; and it is only in the remote isles, where the people know little of general histories, and are thus thrown upon the judgment of their own senses, that the flesh of the smooth shark is esteemed as an article of food. It so happens, too, that the fish is most abundant in those situations.

This fish inhabits farther down in the water, and lives upon different food from the typical sharks. Its mouth is a crushing mouth, not a cutting one; and, accordingly, it keeps near the bottom, and feeds chiefly upon crustacea. As is the case with the tope, the young, though produced alive, are all produced at nearly the same time, which is about the middle or toward the end of autumn, according to the situation of the place. When this operation is performed, the fishes quit the shallows, or, at all events, do not verge so near the surface as during the summer; but they make their appearance again in the beginning of that season. They are not very prolific, for it is understood that the average brood is not more than from twelve to fifteen.

In this genus we could have many relations, for the fish holds a sort of intermediate place, or, according to the phraseology of the day, it is "a connecting link." This phrase is inaccurate; for the fish is "connect*ed*," not "connect*ing*;" but it is used by the initiated only, and of course it cannot mislead *them.* The fish feeds at the bottom, and does not range the free waters; therefore, though it does not come to the shores to spawn, it comes up to the air and light for the maturing and hatching of the eggs; whereas the sharks that range near the surface find the action of the air and light there; and when they come to the shores, it is only, or chiefly, for the purpose of feeding. This fish does come, and therefore,

though not to such an extent as the spawners, it is a seasonal fish, much less discursive in its every-day habits; consequently it does not stand in need of the firm skin or the tough muscular fibres of those that dash across the breadth of the ocean in quest of their food.

Specimens of five or six feet in length are occasionally taken on different parts of the coast, but in general the fishes are smaller, as the largest ones keep much out at sea. In these there is a farther resemblance between them and the rays. The teeth of the young are without any very elevated points, and thus not well adapted for swallowing a large morsel; but, as they increase in age, the posterior angles of the teeth become more elevated; so that, while they were formerly fit only for bruising a crust, they are now fit for swallowing a fish. The colour of the upper parts and the fins is pearl grey, and that of the under part dull yellowish white. The very young ones have the portion above the lateral line marked with numerous circular white spots; they become fainter and fewer as the fish increase in size; and in very large, and old ones, they are nearly, if not altogether, obliterated. It is these differences which have caused some to describe the spotted one as one species, and the grey one, without spots, as another. This fish is pretty generally distributed over the European seas.

Notidamus. The species of this genus, of which there are two in the Mediterranean, and some in the Indian seas, are often termed "grey sharks" from their colour, and they have sometimes been confounded with the smooth shark, which favour the preceding genus. The generic name means "dry-back," which is understood to have been the old Greek name for a shark, but whether for these by way of eminence, has not been ascertained. In most respects they so much resemble the smooth shark, that an enumeration of particulars is not necessary. The chief ones are the absence of the first dorsal in this genus, and a greater number of gill-openings. They do not belong to the discursive sharks, and have not, we believe, been found straggling so far as the British isles.

The two Mediterranean species are as follow:—

N. griseus. The grey shark, called also the low shark. It has the muzzle depressed and rounded like that of the white shark, triangular teeth in the upper jaw, and serrated ones in the under. It has also six gill-openings, whereas all those that have been previously mentioned have five only. The colour of the upper parts is ashen grey, and that of the under parts whitish.

N. cinereus. The pearl-grey shark. This one has the muzzle very sharp pointed, as it is in the porbeagle; the teeth, both above and below, are like the under teeth of the preceding species; and there are seven gill-openings of very large size.

Selachus.—This name was applied by the Greeks to the whole of the cartilaginous fishes, and is supposed to have alluded to the general uniformity of the surface, which, not being broken by scales, shines while the fish is moistened by its mucous application; and probably the reason why the sharks were called a dry-back was the roughness of their granulated covering. Be that as it may, the fishes of this genus are very different in their dispositions from the true sharks. The generic characters are: the general shape of the body resembling that of the true sharks; temporal air-holes; gill-openings five upon each side, and so very large that they almost surround the neck; they are placed wholly in front of the pectorals; the teeth small and conical, not serrated in their edges or with lateral tubercles; all the fins present. There are probably more species than one; but the distinctions of them are not known. The one which is known is

The basking Shark (*S. maximus*). No fish deserves its specific name better than this one; for though, in as far as accurate information goes, it is both maximus and minimus in its own genus, it is *maximus* among the whole of the fishes, being larger than any known inhabitant of the deep, excepting the *Cetacea*. It is a fish of the more northerly parts of the Atlantic, although not exactly of the polar ones; but it ranges to considerable distances, and occasionally finds its way as far to the north as the Bay of Biscay. On the western coasts, especially among the Hebrides and toward the north-west of Shetland, it is a common fish in the summer months; but it goes out to sea in the winter. It swims high in the water, so as to display the dorsal fin which is of considerable size, and as the fish does not tumble along like the porpoise, but swims smoothly, and at times remains basking in the same spot as if it were becalmed, it has got the name of the "sail fish." In sailing or rowing about among the western isles in the summer months, where such an occupation is so very pleasant, one is never long without seeing the fin, and sometimes a portion of the back of the fish rising over the water. It is also as mild and unsuspecting as it is conspicuous; so that, if it is basking, one may row close to it, and even touch it, nay wound it, if the wound is not severe, without its apparently taking much heed of what is going on. If, however, this wound is deep and severe, the fish is instantly roused, and dashes off with so much velocity that, if the wound is inflicted by a harpoon, those in the boat must stand clear of the line, and be careful of the boat itself, as, if it is an ordinary skiff, it is liable to be upset. The flesh of it is not eaten; but the liver yields so much oil, that a large fish is a prize to the captors. Any thing equal to or exceeding thirty feet in length is accounted a large fish; but there are accounts of some reaching little less than forty.

Though this fish makes its appearance regularly and in numbers on the coasts that have been alluded to, and though there are few parts of the British coasts where it is not occasionally to be met with, yet very little is known of its feeding or its manners. It does not appear to follow any of the shoaling fish for the purpose of feeding on them; and therefore it has been supposed to feed chiefly on the floating mollusca and on crustacea. It is ovoviviparous; but the rate of its productiveness has not been well ascertained. The colours are: clouded brown and blue on the upper part, and bluish-white on the belly; the body is spindle-shaped, thickest at nearly the middle of the length; the head is conical; the muzzle rather blunt and very short; the opening of the mouth much more nearly in the plane of the body, and the jaws much more nearly of equal length than in the more ferocious members of the family; the eyes are situated near the snout; they are small, of a brown colour, and longer in their horizontal diameter than in the vertical; the nostrils are lateral, there being very little projecting snout for them to be placed under; the pectoral fins of moderate size; and the

first dorsal, notwithstanding its sail-like appearance, not large, considering the size of the fish; all the other fins are well formed, but not large; the caudal forked, with the two lobes divergent, and nearly equal in length; the tail near the base of the caudal keeled laterally, and grooved on the upper and under sides.

Perfectly harmless as this huge fish is to man, and apparently to every thing in the sea upon which man sets a value, it is a subject of very great alarm when it appears upon a part of the coast where it is but little known. It is a shark in name, which appears to be sufficient ground for investing it with all the terrors of the tyrant of the sea. We have known instances where the rumoured invasion of a shark put all the people in motion, and the timid were apprehensive that the "monster, whose terrible fin could be seen from the beach, would swallow men, boats, and all." But the more adventurous who embarked to avert the destruction rowed close up to the fish, soon despatched it and towed it to the beach, where, after the liver was abstracted, the spoils of the portentous spoiler remained there, testifying to more senses than one how well the natives could defend themselves against invasions of sharks. There might have been another prop to their prowess; for at that particular time they were girt with weapons against another kind of invasions in which the eye of reason saw about as much real danger as even that by the basking shark.

Cestracionus.—Of this genus only a single species is known. It is a native of the Australian seas. In its characters it appears to be intermediate between *Mustelus* and *Spinax*, having teeth like a pavement in common with the first, and a spine in the anterior part of each dorsal like the second. Nothing is known of this genus that could in the least interest the reader.

Spinax.—This is a genus with which we are better acquainted, as there is one species which is not only common, but exceedingly numerous on some parts of the British shores. The characters of the genus, in brief, are: the body elongated; two dorsal fins with a strong spine in front of each, united to the edge of the fin at the base; no anal fins; temporal orifices; the teeth in several rows, small, and with cutting edges; the gill-openings small, close together, and all in advance of the pectorals. The British species, and indeed the only species which is very well known so as to be interesting to the general reader, is

The Piked Dog-fish (*S. acanthias*). This is the Scotch name of the fish, the English one on those parts of the coast where it is most abundant, being the "bone-dog," which is also in allusion to the spines. "Pyked" is the proper pronunciation of the epithet, and though this is from the same radical word as "pick," yet the senses in which they are now used are not the same; and thus even Mr. Yarrell, following the false orthography of some one else, has spelled the name "picked," which, as we use it, means "selected," whereas, if he had just left out the *c*, and written "piked," there would have been no need of telling that "pike means pike."

This fish is much more abundant on the British coasts than any of the other *Squalidæ;* and in the northern parts where the genus *Scyllium* is hardly known even now, it has been the "dog-fish," and the "sea-dog," time out of mind.

It is a small fish compared with many others of the family, but it is a very bold and active one, and well organised both for swimming and for using its teeth. The length of what are usually considered full-grown ones is about three feet; but the majority that appear are smaller. The general shape of the body is not unlike that of the tape; but there is an expression of greater vigour about it. The head is flat with the temporal orifices large and upwards; the snout produced, but rather blunt; the nostrils pierced in the under part; the gape wide for the size of the fish, and opening to a circle as in the sharks; the teeth pointing outward on each side, and with sharp cutting edges; the eyes lateral, the horizontal diameter the longest; the pectoral fins large, triangular, convex before, concave behind; the ventrals much smaller, and the anal entirely wanting; the two dorsals divide the entire length from the snout to the tail very nearly into three equal parts; these last fins sloping backwards, and slightly convex in their anterior margins, rounded at the tips, concave backwards, with a narrow lobe at the base of each; the spines in front of the dorsals strong and very sharp-pointed, the first rather more than half the height of the fins, the second the whole height; the upper and under lobes of the caudal forming a rounded terminal fin, but with a triangular lobe of the under one opposite to about the anterior half of the upper; the upper part and also the fins slate-grey, the under parts yellowish-white; the skin rough when the hand is passed forward over it; the fins granulated and used for polishing wood, as are the fins of many of the family, the "grain" on them being finer than that on the body.

There is, we believe, scarcely any part of the country where the flesh of the dog-fish is eaten in the recent state; and there are few fishes which the fishermen are less fond of seeing in numbers on the fishing-grounds. The numbers in which they appear are almost incredible. They are on the coast early in the season, and they remain till it is late, so that they attack all the more valuable fishes when they shoal toward the land. From the tendency which they have to associate in immense packs they are seldom found along the whole line of the coast, but they alarm the fish, and drive them from the grounds. Their bite is powerful and their gape wide, and thus they swallow and mangle vast numbers. It is also understood that they get below the fish and wound them with their dorsal spines. The command which they have over these weapons is very great; they can work them with the whole muscular power of the body, and strike with wonderful rapidity and certainty. It is not safe to tamper with them after they are taken, for, like all the rest of the family, they are very tenacious of life; and, when lying apparently lifeless, they will start into action and inflict wounds with the spines.

Besides the injury which they do the fishers in driving the fish from the grounds, they watch the lines and cut off such fish as are caught; so that even after the lines have been filled, a large pack of sea-dogs coming on the ground will leave the owners to draw them in empty and hookless. Mr. Couch mentions that he has heard of twenty thousand being taken in the seas at one time, among which, however, there must have been a great number of young ones. The livers afford a good deal of oil: and in those northerly places where the people depend so much on the sea for their subsistence, and the sea is in a great measure inaccessible or unprofitable in the winter, their flesh is salted and dried. It is rather

hard and tasteless; but still it is better than absolute hunger. Then, when they are abundant, the offal is of use in enriching the fields.

Centrina.—This genus have spines on the back as well as the last, but the one is directed forwards and the other backwards. They have several rows of small pointed teeth in the upper jaw, and one or two rows of cutting teeth in the lower; they have the tail very short and the body massive, a sort of triangle in the section, the lower part of the fish forming the base of the triangle; they have the habit of lurking in the mud at the bottom, for which reason they are sometimes called sea-hogs. It is probable that, while they lie in this manner, they wait for prey, which they first wound with the dorsal spines, and then seize with the mouth. They are found both in the Mediterranean and the Atlantic; but there is no mention of them even as stragglers upon the British coasts. They are fishes of little interest, as they are of small use, and do less harm than the dog-fish. In consequence of their lurking habits, they are seldom caught or even seen.

Scymnus. Some species at least of this genus are better known and possess a higher degree of interest than the preceding one. In the characters of the mouth they are nearly the same, having several rows of sharp-pointed teeth in the upper jaw, and two rows of cutting ones in the under; the first dorsal fin is placed near the middle of the length of the body; there is no anal fin, and the tail is rather short. Some species of this genus occur in the seas of the southern hemisphere, and there is one in the north, which is a large and powerful fish, and among the most polar in its locality of any of the shark family. This one is

The Greenland Shark (*S. borealis*). This has been named in the lists as a British fish, but on very slender grounds; for the two that have been mentioned did not come even as living stragglers, but were cast on the shore. Farther to the south it has never been observed, even in the state of a wreck, drifting before the current of the water. Its colour on the upper part wants the brownish tinge, but otherwise it is not very unlike that of the great white shark of the warm latitudes; but the shape is like that of the prehensile. In consequence of the similarity to the white shark, when seen at a distance, this Greenland one was long considered as being either the same or a variety; and thus, though it is a large and powerful fish, it has got a character for voracity which it probably does not deserve to the full amount that has been stated.

The best, and indeed the only good account of the Greenland shark which has been given from actual observation, is that in Scoresby's work on the Arctic Regions, which we shall quote:—"The *Squalus borealis* is twelve or fourteen feet in length, sometimes more, and six or eight feet in circumference. The opening of the mouth, which extends nearly across the lower part of the head, is from twenty-one to twenty-four inches in width. The teeth are serrated in one jaw, and denticulated in the other. It is without the anal fin, but has the temporal opening; the spiracles on the neck are five on each side. The colour is cinereous grey. The irides are blue; the pupil emerald green.

"This shark is one of the foes of the whale. It bites and annoys it while living, and feeds on it when dead. It scoops hemispherical pieces out of the body, nearly as big as a person's head; and continues scooping and gorging lump after lump until the whole cavity of its body is filled. It is so insensible of pain that, though it has been run through the body and escaped, yet, after a while, I have seen it return to banquet on the whale, at the very spot where it received its wounds. The heart is very small; it performs six or eight pulsations in a minute, and continues beating for some hours after taken out of the body. The body also, though separated into any number of parts, gives evidence of life for a similar length of time. It is therefore extremely difficult to kill. It is actually unsafe to trust the hand in its mouth, though the head be separated from the body. Though the whale-fishers frequently slip into the water where sharks abound, there has been no instance, that I have heard of, of their ever having been attacked by the shark.

"Besides dead whales, the sharks feed on small fishes and crabs. A fish, in size and form resembling a whiting, was found in the stomach of one that I killed; but the process of digestion had gone so far that the species could not be satisfactorily discovered. In swimming the tail only is used; the rest of the fins, being spread out to balance it, are never observed to be in motion but when some change of direction is required."

There is the foundation of much knowledge in this passage; and if the other inhabitants of the deep could be examined as closely, and described as well, our knowledge of fishes would assume a very different character from what it has at present.

Insensible as the Greenland sharks are to pain, and formidable as they are to the whale, they are not without their enemies, of a description against which their powers are not of the slightest avail. Captain Scoresby found attached to the eye of the shark a white worm-shaped substance about two inches in length, terminating in two filaments. On examination this was found to be a species of *Lernæa*, a parasitical zoophite, various species of which torment fishes by attacking their gills, their eyes, and other delicate parts of their structures.

There appear, from the reports of naturalists who have visited the South Sea, to be sharks there which agree with the Greenland shark in some particulars, but differ from it in others.

Zygæna—Yoke-headed or hammer-headed sharks. These have many of the characters of the genus *Carcharias;* but the form generally is very unlike them, and the head is so singular as to have no parallel in the whole animal kingdom, many and varied as are its members. These curiously-formed fishes appear to be widely distributed, being found in the seas both of the north and the south; and one specimen is recorded as having been taken at Yarmouth in 1829. Four species have been described, and there are probably many more, but we must confine our notice to one.

The common hammer-headed Shark (*Z. malleus*). This species grows to the length of twelve or fourteen feet. The body is rounded in its section, spindle-shaped, with the thickest part behind the first dorsal fin, and the tail very long; the pectoral fins are large, originating immediately in the rear of the last gill-opening, convex on their anterior margins, concave on their posterior, and pointed. The first dorsal is nearly opposite to them, of considerable size, and with a deep curved notch in the extremity.

The ventrals are nearly midway between the pectorals and the anal, of moderate length in the first part, but shortened posteriorly. The second dorsal and anal opposite to each other, the first rhomboidal, the second with a deep curved notch in the extremity. The caudal longitudinal, in the upper and under sides of a very long and rounded tail, the two lobes meeting and forming a lancet-shaped tip. The upper lobe very low and of uniform height; the under rather broader, with a fulcate prominence at the commencement, and a portion near the tip a little enlarged.

Hammer-headed Shark.

The most singular part of the structure, however, remains yet to be noticed. The body, which tapers from midway between the pectoral and ventral fins, continues in a lengthened and comparatively slender neck; then the head has the snout truncated in front; but the head itself is drawn out into two branches at right angles to the axis of the body, nearly of the same thickness as the neck, and altogether not unlike a double-headed hammer, with an eye in the middle of each face, and directed at right angles to the axis of the body. The nostrils are in front of these curious branches, and the mouth is at the middle of their length below. The outlines of the fish are remarkable for the gracefulness of their curvature; the neck and the two lateral branches of the head appear to have great power of motion, and the whole air of the fish is expressive of velocity and energy. What particular purpose in the economy of the fish is answered by the eyes being thus placed on peduncles, has not been ascertained; but there is no doubt that a necessity for such extended vision as this strange organisation can command accompanies the organisation. In farther confirmation of this, the eyes themselves are large and prominent; so that, taking the whole together, there is really no animal that commands so extensive a field of view. The teeth are large, formed and serrated like those of *Carcharias;* and there are at least three rows in each jaw. It is a very discursive fish, found in the deep water rather than near the land. It is said to be exceedingly voracious and daring, scarcely less so than a white shark of the same dimensions. Its food is said to consist chiefly of the rays; and as they are exceedingly active fishes, it requires all its powers, both of vision and of motion. A full-grown one weighs four or five hundred weight, and the liver yields a great deal of oil; but the fibres of the flesh are very rigid, and unfit for food.

Squatina—Angel-shark or Monk-fish. This is the third of the leading genera into which Cuvier divides the family of the *Squalidæ*. The generic characters are: they have temporal openings, but no anal fins; the body very much depressed, and the head rounded at the snout, and very broad and flat; the opening of the mouth in front of the muzzle, and the eyes in the upper surface of the head, and not lateral, as in the greater part of the family; the pectoral and ventral fins so large that the outline of the body resembles that of the rays. The fish of this genus are, however, independently of their more scientific differences, easily distinguished from the rays by the form of the disc or flattened part itself. In the rays, especially in what may be, and are, called the true skate, the disc is composed of the pectoral fins only; and in the thornback, the starry ray, and some others, in which the ventrals form part of the line, that part is so little in comparison with what the pectorals form, and so easily understood to be a mere supplement, that one can easily see it in its proper light, and look upon the great breadth of the fish as produced by the enlargement of the pectorals only. Even in the torpedo, where the ventral fins are more produced than they are in almost any of the others, the fact of their being only supplemental to the body of the fish is apparent upon mere inspection. But in the genus *Squatina*, though the pectorals are much larger than the ventrals, they form an integral part of the body of the fish, and not a supplemental one. The character of the head also is not to be mistaken; for there are none of the rays which have a rounded muzzle with the opening of the mouth at the extremity. The only species of which we can find room to give a few particulars is

Squatina Angelus — the Angel-fish, Monk-fish, Shark-ray, and a variety of other names. How it came by such a "commodity of good names" as it has obtained is a matter of some little astonishment at this time of day, and when we carry back our consideration our astonishment increases. Though the association of any material form, however admirable in itself, with the proper notion of an angel, as an existence of a spiritual and ministerial nature, and as such having nothing to do with form, be a very palpable and most unphilosophical absurdity, yet, if we will speak of an angel in tropes and figures borrowed from material forms, it behoves us to select something for our symbol which at all events is not repulsive. But taking it in its mere appearance, without any reference to its manners, which are certainly not the most angelic, this angel-shark is about the ugliest fish that the sea contains. True, the pectoral fins of the fish have some resemblance, and a very slight resemblance it is, to wings; but granting that it were not the mere resemblance, but the most perfect wings that ever were grown of material substance, what have wings to do with our notion of an angel? Wings are for overcoming the gravity and motion of matter, and for no other purpose; and if they are essential requisites of an angel, then that angel is a material creature, and consequently no angel at all. It is true, that we use the word "wings" in these cases; but all that we mean is, that there is a velocity or a power of velocity which we cannot trace farther than that which displays, or is capable of displaying, the said velocity.

This fish is occasionally found on various parts of the British coasts, most frequently on the south, but

occasionally on the east, though not very far to the north. Its proper home, that is, the locality in which it is most abundant, is the Mediterranean, where it has been known since the days of Aristotle, who called it the "file," probably on account of the roughness of its granulated surface. Its form indicates a very different habitat from that of most of the *Squalidæ*; and any one in the least acquainted with the structures of fish, and the localities for which their structures are adapted, would at once say "this is a bottom fish, an inhabitant of the bank." It would of course be in vain to look for such a fish on the rocky shores, where the water is deep and clear. The banks where tides and currents meet, where there is a constant accumulation of animal matters, and abundance of flat fish, are the places where to find this "angel of the deep," in the home of its enjoyment.

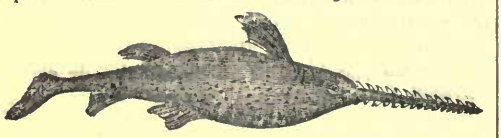
It is well adapted for the office which nature has assigned it. It grows to the length of seven or eight feet, and is very muscular. The division of each of the produced lobes into two by the fins is an advantage in swimming which the flat fish, and even the rays, which have the principal lobe single, do not possess; and thus it is admirably fitted for beating its prey in their own kind of swimming. When it attains the largest size, it is a very heavy fish, not less than 150 pounds in weight; and this, with the quickness of its swimming, enables it to impinge with great force on its prey. Then its eyes and mouth are adapted for forward chasing; the depth at which it preys is not too great for the view, and the broad mouth and wide gape are ready to dine on a turbot, even of very considerable size. The rays are usually set down as among the articles of food consumed by this singularly ugly fish; but we have some doubts as to this part of its bill of fare, more especially in the case of those rays that have formidable spines on the tail. Indeed the following up of these spiny rays to take them in the rear would not be a very pleasant business even for the fish, clad in armour as it is. Besides, the rays feed chiefly on what is under them; and this is rather against their being a common prey to this species, though the peculiar structure of the hammer-head fits it for seizing them with the greatest certainty. This fish is so peculiarly formed, and so powerful, that it would be very desirable accurately to determine its place and function in nature, but at present the data are far from complete.

We have already mentioned the size which this fish attains. The body of it is formed something like a tadpole; that is, the head is, if the lateral fins are not taken into the estimate, so far wider than the body, and the body, the distinction between which and the fins is much more conspicuous than in the rays, is cylindrical, or has the sides parallel from the head to the first dorsal, and then it tapers gradually to the tail. The plane of the head is nearly circular; the eyes far apart, though both on the upper surface; and the temporal openings are behind the ears, large and crescent-shaped. The anterior margins of the pectorals touch the sides of the head, about the middle of their lengths, so as to leave about a semicircle of the outline of the head free. After this they diverge in nearly straight lines, at rather less than a right angle, until their distal extremities are nearly as far asunder as from the mouth to the first dorsal. They return in lobes nearly at right angles to their front lines, and then return rounded, overlapping the anterior and external edge of the ventrals. The ventrals extend as far as the first dorsal, projecting beyond the lobes of the pectorals anteriorly, and slightly bilobate in their posterior margins. The general form of the disc is thus nearly a rhombus, but with the posterior sides deeply notched between the pectorals and ventrals, and the anterior ones very slightly between the head and the pectorals. The tail is nearly as long as the body from the head to the first dorsal, bearing the two dorsals, and a caudal of two triangular lobes, one on the upper side and another on the under. The opening of the mouth extends nearly along the whole semicircle from the one dorsal fin to the other, so that the gape, when at its full extent, is circular and very wide. The upper part is shagreened with tubercles, and there is a row of spines along the dorsal line, which are said to be much more prominent in some than in others. The upper part is mottled with brown and greyish, and the under part dull white. It is ovoviviparous, and the young, to the number of about a dozen, are all produced about the same time, as is usual in the members of the family which are not very discursive. The flesh, like that of the others, is hardly edible, and thus the fish is not sought after. It is not so much disliked as the species which feed nearer the surface, as it interferes comparatively little with the fisheries. Hence it is allowed to enjoy its splendid name, and feed its very unhandsome carcass quietly in the deep.

Pristis (*Saw-fish*). This is also made one of the leading genera by Cuvier, and it is the last of the family in the order of his arrangement. There are several species, but this article has already extended to such a length, that we can notice only one as a specimen of the general appearance and habits. The generic characters are: the same physiology as the rest of the family; they have the anterior part of the body flattened, and the gill-openings pierced below, as in the rays, and their teeth are small and round, like those of the smooth-hound. The most remarkable of their character, however, is the form of the muzzle, which is lengthened into a very long weapon, formed like the blade of a sword. This weapon is furnished on each side with a row of very large and strong teeth, standing at some distance from each other, and forming altogether one of the most terrific weapons that can well be imagined. The species which we shall notice is

The common Saw-fish (*P. antiquorum*). This fish has been known from remote antiquity as one of the monsters of the deep, and the present generic name is the one which was given to this species by the Greeks. This fish is more generally distributed than almost any other; but it is a fish of the high seas, and rarely, if ever, makes its appearance on the shores. It is found on the margins and in the openings of the polar ice, and probably it passes freely under the fields and floes; it is also found under the equator, and equally in the southern seas and the northern. It thus, in all likelihood, passes purely along the same latitudes as the British islands; but not a single specimen is mentioned by the authorities as having occurred on any part of the coast. The colour of the saw-fish is very dark grey on the upper part, passing into ashen-grey on the sides, and nearly into white on the middle of the belly; the skin of the upper part, excluding that of the lengthened snout, is covered with hard tubercles, with their sharp points turned backwards; the covering of the snout with these would make it a very serious weapon, from the

ragged wound that it must inflict; but they are nothing compared with the teeth with which the sides of the back are beset; they are large and strong, firmly rooted like teeth, and about eighteen or twenty on each edge of the back; the point of the blade is not sharp; and, in fact, the whole weapon is one fitted for tearing and mangling rather than for simply wounding. Of course such a blade must be moved with great force before it can do its work; and the fish is well favoured for effecting this; it attains a great length; and as the first dorsal and the very large pectorals are placed on nearly the same part of the length, it can swing upon them in every direction as upon a universal joint, and so deliver its weapon in any quarter where it may have the greatest effect. This, and not the sword-fish, which is a bony fish of the mackarel family (see SCOMBERIDÆ), is the fish which is so mortal an enemy to the whale, in company, as is said, with the fox shark, but we believe that, far to the north, it is with the Greenland shark. The weapon of the saw-fish is, in the very large ones, about six feet long, and the animal can plunge it into the body of a whale the whole length. Nor have we any reason to doubt that, when the fish takes a rush from a distance, in order to deliver its weapon, it has force enough to accomplish this, for it sometimes runs the snout into the timbers of a ship in the same manner as is done by the sword-fish.



Saw-Fish.

It is probable that this one uses the sword for the purpose of killing, in order to eat; for, though the saw-fish could no more swallow a whale than the sword-fish, yet it has powerful teeth, and could bite off pieces, an operation for which the toothless mouth of the sword-fish is not at all adapted. It should seem, therefore, that whenever the stabbing of the Greenland whale by any ferocious fish is mentioned, the present species, and not the sword-fish, should be understood. This understanding gets us out of another difficulty. In all such accounts of battles as that related by Captain Crow, of which some account will be found in the section *Sword-fish*, as above referred to, it is stated that the stabbing fishes are in numbers; whereas, even in our seas, it arrives only singly, and that but rarely; nor is it for feeding in concert that sword-fishes congregate. All the *Squalidæ* hunt in packs; and thus, whether the object of their hunting be a whale, or anything else, we may expect them to follow the general law of their family.

Such is a very brief outline of the shark family, one of the least valuable, in so far as human food is concerned, of any that are to be found in the sea; but, taken as part of wild nature, and as showing the power and the beauty with which created things are adapted to the end which they are appointed to accomplish, one of the most instructive that can be made the subject of human observation and reflection.

SHEEP (*Ovis*). A genus of ruminating mammalia with horns, placed, in Cuvier's arrangement, after the goats, and before the oxen, but having far more resemblance to the former than the latter. It has, indeed, been pretty generally alleged that sheep and goats not only can produce, but actually have produced, a mongrel breed, which continues fertile as well as either of the races which are blended in its formation. It must not, however, be supposed that, in the "Règne Animal," Cuvier actually asserts that the mules between the goats and sheep continue fertile in the mixed blood, so as to obtain a flock, a breed, in which the qualities of goat and sheep shall be blended together. His words are, "Ils (the sheep) méritent si peu d'être séparés génériquement des chèvres, qu'ils produisent avec elles des pétits féconds." This is true, and we may add, that whenever any two species of animals are so nearly allied in their structures and their modes of life, as to produce a hybrid at all, that hybrid is always fertile. But it is fertile to return to the pure blood only, and not to remain in the same state of mixture from generation to generation. We must not, however, seek for any distinctions founded on the production of animals, beyond these three; first, that the race continues, without any return to another species; secondly, that there are mules which will only breed back again; and, thirdly, that there are cases in which no mule is or can be produced. Taking this as the foundation, the first of these would determine what were the same species; the second what were not the same species, but the same genus; and the third, what were different genera. If this could be established in all cases, and referred to at all times, there is no doubt that it would be an excellent foundation for a systematic arrangement of the animal kingdom. But there are no means of doing this in one case out of ten thousand; and therefore, though we may appeal to it in common cases, it is really of no value whatever. The distinction between genus and genus is not founded in nature. It is an application of art which man makes, in the hope of thereby shortening the road to knowledge—whether he always does so by means of it is another matter. It is thus quite clear that the greater part of our systematic distinctions must be purely artificial; and all that we have to do is to take care not to impute to nature that which is our own doings; for we may appropriate nature to ourselves without the slightest injury.

But, to return to our subject, sheep have been broken down into such a number of breeds by artificial means, that is, by climate, food, and attendance, that we cannot help admitting that they may have been to a very great extent changed by nature in the same way; and though, of the few races of them that still remain in a state of nature, those which have their pastures very different, in a physical point of view, are themselves different, yet they may have been all originally from the same stock. It would, however, be a waste of time to go further into the details of this part of the subject, than the statement of the principle to guard against positive assertion, where there is or can be no real knowledge. The generic characters of the sheep are founded on its structure, which is open to all, and not on its physiology, which is more limited. In this simple and popular view of it the following are the characters usually given: the horns angular in their erection, furrowed across, bent laterally into spirals, and formed upon a cone of spongy bone, which, as far as it goes, takes the form of the horn itself; the teeth are in all twenty-two, eight incisors in the lower jaw, and six grinders above and below on each side; the incisors form a regular

arch, the number of which are placed neatly and compactly together, the two next the middle being the largest, and the others becoming less and less as they are nearer the sides; the line of the forehead is arched; the muzzle is without any naked part; the nostrils elongated, oblique, and terminal; and the chin is without any beard; the ears are of mean length and pointed; the body of middle stature, warmly covered with hair; the legs are slender, and without any brushes on the knees; the females have two inguinal teats, but there are no pores in the groin; the tail is generally short and pendent.

Generic characters of the sheep can hardly, however, be so expressed as that they will be perfectly applicable to any one of the great number of breeds into which the genus has been broken; and thus, though every child knows a sheep from any other animal at first sight, it is not quite so easy a matter to say why it is a sheep, and not a goat or something else. In order to be quite clear upon such matters as this we want information respecting the reversed operation. We know that certain stocks may be broken into sections, but we have very little knowledge as to how these sections may be put together so as to get us back the original stock of which they were broken. It is true that, when plants or animals that once have been changed, or as we say, according to the notions which we have of them, improved by artificial means, are neglected, they become very inferior to what they were in the cultivated state; but we cannot assert with truth that they return to the original. If they are very highly cultivated, that is, brought very far out of their natural state, and then abandoned to the contingencies of wild nature, they are apt to perish entirely. This seems to have all along been the case with the cereal grasses which mankind have cultivated for their bread corn. There is no reason to doubt that all of these have been cultivated out of wild grasses; and it is very unlikely that all the wild grasses out of which they have been cultivated should have perished. Of several of the millets, and the *raggy* of India, as well as various others of the inferior sorts, the originals are still to be met with in wild nature, not very different from the cultivated ones; but we look in vain for any wild plant which we can with certainty say once was, or hereafter is to be, wheat or barley; and the same may be said of many of the more valuable luxuries.

Animals being more removed from the state of mere matter than plants—less completely in the power of man, as clay in the hand of the potter, than plants—cannot be so much changed by human art; but still there are several of them of which we cannot find in wild nature any thing that we can absolutely say is the original. This is the case with the dog, the horse, and the ox; for though there are wild animals still to be met with, with which some at least of these can have fertile progeny, yet we cannot say that they are the species out of which the domestic one has been cultivated.

It is probably the same with the sheep. The sheep, notwithstanding the influence which cultivation has had upon it, is not nearly so domesticated an animal as the ox; and, therefore, there are wild sheep which resemble the cultivated sheep much more than any of the wild oxen resemble the cultivated oxen. But still this resemblance, or the fact of their having fertile progeny with each other, must not be hastily taken in evidence that the ones which are now wild are the stock out of which the cultivated ones have been bred. Of late it has been ascertained that the wild sheep of the mountainous parts of the Mediterranean islands will breed with tame sheep; but this fact has not been ascertained long enough for enabling us to decide whether they will remain as permanent races or not.

The wild sheep which are still to be met with are found in the mountainous parts of the great lands in the northern hemisphere; but it does not appear that there are any in the south—in South America; in Africa, south of the Great Desert; in Asia, south of the Himalaya; in the Oriental Archipelago; or in the isles of the Pacific, except the very northerly ones. Thus it should seem that they are originally and properly animals of the northern hemisphere; and the places in which they are found point out the physical circumstances of what may be considered as their country. They are decidedly mountain animals, but not scrambling among the rocks as the goats are; and although they are placed differently in the systems, it appears that their proper locality is between the goats and the antelopes, though in the countries where antelopes are most numerous, there are no wild sheep, which has led to the placing of them between the goats and the oxen. The goat on the pinnacles where the patches of herbage are small and of difficult access, the sheep on the breadth of the dry upland pasture, and the ox in the valley or meadow by the large river, are the places of the three in nature. In their food, and the manner of taking it, they all very much resemble each other, for they are all grazing animals; but a goat can eat vegetables which are poisons to the other two, and a sheep can find its food where an ox would starve. On the other hand, a goat would be very much out of its element in the humid pasture which the ox prefers; and a sheep would soon become diseased in the feet and unable to seek its food. The sheep too, even in the cultivated races, must, in order to be profitable, have a much greater breadth of pasture than any of the other two.

There is another result of the comparison of these three genera of the *Ruminantia*—all things considered the most valuable to man in the whole animal kingdom, which should not be overlooked, because it points out the situation in which each may be introduced with the greatest advantage. The rocks of the goats, and the plains and meadows of the oxen, are both liable to sudden rains; and the coverings and also the constitutions of the animals are such, that the rain does them comparatively little injury. The hair of the goat throws off the rain as if there were absolutely a repelling power in it; and even when the goat is, like the shawl goat of the northern slopes of the Himalaya, provided with a close wool on the skin, there is always along with it a sufficient quantity of long hair of a smooth and shining surface to throw off the rain and snow. Sheep, in the wild state, are understood to have hair and not wool, though the point is one which does not admit of absolute demonstration; but even then their hair is very different from that of goats; and when the hair of which is laid into wool, unless it be in climates which are positively cold and rainy, the whole hair turns wool without any long and smooth hair to carry off the water. There is also a tenderness in the covering of the sheep, whether that covering be hair

or wool, which is never found in that of the goats, be the staple what it may. No fabric made of wool has nearly the same durability as the shawls that are made of the fine under-covering of the goat of the Himalaya, formerly alluded to; and, on the other hand, the covering of the goat cannot be felted or wetted in the same way that wool can. In consequence of this, the covering of the goats, however long and shaggy it may be, never gets matted, while the wool of the sheep always does, and does so the more the finer it is in the staple. It is this matting which renders the covering of the sheep so liable to injury by long exposure to the rain. It holds out for a considerable time no doubt, and the finer that it is it holds out the longer; but then, when a fleece of this kind is once wet through, it takes a very long time in drying, and the health of the animal is injured by the cold produced by the evaporation of so much moisture as there is in the fleece. We find that there is, in the nature of the animals, a tendency to correct this in so far. If the fine-woolled sheep, whose proper pasture is the dry plains where there are not many rain-storms during the summer, are taken to the hills where the atmosphere is habitually cold and dripping, they in time become comparatively rough in the coat, which is longer in the fibre, but much less matted together. On the other hand, if they are taken to very hot countries the fleece changes in time to thin and coarse hair, as is the case with the sheep in India. All the circumstances, indeed, point out the locality proper for the sheep, as being that which is dry, and neither too cold nor too warm. Oxen, on the other hand, thrive best where the atmosphere is rather moist, because they have a more luxuriant and tender pasture. Goats are more proof against all weathers than either oxen or sheep; and their sure-footedness enables them to reach the patches of herbage in places which are quite inaccessible to both the others. We shall, however, have occasion to make a remark or two upon this part of the subject when we come to notice the leading varieties of cultivated sheep; and, therefore, we now proceed to a mere notice of the wild ones, in which we shall take them as they stand in the system, without admitting or denying that they are different species. In doing this we shall take them in their geographical distribution, without considering any of them as more typical of the genus than another.

The Mouflon. This one is called the Corsican sheep and the Sardinian sheep, because it is particularly numerous in the mountainous parts of those islands, though not confined to them. It is also called the wild sheep, and supposed to be the parent stock of all the tame breeds of Europe, though of this there is of course no conclusive evidence either way. This species is rather larger; that is, it is a larger-boned animal than the average of the cultivated sheep. The horns are triangular; that is, they present three faces; the first posterior and internal, the second inferior and anterior, and the third superior and anterior. The posterior face is smooth, or without ridges, and larger than either of the others, and it is slightly convex in the first part of its length, but concave in the remaining part. The other two faces are flat for the greater part of their length, but concave for a little space toward the point of the horn. The ridge which separates the two faces of the horn is very prominent, and almost what may be called a cutting edge. The first curvature is always outwards and inwards, and backwards and forwards. These horns, though triangular in the basal part, are flattened into a sort of laminæ or blades toward the points. They are very broad at their bases, and occupy so much of the upper part of the head that they are separated by a space of only about a quarter of an inch, and in some instances their bases meet without any interval. Their average divergence from each other at the base is about a right angle; but it is not quite constant, being sometimes ten degrees more, and at other times ten degrees less. These horns are ridged and annulated, like those of the cultivated sheep, but the annuli are generally closer together, and on the basal part of the horn they are at irregular distances.

The mouflon is covered with two sorts of hair, one woolly, and very fine and soft to the touch, and arranged into curled locks like the wool of the common sheep, and of a grey colour. The other kind is straight and bristly; and from its length it is the only part of the covering which is visible to the eye, and has to be lifted up or aside before the woolly part is seen. The colour therefore depends on this larger and more bristly part of the covering; and, as it is variously coloured, the apparent colours of the individuals vary along with it. In some cases it is yellow, in others black, and in others again it is variously annulated of these two colours. These differently-coloured hairs are generally found on the same individual, but they vary in their proportions; so that, taken on the whole, different individuals of the same flock appear to be differently coloured, the yellow predominating in some instances, the black in others, and others again having every shade that can be produced by a mixture of the two. These colours are not constant, even in the same individual, but change with age and with the season. In winter the colour is more inclining to brown than at other times, and the young are of a clearer and brighter tint than the old. Some individuals are also nearly or altogether white, and others are black. They have very often a black streak along the dorsal line, and not unfrequently another, black or blackish, on the flanks, separating the upper parts from the under; the latter are white, as are also the insides of the legs, the buttocks, a spot under each eye, the middle of the face, and the insides of the ears. The tail is very short, and the sides of it are white. The hoofs and horns are of a yellowish grey, and the latter, measured from the base along the curvature, are nearly two feet in length. The tongue and the inside of the mouth and nostrils are black. The authorities are not quite agreed about the horns of the females: some describe them as having no horns, and others as having them, only smaller than those of the males. The fact of the case seems to be that the females have sometimes horns and sometimes not; but the presence of these appendages seems to be the exception, and the absence of them the rule.

The mouflon has been known from the remotest antiquity, and it is probable that, in former times, it was common in places where it is not now to be found. At that time it was sometimes called the *Ophion*, or "glider," probably from the fleetness of its motions; and Strabo and Pliny describe it pretty accurately as the *Musmon*. Pliny mentions it as being found in the mountains of Spain, and in those of Sardinia, Corsica, and some other of the islands of the Mediterranean, the places where it is still to be

met with; [for some naturalists mention it as still occurring in the mountainous parts of the south-east of Spain.

In their habits these animals have a very close resemblance to the common sheep. They assemble and pasture together in numerous flocks; and so much is this their habit that, if an individual is kept in solitude, it pines away and very soon dies. As is the case with common sheep, this social instinct appears to be the only one which is very strong in them, and they will follow it even to their personal danger. When kept in confinement, they do not appear to acquire any knowledge of persons, so as to be able to distinguish those who feed and are kind to them from others. When food is presented to them, they come to that; but they do not heed the person who is in the habit of feeding them, unless the food is shown. This is very much the character of common sheep, which are far less intelligent than oxen, and do not appear to know either their owners or their homes. Therefore they must always have a shepherd to conduct them, and lead the flock to where it may be wanted; for, although they keep together, the whole would wander off, and never return to the fold, unless conducted.

The Argali. This is the wild sheep of the central and northern parts of Asia, and has been not unfrequently confounded with the mouflon of Europe. Perhaps they are the same species, and the differences between them are merely climatal, and therefore we have not added the systematic names to the common ones by which they are known. The argali is found in all the mountainous parts of the temperate and the cold regions of Asia, to the eastward of the Caspian, and even in places so cold as Kamtschatka, where it is highly esteemed both for its flesh and its fat.

South Down Sheep.

It is an animal rather less than the fallow-deer, but thicker and stouter in the body, and shorter in the legs. The male is considerably larger and stouter than the female. The head has a good deal of resemblance to that of the common sheep, but the ears are shorter. The horns of the male are not very unlike those of the ram, but they are larger and higher, more compressed, more triangular in their section, more divergent, and also more rough and furrowed. In very old animals they are of great strength and thickness, especially at their bases. The front side is flat or very slightly convex, but toward the point the convexity is greater, and it is very compressed. The interior side is grooved for nearly its whole length; and the external one is a little convex in the basal part, and a little concave toward the point. The internal angle on the front side is the most prominent; and the external of the same is rounded, especially in the old ones. The cross furrows and ridges with which the horn is annulated are very irregular. The female, when full grown, has the horns more elevated and less divergent than the horned ewes of the common sheep. They are compressed, flat on their inner surfaces, and convex on their outer. They have the angle of the convex edge rounded, and that on the concave sharp; but toward the points they are flattened and turned outwards. Both on the males and the females, these horns begin to make their appearance when the animals are about three months old. They are then semi-oval in their section, and of a black colour. The tail of the argoli is very short, and naked on the under side, the same as in the mouflon. In winter, the colour on the upper part is generally greyish yellow, with a line of brownish red down the back; the buttocks bright yellowish; and the under parts and insides of the legs white. In summer, the colour of the upper part is generally more inclining to red, but the yellow patch on the buttocks surrounding the tail remains of the same colour at all seasons. The hair is very short and smooth, resembling that of the deer, and has hardly anything of a woolly appearance. It is remarkable for the fleetness of its motions and the vigour of its leaps, and in many points of its character it bears no small resemblance to the deer; though in the more essential ones it is decidedly a sheep, yet certainly more removed from the common sheep of Europe than the mouflon. It is an exceedingly lively and active animal, and its flesh is as much esteemed in the countries which it inhabits as venison is with us.

Wild Sheep of America. This is often called the "rocky mountain sheep," under which name a figure of it will be found in the plate Sheep, which figure will give the reader some notion of the general appearance of the animal. By some the goat of the rocky mountains has been confounded with this animal; and it has also been called an antelope, though it is neither the one nor the other, but truly and properly a goat. The characters of this species, or probably variety (for it really seems that, notwithstanding all the diversities of the genus *Ovis*, whether in the wild or the cultivated state, there is no well made out distinction more broad than that of variety), are very apparent, and at once prevent any possibility of confounding it either with the antelopes or the goats, though of course, as all sheep do, it approximates more closely to the latter of these than to the former. The body is remarkable for its thickness and roundness in proportion to its length; the legs are very long; the outline of the forehead, seen in profile, is nearly straight; and the muzzle is almost exactly that of the common sheep. The horns of the male are very thick and large; they advance in front of the eyes, and form nearly an entire turn of a spiral. They are flattened laterally like those of the domestic ram, and have similar transverse furrows and ridges. These furrows and ridges are very conspicuous on the basal half of the length of the horn, but much less so on the terminal half; and of the three lateral faces the front one is the largest. The horns of the female are much more slender than those of the male; they are compressed, nearly straight, and without furrows; there are, in some instances, plates or folds of skin under

the throat, especially in the male; the tail is very short in both sexes; the colour in summer is generally greyish fawn, with a reddish or yellowish line down the back, and a large patch of the same colour on the buttocks; and the under part, and the insides of the legs, are either russet, yellowish, or of a white sand colour; in winter the colour of the upper part is more reddish, and the throat and breast are more inclining to white; but the patch on the buttocks remains much the same at all seasons.

According to the American naturalists, these animals are found in little flocks, of about twenty or thirty in each, on the rocky mountains, and extending southward as far as California. Several naturalists have expressed their conviction that the mouflon of the south of Europe, the argali of Asia, and the wild sheep of America, are only climatal varieties of one great species, to which they have given the name of "mountain sheep;" but whether this is or is not positively the fact, we have no means of ascertaining. Probability is in favour of it, however, and the more so that, among the domesticated sheep, which we have every reason to believe are all originally of the same stock, whatever that stock may have been, there are differences of external appearance fully greater than any which are to be met with among the wild ones; and we believe that, in the whole genus, there are no differences but external ones. Some farther confusion and uncertainty is produced among these wild sheep by the conduct of the keepers of museums, who have filled these with horns and other scraps, not having any history, and which have, in consequence, been referred to places where they are not to be found. The great puzzle in the history of this genus, however, is the proneness which it has to break into varieties, not only in different countries, but in the same country, and even in the same flock. There are, however, other two species or varieties which are worthy of notice, though even they do not settle, or tend to settle, the question of common origin.

The bearded Wild Sheep (*O. tragalephus*). This is the wild sheep of the mountains of Atlas, in northern Africa, but whether it is native there, or merely the common sheep that had been left to wander into the mountains during one or another of the many disastrous changes to which that part of the world has been subjected, it is not easy for us to ascertain at the present day. This species has been known to European naturalists since the middle of the sixteenth century, at which time a specimen was brought from the mountains of northern Africa. It was an animal of considerable dimensions, hardly inferior to the red deer, standing three feet and a half at the shoulder, and measuring four feet and a half from the occiput to the tail; the head, from the top to the nostrils, was one feet three inches; the horns nearly thirteen inches in circumference at the base, and so close to each other as to approach within a single inch; their curvature backwards and downwards; the length rather more than two feet; the section triangular; the faces with cross ridges and furrows, and the colour black; the ears of small dimensions; the cheeks furnished with long hairs, which divide into two tufts of a beard on the under jaw; the neck short and thick; and the sides covered with hairs pendent as low as the knees; along the neck, and great part of the ridge of the back, there is an erect bristly mane, which is particularly high and tufted on the shoulders of the animal; there are also tufts, or brushes of hair, on the knees, but no callosity as there is in the camel and in many of the antelopes; the covering of the body, which is of a rusty black colour, is hard and rough, resembling the hair of a stag more than the wool of the common sheep. Indeed, we believe that the fine wool of sheep is wholly the result of culture, and appears only upon those that are in a state of domestication; and we find so many varieties of it, arising from climate, pasture, and other causes, that it is really very difficult to say what change cannot be produced in the covering of animals of this genus, though the cause of the change is, in many instances, a matter beyond our philosophy. The legs of this animal are slender in proportion to their length; on the fore feet the exterior hoofs are considerably larger than the interior ones. The females are also said to be of larger size than the males, which, if true, is an anomaly not only in the ruminantia, but in the mammalia generally. The account of this species or variety, as from the mountains of Barbary, is by Caius, at so remote a time as 1561, and thus it is open to some suspicion.

That there are wild sheep in the mountains which skirt the valley of the Nile, and by inference in all the other hilly parts of northern Africa, is placed beyond a doubt by the testimony of M. Geoffroy Saint Hillaire, who obtained one that had been killed near the gates of Cairo, though not common in that part of the country. It answered pretty nearly to the characters that have been mentioned, and was at least a fifth larger in size than the mouflon of the south of Europe. In fact, it appears to be a sort of connecting link between the goats and the sheep; but its history is still too imperfect for enabling us to come to any distinct conclusions respecting it. It appears to have been discovered by different authors, as if it were two distinct species, some calling it the *ruffed* sheep, and others the *bearded* sheep; but its appearance at different ages and seasons has been too little observed for enabling us to come to any definite conclusion respecting it.

The history of sheep in the natural state is one which, though of much interest, is attended with many difficulties. That they inhabited most parts of Europe in the very early ages appears to be a point not admitting of much dispute; and the question arises, what has become of their bones? This is a question put, not only with regard to the bones of sheep, but to those of the greater part both of the mammalia and of birds, none of which are found in preservation, except in places where they have obviously been covered by a deposit of earthy matters. The only answer appears to be that, in wild nature, there are bone-destroyers adequate to the consumption of all the bones that may be left on the surface. The action of the atmosphere and the sun is the most powerful and most constant in its operation in the warmer climates; and then, in addition to this, there are many animals which gnaw bones. Of these the most remarkable are wolves and hyænas; though there are also some birds which, though they cannot of course gnaw bones, yet swallow and digest them. Now it will be found that where there are wild sheep or other wild ruminantia still to be met with, there are either wolves or hyænas, or both; and though the hyæna of the north belongs perhaps to a more remote period than the sheep (of which, however, we have no positive evidence), yet the wolf was certainly a

contemporary of the sheep in every part of Europe in which wild sheep ever existed; and it is not a little curious that, in most places, the two appear to have become extinct in some localities at the same time. Many of the old accounts mention that wild sheep existed on the Scottish hills at an early period of the history of that country. Hector Boece, who wrote a history of Scotland in the early part of the sixteenth century, mentions that there were then, in the remote isle of St. Kilda, wild sheep larger than the biggest goat, with tails reaching to the ground, and horns larger than those of the ox. It is very doubtful whether this most eloquent but highly romantic writer can be implicitly trusted in any matter of history, and more especially of natural history; and, therefore, if the matter rested upon his authority only, we should doubt, or even deny, the existence of these long-tailed sheep in any part of Scotland, and, even with the corroboration of the bas relief found near Glasgow in the ruins of the Roman wall, we must deny the existence of those sheep in the island of St. Kilda. At the same time we are ready to admit that there have been breeds of tame sheep in some of the remote isles appended to Scotland, as, for instance, the Shetland Isles, the origin of which it is no easy matter to trace. In fact, the whole history of the sheep as members of the animal kingdom in the wild state, is a subject of the greatest uncertainty, and one upon which conjecture may be exercised without almost any limit. This is the more to be regretted as the animals, when in a state of domestication, or rather semi-domestication—for that is all which, in general, is arrived at in the case of sheep—are so very useful and so very abundant to the hand of the cultivator.

We shall say a few words on the varieties of cultivated sheep by-and-by; but we may mention, as part of the general account of them, that they appear calculated for performing a service in the cultivation of the earth which cannot be performed by any other domesticated animals. Sheep nip or nibble the herbage, and thus never pull the roots out of the ground. But they nibble it very close, and thus none of the grasses upon a sheep-walk ever come into flower. Now it is the habit of all the grasses, and perhaps of the kindly and succulent grasses more than any others, to "tiller" at the roots, and spread upon the ground, if the flowering is completely prevented. We believe that this is true not only of those grasses which are perennial, but of the annual grasses, and even of the cereal ones, which are in use as the bread-corn of all civilised nations. In as far as the last are concerned, it is, however, a matter of minor importance, because there would probably be but little profit in breeding them back to the wild state, in which they should be valuable only as pasture grasses. But, in the case of those members of the grass tribe which are of little or no use to man as food, the management so as that they form a carpet or covering to the surface of the ground is of far more importance. Now we have, in many parts of the British islands, very convincing instances of the advantages that have resulted from the pasturage of sheep. We do not allude to the value of the animals themselves, in their wool, their flesh, and their skins, though these have enriched many a man, and many a district; we allude to the advantage which the soil itself derives from sheep, and the tendency which sheep-pasturing has to bring land into a state fit for tillage, or any other sort of culture. Those who have been for some time acquainted with those parts of the Highlands of Scotland, where the climate is not of so wet and dripping a character as to be injurious to sheep, do not need to be told how much the pasture improves under these useful and interesting creatures. It is true that in some places, where the sides of the hills are particularly bare and steep, the sheep tracks have cut the surface to such an extent that it has "peeled off" by the heavy rains, and left nothing but the bare gravel or rock, both of which are equally unfit for vegetation of any useful kind, or indeed of any kind at all; but situations in which this can happen are by no means fit for sheep pasture, not only on account of their steepness, but on account of their humidity, that is, of the habitual rainy character of their atmosphere.

In places which are sufficiently dry for being wholesome for sheep, these animals are the means of very great as well as of very speedy amelioration; and while, in those parts which are not pastured by sheep, heath, moss, and lichen consume the little grass that there is, and gradually convert the surface into one of the most sterile and hopeless character, in those which are pastured by sheep the grass extends, and the less valuable plants diminish. This effect is visible on very many parts of the Scottish hills, where sheep have been introduced for some time; and there is not a doubt that, after this kind of stock has been upon the ground for a considerable number of years, the soil may be, at very small expense, brought into use as tillage land; and the food of thousands may be obtained where but for the sheep there would not have been the means of supporting even one human being. Any one who chooses to inspect those parts of the Highlands of Scotland that have been for some time pastured by sheep will be able to certify what has been here stated, as to the effect of that kind of stock in ameliorating the condition of the ground. Wherever they have been, the heath, moss, and lichen are wearing away, and grass is gradually coming in their stead. The advantages which result from this are much greater than those who have not attentively studied such subjects would be apt to imagine. The heaths, mosses, and lichens produce bad mould—mould which is unfit for the production of any kindly plant; and their constant tendency is to cover the surface with bog-mould, which, when it once gets complete possession, is the ruin of everything else, and actually cuts up the better soil previously formed by the other plants, which it displaces. Any one who has examined, with even moderate attention, one of the numerous deep peat bogs which occur in the Highlands, and generally in all the cold uplands of the northern parts of Britain, must have been struck with the vast quantity of the remains of forest trees of large size—oaks, pines, birches, alders, and others, the greater number of which, the oaks especially, will not grow but upon rich soils; and yet, when the whole is examined down to the clay or sand which forms the bottom in such places, there is not one particle of the soil in which an oak, or any other of these trees, could grow, to be found. The top is spongy, and the bottom more solid; but there is not in the whole a single particle of earth in which any kindly vegetable could be grown. Yet, from what we know of the habits of the trees which are found in those deposits, there must once have been an abundance of rich soil; and

that soil has not been washed away by rains, or removed by any other mechanical means, for all is obviously in a state of nature, and the situations are places of deposit, not of wearing or wasting away. The question then arises, what has become of the rich soil that nourished those great oaks, and some of them are truly gigantic, which are now found buried in the bogs? The only answer that can be given to this question is, that the bog plants have not only exterminated all the more kindly vegetation on the surface, but have consumed the very soil by which those plants were supported, have destroyed both the produce and the land.

Now, if, in the places of its greater accumulation, this "poison of the bog," for so we may term it, is capable of eating up the soil which had sufficed for the growth of oaks of the largest dimensions, it follows, by obvious consequence, that, upon the general surface, where there is a cold and dripping atmosphere, the same plague will be able effectually to destroy the grasses, and all those more kindly plants which are available for the pasturage of stock. Nor is there any doubt that this is the cause which has rendered so much of the hilly parts of the country comparatively barren and useless; and pasturing with sheep appears to be the only means by which this evil can be cured. Therefore, these animals have a value beyond that which they yield in their carcasses and fleeces, great though that is.

This "poison of the bog," to which sheep appear to be the only certain and effectual antidote, is by no means a passive evil. When once established, it spreads, and no ordinary labour of man can arrest its progress. It invades the surrounding land, and invades it not merely with its presence, but with the climate which it brings along with it. That climate is decidedly a winter or polar one, one of cold and damp, and uncongeniality to every thing useful that the earth can produce. Summer is, in all temperate climates, really the winter of the mosses, unless they have so far got the better of every other kind of vegetation, as to have their own dripping atmosphere all the year round; and whenever this is the case, farewell to all that is beautiful or valuable on the surface of the earth. In average situations, the mosses are green and thriving only in the winter months; and whenever the state of things becomes such that they are green in the summer, then the almost necessary accompaniment is, that no other class of plants can be green at any season. In moss-clad places the winters are always extremely cold, because the mosses retain so much moisture, that every sunbeam in the latter part of the year is absorbed in the evaporating of it; and then, when the summer occurs, they are as liable to be parched with burning drought. They are constantly dying at the roots and growing at the summits, so that they very soon cover the earth with a deposit of moss in which no other deposit will grow; and thus the surface is ruined in as far as any valuable crop, or use in the finding of food for human beings, is concerned, once, and for ever, unless reclaimed at an expense of drainage and other means, which amounts to fully more than the fee-simple of the land. But this is not all; the evil, once having got the mastery in one place, steals onward in all directions; mildews and white frosts invade the portions under cultivation; and they spread and spread, till the whole country becomes barren and unprofitable. The writer of this article remembers well that there was no ripening of corn in the vicinity of the peat moss; and that though peat earth, when not too much soured by tannin, which it always is if the bog contains many remains of trees other than pines, is not unfavourable to the growth of the potato, the leaves of these plants used to be blackened in the early spring, and the crop became a perfect failure. Where matters have proceeded to this length, no pasture of sheep can be of any avail; but it is only in particular situations where this can take place, and over the general surface of even a moist country which is hilly, the moss itself cannot accumulate, but in time gives way to lichen, and that absolutely eats up the heather, and the result is a surface of absolute sterility. If sheep are introduced in time, this may be averted, and the grass nibbled by them, and kept from flowering, may spread, and in time produce a more kindly and valuable surface, to which the droppings of the sheep contribute not a little.

There is another state of things in which sheep are not less valuable, and that is where the tendency is not to produce moss and peat-bog, but arid waste. This is the ultimate tendency of nature on the dry downs in the south of England; and it is still more marked and conspicuous in countries which are of a more dry and sandy character. Whether the pasturage of sheep could have prevented the formation of the Great Desert which extends from the west of Africa to almost the extreme north-east of Asia, is a point which cannot now be determined, because that desert is confirmed in its desolation beyond any thing that human ingenuity and power can accomplish. But there are many other regions in which things have not gone to such extremities, where the introduction of sheep has been attended with the happiest effects. Spain, Saxony, and Poland are remarkable instances of this. Estremadura, the province of Spain which borders upon Portugal from the Tagus southward, is a country of a very dry and sterile character; and, as will be more particularly noticed afterwards, that is the principal "run" for the Merino sheep, whose wool has been so long and so justly celebrated for the fineness of its staple. The breeding of fine-woolled sheep in Saxony is a later improvement; but it is one which has been eminently successful in those sandy places which had well nigh ceased to be productive in any other way. In Poland the advantages of the introduction of these sheep have been still more remarkable. That country was long famed for the production of corn; and those portions of it which are annually flooded by the great rivers are still fertile. But their fertility is kept up at the expense of the rest of the country. Great part of Poland consists of very thin soil over a substratum of sand and gravel. The rains are very heavy upon it in the autumn, and the summer is very long. The soil is thus apt to be washed off the heights; and though there is a deposit on the plains by the banks of the rivers, the whole country suffers an unusual deterioration. This has been very much increased in consequence of the drain of the country by armies, which has reduced the number of domestic animals far below what is required for an agricultural country. So much was this the case about the time of the close of the war, that hardly any of the land could bear to pay rent, and not much of it could be cultivated to any advantage. The annexation of great part of Saxony to the kingdom of Prussia, had the effect of causing many of the Saxons

to sell their lands and migrate to Poland, where they have carried on, upon a very large scale, the same sort of sheep farming which had previously been so successful in Saxony, and by this means the country is in a state of improvement equally certain and rapid. Places which, not long ago were plantless, or covered with the most noxious and unprofitable weeds, have come into grass under the pasturage of the sheep; and if changed circumstances should again render it desirable that the breadth of Poland should be a corn country, the pasturage of the sheep is preparing it for being so, and at the same time the present profit to the occupiers is far greater and more easily brought to market than the produce they would have obtained by any other means. Soil which is best adapted for sheep pasture is also well adapted for the culture of turnips and potatoes; and the introduction of the latter especially has been of vast advantage to all the dry and sandy countries southward of the Baltic. Where the land is favourable to their growth, potatoes yield more food from one acre of land than rye, which was the staple domestic bread of the people of these countries, yields from ten acres; and thus there is a greater supply of vegetable food along with the sheep-walk, and the mutton remains for consumption in the country, which is a luxury that comparatively few under the old system could command. We have felt it necessary to make these few observations on the national advantages that result from the cultivation of sheep, because the subject is in itself highly important; and because in many parts of our country, the love of practices merely because they are old, however bad they are, has caused a prejudice against it. No doubt the throwing of large tracts of hill-country into sheep-walk, has rendered it necessary to remove the cottagers, whose dwellings at one time spotted the wilderness. But, how much soever the tenants of these miserable abodes might be devoted to the ground upon which they were born, and how dear soever the customs of their fathers may have been to them, in the judgment of reason they were out of place for the general advantage of the country, and still more for their own personal advantage. No matter what the prejudice is by which the general good is retarded, for it is equally worthy of removal be what it may; and though the removing of it may in many cases require no small degree of delicacy, yet that should not prevent it from being undertaken. We shall probably have occasion to advert to one or two circumstances which show the value of sheep, when we come to speak of the several breeds, which we shall do in as few words as possible.

Domestic Sheep (*O. aries*). Whether the many varieties of domesticated sheep which are found in various countries, or in the same country, are descended from the wild runs now found in the hills, or from a race which has now become extinct, is a question which cannot be solved, neither would the solution of it be of very much importance. It is probable that there have been originally two races, one with the tails long and the other with them short; but neither this, nor indeed any thing to which we can at present refer in wild nature, can determine the question of origin. The variations which climate and culture seem to have produced on sheep appear in different parts of their bodies. In some the horns are diminished, in others they are increased, and even multiplied in number. In some again the coarse hair which forms what may be called the outer clothing, wholly disappears, and leaves the whole body with only a soft and woolly fleece; while in others the coarse hair remains in greater or smaller quantity along with the wool. It does not appear, however, that the loss or the retention of the coarse hair has any very great effect upon the staple of the wool; for some of the finest woolled sheep, as for instance the old Shetland breed, have coarse hair and very soft wool under it. It seems a tolerably well-established law, however, that in humid climates sheep have a tendency to produce the rough hairs; that the wool is long in cold and exposed climates, where the sheep have to range much in search of their food, while on low and rich pastures the wool is much shorter. The form of the head, the size of the tail and various other characters, are altered by differences of breed and of pasture; but the causes of these are all very imperfectly made out.

There is one circumstance connected with this topic which it is important to attend to, and that is, the quality of the flesh, as connected with the character of the pasture. Sheep grow to a much larger size, and accumulate much more fat, upon rich pastures, where they have comparatively little labour. But this, though, in so far as quantity is concerned, the profitable state of the animal, is by no means the healthy and profitable one; and it is doubtful whether it is, on the whole, the most economical. As provisions of all kinds are valued and sold by weight, it is the interest of the grower to obtain, in all cases, as great a weight as possible; and, in order to obtain this, there is often a very great sacrifice of the quality. Quality, especially in such an article as mutton, if it be brought to market in a wholesome state, is very much a matter of taste, or, in other words, it is one which cannot be decided arithmetically, as pounds and ounces can be decided; and for this reason it is apt to be overlooked, or, at all events, to meet with less attention than it really deserves. From the superior flavour of wild animals above those which are tame, except in those cases where the flavour of the wild ones is too high, we may infer, that the nearer the condition in domestication is to that which it inhabits in free nature, the better must be the quality of the flesh. This is well established in the case of the sheep of our own country, where the mutton from the hills of Wales and Scotland, and also of the dry downs in the south of England, is vastly superior in flavour, more digestible and wholesome, than that of the large sheep of the low-lying pastures and midland counties. These are, therefore, clearly the places in which sheep ought to be bred with a view to their perfection as an article of human food.

Ought we, then, to abandon the flocks which look so well, and are so productive, in the rich and dry meadows? Assuredly not. But it is equally true that the flavour of the flesh cannot be retained if the sheep are bred "in and in," for a long time, upon these rich pastures. To breed in the uplands, and fatten on the plains, is a good rule in the case both of sheep and of cattle. Nor does it appear to be necessary that the animal should continue for a very long time on the upland. The quality, both of animal and vegetable substances, is determined from the beginning, or, at least, at a very early stage of existence; and, if it is transferred from the one pasture to the other while young, the quality of the upland, and

the quantity of the plain, may be both obtained in the maximum of perfection which they can jointly have in the same subject. These, however, are professional matters, though at the same time matters of great public interest; and we merely mention them to show how wide a field is opened up for useful study in the single genus, and probably species, of the sheep. We shall now enumerate some of the varieties or breeds, and in respect of these Africa appears to claim the preference over the other quarters of the world. The drought of the climate might perhaps lead us to expect this.

The long-legged Sheep is one of the chief in the northern and central parts of Africa. The general characters are: the legs long, and the form of the body stout, but the flank not so plump as those of the European breeds: the profile of the forehead is arched; the ears stick out nearly at right angles to the central line; the neck is short; but the tail is proportionally longer than in the common sheep: there are two kinds of covering on the body; on the fore part it is long and shaggy, and on the hind part it is woolly; on the breast especially it is very long, and pendent almost to the knees; the horns are rather short, curving round the ears, but forming only a portion of a circle. This seems to be pretty nearly allied to the bearded wild sheep of Africa, of which mention has already been made. But there are breeds in the different parts of the country which vary a good deal in their individual characters, as one might be prepared to expect in so wide a country as Africa.

The Morocco Sheep have the rough hair on the fore part of the body shorter than in the general type of the race; but the wool on the other part is longer. The ears are small, and so are the horns, which curve outwards. The colour is in general white, but occasionally varied with reddish-brown or liver colour. They are pastured in large flocks on the dry plains, both between the mountains and the sea, and on the other side of the mountains toward the desert.

The Guinea Sheep are without the long hair on the fore part of the body, and the long wool on the hind; and in some instances they are nearly without wool. The horns form nearly semicircles, with the points directed to the front. They are not long, but rather stout. The general colour of the Guinea sheep is white; but they have usually some black on the head; and it is said that, in proportion as the black is more abundant, the horns are smaller. The ears are pendulous in some of the varieties, and there are traces of goitres or enlargements on the sides of the neck. This breed is found not only in Guinea, but in the larger tracts of habitable ground which spot the desert. Some of them are without wool upon the body, and with a mane of silky hairs down the ridge of the neck, and partially on the shoulders. The females are without horns.

The Congo Sheep, inhabiting as they do a climate almost immediately under the equator, and intensely hot, are almost wholly denuded of wool, or indeed of covering of any kind; and they are lank, and apparently feeble, as compared with the sheep of temperate countries. The hair upon them is thin and bare, and only a very little longer on the throat than on the rest of the body. The horns are very short, and bent backwards; the ears hang down the sides of the face; and there are two goitres or pendulous substances under the throat. The tail is long, but slender, and almost without hair; the flanks fall in very much; and the colour is white, with clouds and patches of dull rusty brown.

Of Angola Sheep there are several breeds, and they differ in many particulars from the last mentioned, as well as from each other. One of the most characteristic of these is the goitred sheep, which, in its external appearance, differs very much from the sheep which we are accustomed to see in Europe. They are lower on the legs than most of the breeds in the west of Africa. The hair upon the body is short and close, not in the least like the wool of common sheep. The ears hang quite down by the cheeks; the horns are very small, curving forwards; the outline of the forehead is very convex, and it is also rounded from the depression between the eyes to the muzzle. There are two appendages which tend to increase the irregularity of form in the head of this sheep. There is one large rounded accumulation, or rather two lobes of it, under the chin, and another, and rather larger one, beginning at the base of the horns, and reaching backwards a little on the occiput. These look as if they were deformities resulting from disease, but such is not the case. They are not glandular affections, like the goitres. They are provisions of nature for the subsistence of the animal at those times when, from the burning up of the vegetation in the dry season, it can find but little food. They consist of hard and curdy fat, very similar to what accumulates in the hump of the camel, or in the dewlap of the ox; and this sheep, as an animal something intermediate between the camel and the ox, has both the hump and the dewlap, only they are seated much farther forward on the body. Fat of this description is not so liable to be softened and turned to oil, by exposure to heat, as the common fat which animals accumulate in temperate climates; and thus it suits well with the habits of animals which inhabit tropical countries. It is only, or chiefly, in the graminivorous animals that it is found; and it is found only in such of them as are not fitted for a very extended range of motion at the different seasons. The antelopes, for instance, are capable of dashing over many hundreds of miles; and they can thus follow the season of fertility, as it changes from latitude to latitude. Sheep have not this extensive power of ranging; and thus, in proportion as the dry season upon their pastures tends to produce sterility, they accumulate stores of this curdy fat to support themselves under it, whereas the ranging antelopes require no such provision, and accordingly they have it not. The camel, though a strong and patient animal, is not a ranging one, and it is also provided with a store in the hump against the time of famine in its native localities. The means which animals thus have of storing up a portion of the produce of the time of plenty, to serve them when the reverse comes, are among the most extraordinary and at the same time the most instructive adaptations in the whole animal kingdom.

One other character of the goitred sheep of Angola is the great length of the tail. It is not thick, or in any way loaded with fat, but it nearly touches the ground. The colours of the animal are generally pale brown on the upper part, and white on the under.

There are other breeds of sheep in the same country with this one, which, in some particulars at least, have more resemblance to the sheep of Europe; and

they are covered with longer and very fine wool; but they all have the very long tails and the pendent ears which are so characteristic of this one.

In Southern Africa there are many breeds of sheep which have been introduced by the colonists, and farther multiplied by crossing. Besides all those which are really sheep, the sailors call the albatross the "Cape sheep," because, when on the water, the size and colour of these birds have some fancied resemblance to those of sheep. There is, however, one Cape sheep which deserves the name, as being a native of the Cape colony. This species is

THE HOTTENTOT SHEEP, OR BROAD-TAILED SHEEP. These sheep get their common English appellation from the enlargement of the tail, which is not, however, in the organ itself, but in an accumulation of fat upon the sides. This fat is of the same curdy nature as that in the goitre and occiputal lump of the Angola sheep, and it is of course intended by nature to answer a similar purpose; but it is not a little singular that of two varieties of sheep, both inhabiting the same quarter of the world, the one should accumulate this store of fat on the head, and the other on the tail. It is, of course, of no great importance upon what part of the body of the animal this store of fat is accumulated, as the absorption of it, when required, can as easily be made at one part as another; but still there must be a cause for this difference, just as there is for the fat of some animals being outward, that of others inward, and that of others still distributed through the body.

The broad-tailed sheep of the Cape may be considered as an eastern race, in opposition to the sheep of Guinea as western races. It is smaller than the common sheep, and rather a handsome animal. The females never have horns, and the males are not unfrequently without them. The tail is long, though not so long in proportion as in the sheep of the west of Africa, and it terminates in a thin point, which is slightly turned outwards. The accumulation of fat lies on the outer side, where it increases the thickness of the tail more than it does the breadth. Its covering is not so properly wool as short white hair, which is pretty uniform over the body; but a patch over the eyes, the tips of the ears, and some parts of the legs, tawny. As found in southern Africa, these sheep are very delicate animals; and when taken on board ships, they waste away if the weather is severe.

This appears to be the parent race of the sheep in a very extensive range of country, namely, from the Cape of Good Hope northward, through Africa, and so through Asia, to the extreme north-east of China and the borders of Silesia. It is natural to suppose that, in so extensive a range, there should be many climatal varieties; and as these meet with the sheep of other places on the confines, and all sheep appear to have fertile progeny, how much soever the breed may be crossed, it is natural to conclude that there should be many mixed varieties arising from this cause. Mention is made of some at the Cape which are of larger size than the Hottentot sheep, and which blend the characters of these with those of the sheep of Guinea. This has the head of a black colour; the horns are longer, and the fat on the tail forms two lateral lobes, which, like that on the other, have the under side of the lobes quite free from hair.

From the peculiar zone of the earth over which it extends, and which includes nearly the largest line that can be drawn wholly upon land, these must have, in the course of time, been the sheep of many races of men, and have been subjected to many changes in the altering states of their country; for there is no doubt that, within the period of human history, many thousands of miles of that country have passed through every gradation from the most fertile to the most irreclaimable desert. There is, of course, nothing in the present character of the sheep which can throw, or tend to throw, the smallest light upon the history of the countries; but, at the same time, they are not a bad artificial memory of the facts, if the history is once known. In the north-east of Africa there is a variety of the broad-tailed sheep which deserve the name more than that of the Cape, for the tail is so wide at the basal part that it extends completely over the buttocks. It has the line of the forehead nearly straight, the horns not unlike those of the *Argoli*, the wool very coarse, and the coloured parts of a deeper shade than in the Cape sheep, though they are marked in nearly the same manner. Another variety, found in northern Africa, and also in some of the rocky isles of the Mediterranean, has often more than two horns; their ears are slouched, the tail not enlarged, and the colour generally, but not in all cases, white. Several experiments which have been made show that, when the sheep of the warm countries, which are there covered with short hair, are brought into cold countries, they acquire the woolly coat of the ordinary sheep of those countries even at the beginning of the winter. They at the same time retain the agility in leaping which is characteristic of the sheep of the southern mountains, which are not encumbered either by a heavy fleece or by fat distributed over the body.

In Asia there are very many varieties of sheep, the greater part of them having more or less analogy to the broad-tailed race already mentioned. They are generally named after the countries in which they are found; and, as they often differ very little from each other, some confusion is produced by the same species or variety being obtained from different places, and called by different names.

One of the most celebrated of these breeds is that which is called the *Astrachan*, not of course from its inhabiting that city or even that province, but because Astrachan is the centre of the trade in the skins. Their furs are well known in all the countries of Europe in which furs are used; and vast numbers of them are sent to China by the caravans which traverse Siberia. These furs are called Siberian lambskins, Crimea furs, and other names. They are usually of a grey colour, produced by the mixture of black and white, and they are closely and very prettily curled. Some are quite black, and they fetch a very high price, though the fur can be dyed as other wools can; but then a dyed fur is a very inferior article both in appearance and in quality. The dye takes off the gloss of the fur, and at the same time weakens it very much, and loosens its adhesion to the skin. These furs are obtained at a great sacrifice of the value of the sheep, and also by the practice of what seems very revolting cruelty. They are the skins of the lambs taken from the uteri of the mothers just a few days before the time that they would be dropped in the ordinary course of nature. If the lamb is ever dropped, and left to dry in the atmosphere, the beautiful curl of the fur, in a great measure, goes off; and when the animal reaches its full size the character of the skin changes still more

by the white portion turning dull and yellowish, and long and coarse, so as to shade the fine grey wool which is below.

There is something revolting and also at variance with the sound principles of political economy in the obtaining of this fur. To sacrifice one animal for the sake of its skin is bad enough—only that it happens that the greater part of the fur animals are those which man makes a merit of killing, besides the value of the skin, as they are all predatory animals, and most of them very destructive ones; but the idea of sacrificing a ewe and a lamb for the sake of a lamb-skin, is one at which not only feeling, but frugality itself, stands aghast. Both the mother and the young are at this time unfit for human food, or, at all events, they are unwholesome and not nutritious; and the very sheep themselves read us a pretty sharp homily against this species of cruelty, for the sheep do not eat the flower stalk of the grass from the time that the flower appears till that at which the seeds ripen. In most cases there is a conservation by Nature itself in the time of reproduction, whatever may be the case with the young when they have separated from the parent, whether in the state of the organised animal or in that of the egg. It is perhaps a palliation of this cruel practice that it is performed by a barbarous people, and in a place where sheep are not of the greatest value; but still it is equally repulsive to the feelings of civilised men, and contrary to their notions of proper economy in the management of animals.

When full-grown the Astrachan sheep are below the ordinary size of the sheep of Europe. The horns of the males curve backwards, and are spiral toward the points; the ears droop very much; the usual colour is dull white in the upper and coarser wool, and grey in the under and finer; the tail is not very broad, but still it indicates that this breed belongs to the broad-tailed races.

There are many breeds of sheep in the south-east of European Russia and the adjoining portion of Asia, which differ from the sheep that yield the fur in the way that has been described, but all of which show that they are, to some extent or other, related to the broad-tailed sheep which, as we have already mentioned, occupy so vast a length of country from south to north-east. One of these is wholly without horns, has the line of the forehead nearly straight; the ears directed obliquely downward to the front; and appendages to the throat. It is white in the body, and the wool is of good quality; the face is of a dull yellow colour; and the tail, though very broad and overlapping the buttocks, is short compared with that of most of those connected with the broad-tailed race.

A little farther north in Siberia, and also in European Russia, there is another breed which, instead of being hornless like the last-mentioned one, has generally four horns in the male. These horns vary in number; they are rarely fewer than four in the rams, sometimes they are five, and in those cases one of them takes a central position, and in other cases they are six; they have appendages under the throat; and their covering, though long and thick, is very coarse, and may be considered hair rather than wool. They are very hardy animals, and endure without injury the severest cold of those parts of Siberia and eastern Russia in which they are found. Their covering is of mixed colours, generally reddish-brown and dull white in the males, and dusky black and white in the females.

To enumerate all the Asiatic breeds of sheep would, however, be a very tedious and not a very interesting process; for what with differences of climate and pasture, what with the crossing of different races, the varieties are very many; and not only this, but, as is the case with many of the sheep of our own country, the same breed is often apt to break into varieties, the causes of which cannot be very easily explained, nor would it, in all probability be of very much value though we could explain it.

The *fat-rumped sheep* of central Asia have the accumulation of fat differently placed on the body from any of those that we have yet noticed; but it is of the same consistency, and, of course, answers the same purpose in the economy of the animals. They have the line of the forehead a little arched; the muzzle slender; the ears narrow and drooping, and the horns small or wholly wanting. There are a good many varieties of them, some with appendages to the throat and some without, and they are called Persian sheep, Tartarian sheep, and other names, according to the places in which they are found. Their colours are mixed, generally reddish-brown and white in the male, and dusky black and white in the female; their wool is fine, and though, in the different countries in which they are, they vary a good deal, they may be regarded as, upon the whole, a valuable breed of sheep. In the Caucasus, especially in Circassia, there is a peculiar breed which have the tails so long as to trail upon the ground. They have spiral horns of no mean dimensions; have coarse but very strong wool, and are generally coloured, and often altogether black.

In India there are several breeds; but altogether India is not very favourable for sheep, either in respect of wool or of flesh, as the one part of the year is too warm and dry, and the rains are too heavy during the other part. Some of the Indian sheep may be said to be wholly without wool, and they are as bare and lanky as skeletons. But in the high grounds some of the breeds are better; some of these have the coat neatly curled into little screws, and of a pure white colour. There are a good many varieties both in India and in China, but they are every way inferior to the sheep of the more northerly countries. The wool is in general very coarse, and the flesh is inferior. Animal food is so little used, however, by the people of these countries, and especially by those of India, that the rearing of sheep for the butcher is a matter of very secondary importance. The superiority of the wool is proved by the fact, that the coarse woollens of British manufacture are among the most saleable goods that can be carried to the Chinese market; and although the common people of India wear little else than cotton, yet the finer woollens are in demand for great personages, state appearances, and the decoration of the temples and idols.

In Europe the breeds are so numerous that the details of them would furnish matter for a volume of considerable size. In fact, Europe may be considered as pre-eminently, above all other parts of the world, the region of sheep; and this partly because they have been more attended to than in the other quarters of the world, and partly because the pastures are both more perennial and clothed with more abundant and kindly grasses. No part of Europe is without its sheep; and in very many places they form

Persian.

Guinea.

Many horned.

Rocky mountain

a most essential part of the wealth of the people. The changes which have been effected by crossing and other means of artificial treatment in the sheep countries, are almost inconceivable, and the parent stocks appear to have come from different parts.

The many-horned sheep which have been already alluded to as inhabiting far to the northward in Siberia, appear to be the most northerly of the European ones. They are found in Sweden and Norway, in the Feroe Isles, and in Iceland. The breeds in most, if not in all of these places, are, however, very much mixed in consequence of the importation after inclement seasons, which are very fatal to sheep in those inhospitable countries, of supplies from other quarters. Those sheep of the extreme north of Europe are rarely if ever white, but rather of different shades of a rusty brown. They are rather a small race, but very hardy; and instances have been known of their existing for a considerable length of time buried up in the snow; and, even in Iceland, some of them are left to shift for themselves during the winter, at which season they are said to scrape up the snow for lichens, much in the same way as the rein-deer in Lapland. They are well adapted to the severity of the climate in the nature of their covering, which consists of three distinct kinds; the first is long coarse hair, which throws off the rain or the snow like a thatch; the next is a very closely matted, but rather coarse wool, which is the portion in common use by the people; and the third is close on the skin among the roots of the others, and exceedingly soft and delicate. It is of this kind of wool, though not from exactly the same breed of sheep, that the very fine stockings were made, for which Shetland was once so celebrated, but which appear to have fallen off in late years. The proper Iceland breed have the horns very irregular in number, amounting to three, four, or five, standing in different directions, but not forming screws like the horns of many other sheep. Their legs are slender, and their hoofs long and sharp, so as to be well adapted for keeping a footing either on the rocks or on the ice.

The *Cretan* sheep, though not confined to the island after which they are named, and on the mountains of which they are very abundant, are remarkable for the shape of the horns. Their horns are large, and with a very marked crest or edge on the front; at the basal part they form one complete turn of a spiral, and then they form three turns of a loose spiral toward the points, the one rising above the other, and then the tip nearly vertical. This peculiarity in the form of the horns belongs to the male only, for in the female they are much smaller, nearly straight, and divergent from the head. These sheep are about the same size as the common breeds, and rather handsomely formed. Their tails are long, and their ears small, and inclining downwards; their wool is coarse in the staple, and waved or slightly curled; the body is generally of a whitish colour, but the face and legs are dark, and sometimes nearly black.

It is probable that this breed is in some way connected with the long and coarse-woolled sheep of western Europe; and there is a race in the hilly boundaries of the lower valley of the Danube which have some resemblance to them, and which are called Wallachian sheep.

Among all the breeds in Europe, the *Merinos* have acquired the greatest celebrity. It was in Spain that they first obtained this, though, according to the chroniclers, they are of English origin, being the progeny of a score of ewes and fine rams presented by Edward IV. to John, King of Aragon, about the middle of the fifteenth century. How they came by their fine wool in Spain has not been stated; but if they are of an English race, it appears that that race has either become extinct or degenerated; for, until a fresh importation, no English sheep of modern times had wool of nearly the same fineness of staple. At present it does not appear that the transfer of these sheep to a warmer climate tends to make their wool finer, but rather that this is the effect of their being changed to a colder one. The wool which is now imported into England from Saxony and Poland is said to be superior to that which was formerly obtained from Spain, and it certainly is of finer staple than the Spanish wool of the present time, though there is no doubt that the long troubles to which Spain has been subjected have injured that as well as every branch of the industry of that unfortunate nation.

Whether from Spain, or from any other country into which the breed has been introduced and preserved in a pure state, this wool is superior to every other for the manufacture of fine cloths. It is a short wool, much matted in the body of the fleece, and curled into little screws at the points. It is best adapted for being spun into soft yarns, and the cloth is thickened by fulling, so that a piece of fine cloth partakes of the nature of a woven fabric, and also of a felted one. Its shortness and pliability fit it better for felting than any other wool, and it is superior to every other for the ground-work of hats, which are lighter, stronger, more water-proof, and hold the beaver better than any other material.

The west of Spain was the great place for these sheep, some of the flocks of which ranged, in the course of the year, over great part of the length of the kingdom. These travelling flocks were called *Transhumantas*, or passers over the soil, as distinguished from the *Estantas*, or stationaries, which remained in the same district. They usually wintered pretty far to the south, in New Castile, Estremadura, and even in Andalusia, but when the grass came up on the pastures, farther to the north, which was in March or April, they took that course, moving northward, as the heat of the summer began to parch the more southerly plains, and proceeding as far as the Pyrenees. They then began to retrace their steps, so as again to reach the south before the winter.

The Merino is rather a handsome sheep. The horns of the male are large, formed with spirals with the tips curving forward and outward, and the females are without horns; the body is thick and round, and the head rather large, with the profile of the forehead but little convex; the cheeks and forehead being covered with wool, make the head appear larger than it is in reality; the colour of the wool is pure white, but, from its closeness and oily nature, the dust adheres to it much more than to coarser wools, and thus, upon most pastures, the external colour is brownish.

Merinos have been often introduced into Britain, and valuable crosses have been obtained between them and some of the native breeds, but they do not appear to be very well adapted for British pasturage in flocks of the pure blood. In many places the climate appears to be too humid for them, and, generally speaking, there is not range enough on the pastures. There are also other considerations

which have to be taken into the account. Fine wool, as is the case with all fine products, cannot be obtained but at a considerable sacrifice. Though

Merino sheep.

pound for pound, the wool of these sheep is much more valuable than ordinary wool, yet the fleeces are very light, the animals delicate, and the flesh inferior to that of many of the others; so that, all things considered, Merino sheep are by no means the very best adapted for a highly advanced state of agriculture. They would need the best of the land, but they would not pay the rent that land fetches in Britain. They, in fact, have their proper locality where the country is in a sort of intermediate state between absolute neglect and high cultivation. Besides, in the rearing of sheep, though the wool is a very valuable consideration, the mutton is far more so in all the more rich and valuable districts especially; and, generally speaking, in a country like Britain, where the land, like all other means of wealth, is understood to be worked up to the maximum of profit that it can yield.

The management of sheep kept for the profit which they yield, the points of excellence which distinguish the different breeds, and the whole details of these most interesting and valuable animals as the property of man, and one of the means that contribute most largely to the wealth and comfort of society, belong to rural economy rather than to natural history, even in the popular view of it. But still there is something so pleasing about sheep to people of all conditions, from infancy to hoary age, and there is such a filling up of the different pictures of rural innocence and enjoyment, by the appearance of the flocks which we observe on the different pastures, each so well adapted to that on which we observe it, that even the short notice to which we are necessarily restricted, in a work of so many subjects as the British Cyclopædia, we cannot allow ourselves to be altogether silent on the subject. No one who has seen the beautiful contrast of the green meadows and inclosures, with their snow-white sheep, in such counties as Northampton and Leicester, can have forgotten the soft luxury and repose which they indicate—no one who has caught the balmy breeze of the spring upon the open downs of Sussex, and seen the wide-spreading flocks nibbling the surface till it emulates the softest velvet—and no one who has seen the dusky-faced tenants of the hill standing sturdily to windward, and facing the storm, or the island sheep upon the wave-beaten cliff, bristling the array of horns over the expanse of that ocean whose tempered and humid breezes maintain constant plenty on those wild and craggy places—no one who has contemplated all or any of these scenes, can have forborne to feel how tame such would be without its sheep. We shall therefore cast a very momentary glance on the leading breeds of British Sheep and their adaptations.

The feeding-grounds for sheep in the island of Great Britain, taking it in the whole extent of its surface, and the utmost variety of its soil and climate, may be reduced to four. These four are, of course, merely averages, and the kinds of situation to which they apply approximate each other on the confines, but they will show the general principle of gradation that runs through the whole. The four situations are: First, the rich parks, inclosures, and meadows, which alternate with the ground under tillage, and could themselves be profitably turned to that purpose. Secondly, the downs, or dry and rather elevated commons, which have a much thinner soil than the first, and could not yield an adequate return under tillage unless some extraordinary circumstances caused an unnatural demand for their produce. Thirdly, the high and rugged mountains, on which cultivation could not be profitable under almost any circumstances that could be imagined. Patches of these are often much more rich than any that are to be met with on the dry downs and commons; but the surface is more irregular and difficult, and the sheep require to be of stronger build and more hardy constitution. Fourthly, the small islands and rugged peninsulæ, chiefly in and toward the northern and north-western seas. These are not subjected to such alternations of heat and cold as some of the others, but they require to be formed and fenced in such a manner as to endure much rain and sleet, which are among the severest trials to which sheep can be subjected. We shall find that the native, or, at all events, the oldest breed in these last places, is that which we have already noticed as occurring in the extreme north from Siberia to Iceland, and which was, in all probability, introduced into the remote isles by the early Norwegians when they were lords of the North Sea. The breeds of sheep adapted to these localities, or which would be moulded by them, if allowed to remain long enough in full exposure to the climate, have differences pretty strongly marked. If we take them according to their wool, and in the order in which we have enumerated the different pastures, they are—long-woolled sheep, short-woolled sheep, rough-woolled sheep, and mixed-woolled sheep.

The characters of the bodies are: the long-woolled ones large in the body, and generally high on the legs; but they cannot be fattened, or even kept in good healthy condition, except upon rich pastures. They are too heavy for the fatigue of the uplands, and of all sheep they are the most quiet and gentle in their dispositions, and the least prone to range about. The short-woolled sheep are more compact in the body, with shorter and cleaner legs; they are much more easily fattened than the others; their flesh is much superior in flavour to the long-woolled sheep, and they are much more active and ranging, so that they are by no means so well adapted for farm-sheep in the meadows and enclosures, as they are always attemping to break through the restraints; and, even if they do not succeed, the attempts irritate

their dispositions, and prevent them from fattening so well as they would do on their own pastures, if they had more full range. The rough-woolled sheep are of a still more robust and energetic character, and can be reared and kept to advantage only where there is a wide range for them. They are bold and daring animals as compared with the other sheep, and they defend themselves stoutly against foxes and other predatory animals. Their wool is long, thin, and coarse in the staple; and although their flesh, when in good condition, is finely flavoured, they are by no means profitable sheep, unless in places where none of better quality can be introduced. Their chief recommendation is their hardihood both against the weather and in ranging about; and Burns mentions two of their bad qualities—

"Muirland rams,
Wi' woo' like gaits, an' feet like trams."

In the north of England and the south of Scotland we believe that this breed has been almost entirely replaced by other and more valuable ones, but it was once common on the hills; and the Lothian proverb, "As bold as a *Lammermuir Lion*," is not wholly ironical, but alludes to the fierce looks and daring character of the hill-sheep on Lammermuir as compared with the more gentle ones which had been introduced on the low grounds. The mixed-woolled sheep are a very hardy, but a very diminutive race, and yet there is reason to believe that they could be greatly improved by rich pastures; and, from their power of bearing rain with comparatively little injury, they might probably be introduced with advantage in many places where more delicate sheep cannot be kept in health.

Repeated crossings have produced a great many varieties in all these kinds of sheep, so that they approximate each other, and every sheep farmer that has the requisite knowledge of his business can readily find the stock that is best adapted for his farm, whatever may be its character. Not a little has been done by amateurs and societies for the improvement and adaptation of the breeds of sheep; but there have been occasional evils arising from the same source, as there always are in cases where men follow the dictates of authority instead of the judgment of experience; and there are few cases more likely to be mischievous in this respect than those that relate to sheep, where a very slight difference in the soil and climate demands a difference in the kind of stock.

The leading named varieties of the long-woolled sheep adapted to the rich pastures are—the *Lincoln*, the *Tees-water*, and the *Dishley;* but, in addition to these, there are many others.

The Lincoln breed have no horns; their faces are white, their bones large, their legs rough and stout, their skin thick, and their wool very plentiful and long, varying from a foot to a foot and a half. Twelve pounds, which is more than that of any other sheep, is about the average weight of the fleece, and the length makes the wool in much request for those fabrics which are not felted, or have a nap on them, and also with the frame-knitters. These sheep are accordingly bred in a great measure for their wool. Their flesh is, however, of coarse fibre and inferior flavour, and the animals cannot be fattened except on the rich meadows near the sea, which are wholly or partially irrigated at certain seasons of the year. Lincolnshire especially, Romney marsh, and the other pastures which resemble these, are the best places for this breed when wool is the object. In places which are more dry and less rich, the carcasses can be fattened for market a year earlier than in those richer districts; but still the fleeces, of which there are three in the one case and only two in the other, and the greater age and weight, make the pasturing of them on the rank ground by far the more valuable. There appear to be many breeds which have originally proceeded from the Lincoln, and among these, in all probability, we must include

The Tees-water. They are shorter and lighter in the fleece than the original Lincoln, but they are more handsome, and very much superior in the carcass; their legs are longer, but more clean made; their bodies are thicker, broader in the back, and heavier, and the flesh is finer both in grain and in flavour. They are much better mutton-sheep than the Lincoln, though inferior for wool, at least in so far as quantity and length of pile are concerned. The two together are examples of breeding two races out of the same stock, and breeding each of them with a separate object in view—the Lincoln for the wool, and the Tees-water for the carcass.

The Dishley breed, called also the New Leicester and the midland sheep, is, at least appears to be, a breed from the Lincoln through the Tees-water. The method of obtaining these improvements consists, of course, in repeated selection of those individuals that have the wished-for quality in the greatest perfection; and whether the wool, the fineness of the fibre, or the disposition to fatten, be the chief object aimed at, it may in time be obtained without any positive crossing. The bones, the skin or pelt, and the wool, appear to go together, and an increase of them is accompanied by coarsenesss of fibre and difficulty to fatten. The increase of the wool is chiefly in the length, but that of the bones and the skin is in strength and thickness; but the long wools appear to have more strength than the short, that is, they afford more lasting fabrics, though not so soft and warm. The midland breed are very handsome sheep; their heads are clean and neatly formed; they are broad on the backs, and the body is cylindrical and very compact; their horns are slender; they fatten easily, and the flesh is excellent, not so high in the flavour as that of some of the hill breeds, but more juicy; their fleeces, not being naturally so oily as those of the short-woolled sheep, do not harbour much dust upon ordinary pastures, and thus they appear beautifully white.

There is another variety of long-woolled sheep, called *Devonshire Nots*, which have some resemblance to the midland breed, but are inferior to them in several respects. Their wool is coarser, their bones larger, and, though they make well up at the sides, they are ridgy in the back. This is their general character upon the richer pastures, but they are different on those which are bleak and elevated. On *Exmoor* they are less by one-third, with the bones very small, and the flesh of good quality, but the shape of the body is not good; and, though these sheep answer well where the land is of no great value, they would not be profitable in the agricultural districts. There are several other varieties of long-woolled sheep, but those which have been

noticed are the most extended and best known to history.

Of the short-woolled sheep there are more varieties than of the long-woolled ones. They are all of too roaming a character for the arable lands, and they are too delicate for the mountains. They are extending over most parts of the country, however, though, in proportion as they are more northerly, their pasture must be less elevated and exposed.

The *South Downs* are probably entitled to take the lead among the short-woolled sheep. They have the wool very short and fine; they are without horns; they have the face and legs of a grey colour, are light in the fore quarter, and have the back a little too ridgy; the hind quarters are very full and well shaped; and, though the carcass is light as compared with that of the midland sheep, the flavour is superior. The downs upon which the best of these sheep are pastured are mostly chalk, covered with short and fine herbage; and the sheep, especially on the higher walks, have the finest air and plenty of exercise, and are in consequence very healthy. There is nothing which shows the healthiness of a sheep-walk, and the fact of the exercise which the sheep have in feeding, more than the quality of the fat, which is always tallowy, and inclining to be rancid, when the pasture is unhealthy, or the animals have not sufficient air and exercise; and when thus improperly assimilated, and therefore indigestible and unwholesome, the quantity may be much greater than when the quality is very superior. South Down mutton is much in request in London by those who are particular in the flavour, though the larger sheep of the midland breeds furnish joints of greater show. The fleece of the South Down sheep, though of fine texture, is light, averaging between two and three pounds.

Though, therefore, they must be considered as good wool-bearing sheep, in so far as quality goes, the quantity is inferior; and their real value rests upon their superiority as mutton-sheep. If we take both quality and quantity into the account, they have few equals in this respect. They have not the exquisite flavour of the "wee sheep o' the Heelands," no doubt; but they yield better, and their flesh is both very digestible and very nutritious. It owes much of this to the fine pure air of the Downs, as well as to the small and sweet grasses; and though the wild thyme and the mountain trefoil give a zest, we are not sure that they add any thing to the wholesomeness, though they do not subtract. An engraving of the South Down is given on page 665 of this article.

The *Herefordshire* breed are of small size, but excellent quality. They have the legs and the face white, and the wool advancing upon the cheeks toward the eyes, though not so far as in the merinos. They are handsome little sheep, furnishing mutton of the very best quality; and the staple of their wool is fine, though the fleeces do not average above two pounds each. These sheep are housed during the night, in cots erected for the purpose; and on this account they are sometimes called *cotting* sheep. They are also called the "Ryland" breed, from the fact that the lands, upon which they were first introduced in stock as herded flocks, being of so light and dry a nature as to be fit only for the growth of rye. The continued pasturing with these sheep has, however, tended greatly to improve the quality of the soil, and the land is now equal to the production of any kind of crop that may be suited to the climate. Thus these sheep furnish a very striking proof of the certain advantage of the introduction of sheep upon arid light lands, when these are so weak or exhausted as to be unfit for any of the more valuable kinds of grain. In tillage husbandry there is no amelioration for such lands, but by the application of manure in large quantity. But the very same circumstances which occasion the exhaustion of the land, lessen the quantity of manure procurable in the vicinity; and even if the manure can be had, great part of it is wasted, because it does not bring a covering of continuous vegetation to protect the surface during the severe seasons. It is worthy of remark that the parts of Saxony and Poland, into which the Merino breed of sheep has been recently introduced with so much advantage, partake not a little of the same character which tradition gives to the land upon which the Hereford sheep have been introduced with so decided advantages. That is to say, they were "rye" lands before the sheep were placed upon them; and not only that, but they were so far exhausted that the crops of rye had become very light. Thus we see that when we get hold of a sound philosophical principle in the study of nature, it carries us much farther than we would *à priori* conjecture, and it always carries us in safety.

The *Dorset* breed is one of the most esteemed of the short-woolled sheep. They generally have horns, white faces, tall and slender legs, and long and rather thin bodies, but they are heavier than the South Down or the Hereford; their flesh is finely flavoured, and the wool, which is heavier in the fleece by a fourth than the South Down, is at least equal to it in quality. There is one property of the Dorset sheep, and of the lands of other countries that are related to it, which gives it an additional value over some of the others. By proper management, lambs may be obtained at almost any season of the year; at least they can be brought to the London market at or before Christmas, at which time they fetch a high price, and amply repay the additional care and trouble that are necessary in the procuring of them. This breed are pretty widely ramified over the south of England between the Devons on the one hand and the South Downs on the other; and they extend northward in the sheep tracks, till they come to blend with the midland breed formerly noticed. They differ much, however, in the different parts of their range, as attention has been paid to their various qualities. In some places, the principal object has been the carcass, in others the wool, and in others again the adaptation to some particular kind of pasture; and these have produced so many diversities of appearance that it is not easy to give a general description.

The *Norfolk* breed, which are chiefly to be met with in the dry parts of Norfolk and Suffolk, are a very discursive and restless race, and require very extensive pastures. They have large bones, long and strong grey legs, a long and thin body, black faces, and long spiral horns. They are of much larger lineal dimensions than the Dorset breed, but the weight is not greater, and the fleece, which, however, is short and fine, is only about half as much. The activity of this breed makes them consume a great deal of food, and therefore they are not the most economical in their keep; but the countries, where they are chiefly cultivated, are favourable for turnips, and the sheep

are less injured by being driven to market than almost any other race of the genus.

The *Cheviot* breed cannot exactly be said to be either long woolled or short woolled; and they do not agree very well in character with any of those in the south or the midland parts of England. They are an intermediate sort between the sheep of the grassy downs and those of the mountains, where, although many of the grasses are rich and sweet, the patches in which they occur are separated by barren divisions. The pure Cheviot breed may be considered as more peculiarly the border sheep, as the border hills, both of Scotland and of England, are especially their head-quarters; but they have been distributed from these over the greater part of the sheep grounds in Scotland, which are not very much elevated, and also into the mountainous parts of the north of England, which are too much elevated for the advantageous introduction of the Teesdale breed. They have been much mixed with other races; and, in different places, they themselves have been bred with various degrees of skill and care; so that there are considerable local variations in what are called Cheviot sheep. When pure, they have the face and legs white, and the former quite bare of wool; and the jaws are long, and the head neatly formed. Their limbs are lightly and cleanly made. The body is long, but there is a want of breadth both in the breast and the dorsal portion, though the latter is not ridgy. The average weight is nearly the same as that of the South Downs, and so is the fleece, but the last is longer and not so fine in the staple. It appears that this breed have been mixed with others, both at the upland and the lower boundaries of their pastures. The cross with the mountain sheep has taken place at the first of these boundaries, and that with the Lincoln, or rather the Tees-water, at the second. The cross with the mountain sheep is known by dark patches upon the face and the legs, a lessening of the size, and a deterioration of the staple of the wool, although with rather an improvement in the flavour of the flesh. It is against this deterioration that the observation of Burns is directed, when he alludes to the coarse wool and clumsy legs of the mountain sheep in the passage that has been quoted. The cross with the Leicester breed produces a sheep of very great value for situations moderately upland, as the hardihood of the Cheviot is in a great measure retained, while the plump carcass, and the lengthened fleece, rather increased in fineness, are to a considerable extent communicated. As already mentioned, the Cheviot and its crosses have been with much advantage introduced upon the secondary heights, in the eastern and central parts of the Scotch Highlands; and now that a rapid communication with London, by means of fast-sailing and ample steam ships, is established with the Forth, the Tay, and the Dee, there is no doubt that an additional impulse will be given to the culture of sheep in that end of the island, where it certainly may be carried to double its present extent with great advantage to all parties. As the fleece of the Cheviot is a secondary consideration in this traffic, and as it is limited to pastures upon which grass predominates, and where the climate is not too humid, it may be that the facility which is thus afforded in bringing the carcass, or rather the live animal, to the southern market, may cause fresh attention to be paid to the old mountain breed, which has certainly been treated with a neglect which it does not merit; and no small part of the cause of this appears to lie in the fact that the improvers of sheep in the north, instead of looking at the state of things as before their own eyes, where they could have made the experiments, and acquired the information for themselves, have been carried away by what has been done in the south, where the physical character of the country is very different; and by pursuing this course, which is unquestionably not the wisest one, they do mischief with the "best intentions," and, like other labourers in the same vocation, glory in the doing of it.

The *Black-faced* heath, or mountain, sheep appear to have been the original breed in all the hilly parts of the north of England and of Scotland, excepting the extreme north and the isles. They are still the prevailing sheep in a considerable range of the country, especially on the hills of the rainy tract, through part of Yorkshire, Westmoreland, Cumberland, and Scotland, till they meet with the northern sheep, which, hardy as the black-faced breed, are still better able to endure the extreme severity of climate. They are in fact an exceedingly valuable breed; and, notwithstanding the smallness of their carcasses and the coarseness of their wool, it is probable that the replacing of them by more delicate breeds, has not been very wisely undertaken in many of the more bleak parts of the country.

They are easily known from all others by their black faces and legs, and by the large size of the horns in the males, which appear of harder and firmer consistency than those of almost any other sheep. They are also bold and daring animals, and of hardy constitution, not liable to the foot rot, even in traversing the boggy parts of the Grampians. The writer of this article has, in the course of his rambles among those delightful mountains, often met with the remains of sheep which had stuck in the mire, or fallen over precipices, but he never heard of disease among the black-faced flocks, though he often has among the other breeds that have been introduced *by way* of improvement; and this has again and again led to regret that those who have the wish and the means of improving the districts in which they reside will avoid what is before their eyes every day, and ground their proceedings upon what is projected or done in countries which have no resemblance to theirs, and very often by mere compilers of books, who have no acquaintance with the subjects of which they profess to treat.

The wool upon these sheep is coarse and shaggy, and may be compared to hair rather than the fine wool of the southern parts of the country. But there is a point here which is worthy of being considered, although often left out of the consideration; and that is, the durability of the wool. Under ordinary circumstances, the durability should increase as the square of the fibre, upon the supposition that the substance is of the same kind. But the fact is that the durability of the wool is in proportion to the hardihood of the animal upon which it grows; and there are many living who can remember how long the old fabrics, made of the wool of the black-faced sheep, lasted, in comparison with those of the present day, even on the supposition that there was the same weight of material in each of them. Mechanical improvements may have rendered the modern fabric cheaper than the old ones; but we would ask, what advantage is gained by a reduction of half the price

in the article, if it lasts for only half the time? The answer to this question will readily suggest itself to any one; but there are probably very many who have not thought on the subject of the injury that has been done to the labouring people of this country, by the endeavours which have been made to adapt the materials of the necessaries of life, and more especially those of clothing, only to the wants and wishes of that portion of the community who are anxious that an article shall wear out as soon as possible, in order that they may follow the fashion in getting another. There is not the least doubt that much misery to the labouring classes in Britain has arisen from this cause, and in none more than in the substitution of fine and tender wools for the stronger ones that were formerly in use. The writer of this article well remembers a countryman, then above seventy years of age, who, from the time that he arrived at manhood, had appeared every Sunday at church in his father's wedding coat, which, after the long period that it had been in use, really looked more fresh than the fabrics used by the same class of persons at the present day. The fact is that the low priced woollen goods that are now manufactured are made of rubbish, not unfrequently of woollen rags, which, after they have lain till half rotted, are torn to pieces by an engine; and, by another engine and the help of glue or size, twisted into yarn, which, without the glue, would be little more tenacious than a rope of sand. It is true, that this rubbish is cheap in the numerical tale of the money paid for it; but in reality it is not worth the cost or even the labour of the leisure time necessary for making it up.

These are considerations eminently worthy the attention of the legislature, and would no doubt receive it, if it were possible to find legislators possessed of the requisite degree of knowledge, which, however, seems to be a matter that is utterly hopeless; for with all the parade of their committees, commissions, and reports, some tons of which latter go to the limbo of waste paper every year, the actual result appears to be that the more they inquire into any subject the less they understand it; and that the most certain and rapid means by which any one matter can be wholly blotted out from the book of knowledge, is by the report of a committee or commission, which gets thanks for costing an abused public so many thousands of pounds. Our business, however, is with sheep, not with senators, and there is some consolation in the feeling that the one case is of far more substantial importance to the country than the other.

We have spoken of the durable nature of the wool of the black-faced sheep, and we may add, that the flavour of their flesh is unrivalled; and that, if bred and fattened on a proper pasture, a haunch of real hill mutton is superior to that of any park deer in the world. We must except the red deer of the free hill, which are tempered by the high spring tide of the elements, and also the mountain roe, which is a luxury in the good old and honest sense of the term; but truly among all the breeds of sheep, however full in the body or however fat they may be, there is truly nothing that comes up to the old black-face of the mountains; and we honestly think that the re-establishment of it in all those upland districts for which it is well adapted, is a matter of great national importance.

On subjects of this kind, feeling ought to be, as much as possible, left out of the question; and yet it is difficult to abstain from some admiration of the personal character of this animal. It can hardly be exhausted by fatigue; there is no severity of weather which it cannot bear; and there are many recorded instances of its subsisting for weeks buried up under the snow. The ram, although not a large animal, is a very bold and powerful one; and when two meet to settle an affair of gallantry, there is a splendour in the conflict to which there is not much superior in the whole wars of the animal kingdom. The run which they take is much longer than that taken by the males of most races of sheep; and if they come into collision at the full swing of their impetus, the result is generally fatal to one, and sometimes to both. The bulls in the uplands, where the cattle are left to acquire the hardihood of nature, are powerful animals, but they quail before the charge of a black-faced ram when he is fully excited. As for the fox, they hem him round if they can find him, and when he is fairly in the circle, with the horns threatening him on every side, two retreat backwards, and then, advancing at the signal stamp of the foot, beat him to a pancake at a single effort. When in the season of excitement, they are prone to run at everything that is unusual; and a ludicrous story of this is told of and by no less illustrious a personage than the highly gifted and truly noble-minded "Sandy Wilson," whose "American Ornithology" will be in the freshness of immortal youth when every other natural history of birds is forgotten. Any of our readers who are acquainted with that illustrious child of nature, whose expatriation and the neglect of Burns are of those leopard spots upon the discernment and liberality of Scotland, which must keep her long or for ever in the class of the low and ungrateful among nations, must be aware that he followed for a time the trade of a pedlar. While he was thus employed, some circumstance, we forget what, revived the story of the rich gold mines in Crawford moor, of the produce of which the broad Jacobuses are said to have been made; and many persons resorted to "Crawford Burn" in order to search the sand and gravel in its bed for a portion of the treasure. [We have generally found the reported gold-dust of many parts of Scotland to be nothing but gold-coloured mica, but *n'importe*.] Wilson went, among others, and leaving his pack on the high bank, descended, shovel in hand, to find his fortune in the pool below. A "muirland ram" espied the pack, as an intruder on the pasture of the flock of which he was the patriarch and the guardian, and advanced toward it upon a *reconnoissance*, on which he was very close in his examination. After he had finished his survey he retreated backwards, as is the custom with rams, till he had gained the necessary distance; and then collecting his energy for the charge, he rushed upon the pack, and sent it endlong into the pool, sousing Wilson with the spray produced by the splash. Wilson immediately got out the pack, and spread his muslins and lawns to dry in a place where they were secure from the ram; and while waiting the operation of the sun and air upon them, he composed a very choice poem on the inordinate passion for wealth, he himself being the subject.

We have mentioned this anecdote for various reasons: First, it is highly characteristic of the black-faced ram, as offering battle to whatever intrudes on the pasture of his flock; secondly, because every reader of natural history must love to hear the name of Wilson repeated as often as possible; and, thirdly, because no independent Scotchman should fail to

"twit" his inconsiderate and narrow-minded country with the loss of such a man as Wilson, who became great in the American wilderness, despite the utmost rudeness of nature and of man. There has been, of late years, no lack of great squires and small knights perambulating different parts of Scotland, for the avowed purpose of examining nature there, and returning and getting laudation from coteries of aged persons for having discovered—nothing, and blessing their own wits upon the occasion, because the burthen thereof had not weighed them down, and made the maw of the hooded crow their monument. But if Scotland had had Alexander Wilson to perambulate the Highlands and Isles, and tell the tale of nature there, then Scotland would have been rich in one volume of her own natural history; but Wilson flourished and died in exile, and thus far forth Scotland is, and must remain—a beggar. Such at least is the opinion of the author of this article.

There is much more that we could say on the subject of the mountain sheep, which we have contemplated so often and with so much pleasure in the very wildest of their haunts; but our measure of space is full to overflowing. We must, however, mention that there is no possibility of tracing the genuine black-faced sheep from any foreign race in Europe or in any other part of the world; and thus we must look upon them as the aboriginal sheep of the wild parts of the British islands, and perhaps as the only breed that can be regarded as native. For this reason, as well as for the other reasons that have been already hinted at, they will merit attention as to the means by which they could be improved, not by crossing and admixture with other breeds, but in themselves as a race. On some of the heights of Cumberland there is a race nearly allied to this; the origin of which is unknown. These sheep have shorter and finer wool than the common heath sheep, and their faces are brownish or bluish, or mottled with these colours rather than black; but they are a very hardy and valuable race for elevated pastures. They have been farmed out to the shepherds for a long time; and, as is said, it is on account of this that they are called Floodwick sheep.

In some of the eastern parts of the Grampians, especially on the hills of the county of Mearns, and part of Aberdeen, there is another race of dark-faced sheep, which appear to have been imported from the north of Germany or from Norway, and which differ in some respects from the mountain sheep which we have mentioned as probably being indigenous. These are, in some places at least, called "broukie-faced" sheep, in distinction from the real mountaineers, which are called "morifaced" sheep. The last of these is expressive of the black colour, and the other implies that it is mixed or clouded like the colour of a badger. These mountain, or rather hill sheep, unquestionably of continental origin, though not to be confounded with the mountain breed, which are more decidedly from Norway, appear to have been introduced only into those parts of the uplands of the north, which were colonised from the east, and not by Celts. Their wool is finer than that of the black-faced sheep; and the fleeces are often of nearly the same colour as the faces of the sheep, the dark parts of which are brownish in some, and inclining to grey in others. When stockings, knitted upon hand-needles formed great part of the occupation of the females on that side of Scotland, the coloured wools of the sheep under consideration were in much request; and they were very durable, and by no means unhandsome in the colour. The sheep now mentioned are sometimes termed the dun-faced breed; and they approach a little in character to those of the western and northern isles, though they are not exactly the same.

The native sheep of the western isles are a very small but very hardy race. They have the face and the legs white or brownish yellow, but the fleece varies much both in colour and in staple. Upon the richer and more grassy isles it is very soft and fine; but on the higher and exposed places where the pasture is poor, it is much coarser in the staple. The wool is in very small quantity; and the entire carcass does not weigh more than half as much as one hind-quarter of the midland sheep of England. In those parts it is only in particular situations that the sheep get fat; but there is either something very delicious in the flavour of their flesh, or the air of the isles is a most excellent sauce, for we never ate mutton with so much zest as we have done in the Hebrides, where, at the time to which we allude, an entire sheep, wool, skin, and all, could be purchased, even by a visiter, for four shillings, and in some places for three. These islands are eminently worthy the attention of lovers of nature; and those who resort to them for pleasure should catch their own fish, and buy their own mutton in the live carcass.

There is some uncertainty in the history of the Shetland sheep. The original breed were very small and remarkable for the extreme fineness of their wool; but in so remote a situation, and one which is so much at the mercy of the contingent winters of the North Sea, they are now rarely to be met with. The other breed in these islands which is understood to be a more recent importation, though whence is not very clearly ascertained, are thus described: "They have three different successions of wool yearly, two of which resemble long hair more than wool, and are termed by the country people *fors* and *scudda*. When the wool begins to loosen at the roots, which generally happens in the month of February, the hairs or *scudda* begin to spring up; and when the wool is carefully plucked off, the tough hairs continue fast until the new wool grows up about a quarter of an inch in length, then they gradually wear off; and when the new fleece has acquired about two months' growth, the rough hairs, termed *fors*, spring up and keep root, until the proper season for pulling it arrives, when it is plucked off along with the wool, and separated from it at dressing the fleece, by an operation called *forsing*. The scudda remains upon the skin of the animal, as if it were a thick coat, a fence against the inclemency of the seasons, which provident Nature has furnished for supplying the want of the fleece." So say the authorities; but we cannot say there is much regard to Nature, however provident it may be, in their tearing the wool off the living sheep, and patches of the skin along with it.

SHELL-FISH. The ordinary name given to various crustaceous animals, such as the lobster, crab, scaly lobster, prawn, &c.

SHEPHERDIA (Nuttal). A genus of North American deciduous trees bearing diœcious flowers, and belonging to the natural order *Elæagineæ*. This genus was called a *Hippophae* by Linnæus. The species are propagated by suckers, layers, or by ripened cuttings under a hand-glass.

SHREW (*Sorex*). A genus of mammalia belonging to the insectivorous family of *Carnassiers*, or eaters of animal substances, in Cuvier's arrangement. They are small animals of obscure and retiring habits, and the number of the species, and the countries which they inhabit, are not very clearly ascertained. They are not, however, animals of very great importance; because, whatever may be their use in wild nature, they do very little good and no harm to man. In so far, however, as they have any bearing at all upon human economy, they must be set down as the benefactors of man, which is true of all the insectivorous mammalia, with the exception perhaps of those which plough up the ground—the mole, for instance; and, notwithstanding the disfigurement of the ground by moles, the fact of their being injurious on the whole is far from being fully established; for, as the mole is very voracious, and feeds in the earth, it is more than probable that the small animals upon which it lives would, but for it, do far more mischief than it does. The animals which the shrews most nearly resemble are those of the genus *Mygale*, called musk shrews, but still they have sufficient distinguishing characters.

In the case both of the genus alluded to and of the shrews, some naturalists have been puzzled as to the proper place they should hold in the system—that is, whether they ought to be classed with those members of the rodentia which they resemble both in their general form and in their habits, or with the insectivorous *Carnassiers*. It must be admitted, that the line of distinction between these is not always so clear, as that one not very much skilled in natural history can draw it—the more so, that the animals of both orders which thus approximate each other are equally prone to eat animal matter. The distinction is, however, founded upon a character which, when it is once known, is not easily mistaken or misunderstood. The true character of the flesh-eating animals is in the canine teeth, though the strength of the mouth is thrown differently upon them in the different races. The character of the *Rodentia*, again, is in the incisors, and, whatever the character of these may be, the rodent animal cuts as with pincers, instead of inflicting punctured wounds like those which are inflicted by the canines of the carnivora.

The teeth of the shrews are generally thirty in number, namely, twelve in the under jaw and eighteen in the upper; but they have sometimes two less in the upper, which, of course, reduces the total number to eight-and-twenty. In these teeth, however, the distinctions of the three kinds cannot always be very clearly made out. That three of the cheek-teeth in the back part of the jaw have the bristling tubercles or points which are characteristic of all the insectivorous *Carnassiers*, cannot be denied or overlooked; but it is not always easy or possible to assign their proper functions to the teeth in the anterior part of the jaws, so as to say decidedly which is incisor, which canine, and which cheek-teeth. The three tuberculous teeth, which are the only true cheek-teeth, have before them five, or four, false molars in the upper jaw; and in the fore part of each jaw there are two long and crooked teeth on each side, and those in the upper jaw have a second branch or tubercle at the base. The teeth of the shrews are thus very different in their forms from those of the true *Carnivora*, and yet they do not very much resemble those of the *Rodentia*, for these have the long teeth at the middle of the jaw and close to each other, whereas, in the shrews, the long teeth are apart with short ones between them. The shrews are furnished with a muzzle somewhat produced, though shorter than that of the genus *Mygale;* and the form of the head is that of a truncated cone, of which this muzzle forms the vertex. The tongue is thick and conical, with furrows on the surface, and corresponding furrows on the palate; the organs of hearing are in general well developed; but most of the shrews can make themselves deaf when they please by means of membranes which shut up the auricular openings. In this double membrane of the external ear they have a considerable resemblance to the bats; the eyes are similar to those of the mole and other *Carnassiers* that live under ground; the optic nerve can hardly be traced, and there are hardly any traceable nerves except some branches of the fifth pair; the usual muscles for moving the eye are also hardly traceable; and the ball of the eye is little else than a mere point; in fact, it appears that the shrews have very little dependence upon this sense. This is one of the great points of distinction between them and the rodent animals with which they have sometimes been confounded. Another character of the shrews is the odoriferous glands which they possess. The odour given out by these has some resemblance to that of musk, but it is, generally speaking, offensive. The situation of those glands is different from that of most, or all, of the other mammalia that have them. In general they are situated far backwards, but in the shrews they are on the flanks, nearer the fore legs than the hind ones. There are some peculiarities in the structure of these glands, but they are of too technical a nature for popular description. Indeed, the animals in themselves have so little interest, that the notice of them is more a matter of curiosity than any thing else, and yet they are so peculiar, and have resemblance to so many races, that there is little doubt that if their very obscure manners could be brought to light, they have a very interesting tale to tell in the relation of the mammalia.

In their external appearance, and the colour and covering of their bodies, the shrews have a considerable resemblance to some of the smaller members of the rat family, and the popular name given to them in many parts of the country is "shrew mice," under which appellation the water shrew is not unfrequently confounded with the water mole; but a very little attention suffices for distinguishing the one from the other. The conical head, the produced snout, the apparent smallness of the cerebral cavity, and the imperfect formation of the eyes, at once point out the shrews. The mammæ of the females also disappear, or at least can be found with difficulty, unless at those times when they are wanted.

In fact, we find in the shrews approximations to so many animals, and at the same time so many characters which are peculiarly and exclusively their own, that it is impossible not to regret the little that is known of them. In their eyes they have a very considerable resemblance to the moles; in their ears there is an affinity to the bats; and in the absorption of the mammæ, and also in the near approach or absolute junction of the passages in the female, there is some resemblance to the *Monotremata*. They are also found in most parts of the world, with the exception of Australia, and they *may* be there; and, in all situations and climates, their habits, so far as they are known, are very much the same. They

have indeed two modes of life in different members of the genus, some living in dry places, and some by the banks of streams and pools, and the margins of fountains; but they all live in comparative concealment, and *in* the earth rather than on it. They generally live in holes, but some get into hay stacks and other collections of dry vegetables, which they render very unpleasant by the odour which they give out. Cats and dogs are prone enough to kill shrews, but neither the one nor the other will eat them, probably on account of their rank and disagreeable odour. As is the case with most animals that have something disagreeable about them, and are but little known, the shrews have been supposed to be poisonous, and the common one stands accused of inflicting serious diseases on domestic animals by its bite; but there is not the least truth in the accusation; and, unless in the case of the insects and larvæ on which they feed, and in the consumption of which they in all probability perform a very important service, the shrews are among the most harmless of the mammalia. Even when we leave out a number of other animals which have been called shrews, the species are rather numerous, and it is easy to make more than there are in reality, as some of them are subject to much variation in colours. We can afford room for a very short notice of the most remarkable only.

Common Shrew (*S. araneus*). This is found in almost all parts of Europe, but is rarely seen in proportion to its numbers. Its general colour is greyish-brown, more or less reddish on the upper part, and ash-coloured on the under, the colours melting gradually into each other on the flanks. Colour, however, is hardly a proper foundation for the description of it, as some are brown, some yellowish, and some white. It is, however, only the points of the hairs, generally speaking, that have these diversities of colour, excepting in the white ones, which are true albinoes, and have the whole length white; for the greater part of the length of the hairs is generally bluish-grey over the whole body. Around the muzzle the colour is a little brighter than on the rest of the body, and a small portion of the tail is usually of a bright brown colour; the ears are naked, large, and rounded, and conspicuous through the fur on the head, though there, as well as on the body, it is long and close; the teeth are conspicuous, and of a pure white colour; the mustachioes are very long, and they are often continued from the angle of the gape to the occiput; the tail is nearly round, covered with short hair, and about an inch and a half in length, which is nearly one-third of the whole length of the animal. The young differ but little in appearance from the old. The common shrew is not rare in most parts of Europe. In the summer it is found in woods and copses, and under hedge rows; but in winter it often takes up its habitation in stables, farm-yards, and heaps of manure, in neither of which places it does good or harm, at least in so far as is known.

Tuscan Shrew (*S. Etruscus*). This is the smallest of all the European species, and rather a handsome one in its appearance, at least in its colours. It is only about an inch and three quarters in length from the point of the muzzle to the origin of the tail, whereas the common one is about three inches in the same extent. Its colour is brownish on the upper part and greyish on the under, the fur being particularly bright and shining. It is usually found lurking under the tangled roots of trees, or in the hollows of decayed ones, though it often burrows in dunghills during the winter, probably because it finds food more abundant there than in more cleanly places.

The Pretty Shrew (*S. pulchellus*) is an Asiatic species, described as being found on the sandy and half-desert tracts of the interior. It is one of the very smallest members of the genus, being less than the Tuscan which was last mentioned, and little more than an inch and a half in length in the head and body, and the tail is about three quarters of an inch; the flanks are of the most snowy whiteness; the top of the head is bright grey, which extends on the back in a deeper tint, and forms a parallelogram, bounded laterally and backwards by the pure white, in the middle of which parallelogram there is a single white spot; the ears slate-colour; the muzzle is long and very pointed. This prettily marked species inhabits the dry sandy districts, and has been observed both in central Asia and in the north of Germany.

The Marked Shrew (*S. personatus*) is an American species, about the same size as the common shrew, and not very different from it in colour. The breast and the under parts are ash-colour, and the feet are reddish; the hair on the head and the tail is very long, and on the former it completely conceals the ears; the head and body are about two inches long, and the tail is about one inch. There is another North American species, mentioned under the name of the small shrew, which resembles the present one in most particulars except colour and size, and, from what is remarked of the common shrew, these can hardly be admitted as specific distinctions. It is probable that, in a wild country like America, there are many species or varieties of shrews, but there is not much of interest in their individual histories.

The short-tailed Shrew (*S. brevicaudatus*) is another American species or variety. It is dark lead-colour on the upper part, and the same colour, lighter in the tint, on the under; the teeth are thirty in number, of a brown colour in the greater part of their length, but with the crowns black; the feet are white, with the three middle toes of nearly the same length, and the two lateral ones much shorter; the tail is short, rather thickened in the middle of its length, and very soft and velvety in its covering. It is rather a large species, being about three inches and a half in length, with the tail only one inch.

The square-tailed Shrew (*S. tetragomerus*) is a European species, nearly of the same size as the common shrew, but distinguished from all the others by the form of the tail, which is four-cornered, or nearly square in the section, the angles of which are very conspicuous; there is a sort of furrow along the under side, and the organ terminates in a very fine point; the ears are much shorter than those of the common shrew, but they are not completely covered by the fur; the colour is blackish-brown on the upper part, and greyish-ash on the under. It has been most carefully noticed in France; but, as its habits and haunts are the same as those of the common shrew, it is probably only an accidental variety of that. Gardens and farm-yards are the places in which it is usually found.

The flat-tailed Shrew (*S. constrictus*) is another European species or variety, of nearly the same size and habits as the common shrew. The characters

are: thick fur on the sides of the muzzle, which make it appear shorter and thicker than it is in reality; the ears short, and completely hidden in the fur; the cranium is larger and more rounded than in the common shrew, but the difference of intelligence in the two has not been ascertained; the tail is straight, flat at its origin as if it were strangulated, thick and rounded in the middle of its length, and flattened again at the terminal part, and the fur at the point forming a sort of brush; the fur is very long, and soft to the touch, black in the greater part of its length, and reddish at the points; that on the throat is ash-colour, and on the belly grey. It has been observed in several parts of Europe, and also in the United States of America; but it is probably nothing more than a variety of the common shrew.

The white-toothed Shrew (*S. leucadon*) has been named from the colour of the teeth, which, contrary to what appears in most of the shrews, are white to the points. It has been noticed in the valley of the Rhine near Strasbourg, where shrews are either more numerous, or have been examined with more care, than in any other part of Europe. It is about the same size as the flat-tailed variety, but with the tail of the same form as that of the common shrew; it is brown on the back, and white on the under part; but little or nothing is known of its manners, and it is in all probability merely a variety of the common shrew. We have often, in the course of this work, had occasion to notice the close connexion that there is between the covering and the teeth of the mammalia; and when we find, in any race, a disposition to break into varieties in the one, we may expect to find the same in the others.

The Lined Shrew (*S. lineatus*) is another species or variety which has been noticed in France. It is of a brownish-grey colour, inclining to ash on the under part of the body, and white on the throat; there are two white lines extending from the nostrils to the top of the forehead, which are the foundation of the name; and there is also a tuft of long white hairs in each of the ears. It has been met with in the neighbourhood of Paris, and in some other parts of France, but it is rare; and the peculiarities of its manners, if they differ in any thing from those of the common shrew, are not known.

The Oared Shrew (*S. ramifer*) is another which has been noticed in France. It resembles the preceding one in some respects, but it is of larger size than the generality of the shrews, being four inches long in the head and body, and two and a half in the tail; the general colour of the fur on the upper part is blackish-brown, that of the under brownish-ash on the belly, and white on the throat, or pale ash-colour with a reddish tinge; there is sometimes a spot of reddish-white on each ear, sometimes only on one, and sometimes it is wanting altogether; the tail is the most peculiar part; it is quite square in the basal two-thirds of its length, with the upper and lateral faces perfectly flat, and the under one with a longitudinal groove or furrow; the remaining third of the tail has a keel or ridge, chiefly on the under side, which makes the tail have something the appearance of an oar, which is the cause of the name that has been bestowed upon the animal; the feet have also long and rather stiff hairs at the sides, which, together with the form of the tail, show that this animal is less or more aquatic in its habits. Like most of the others, however, its manners are but very little known.

The Water Shrew (*S. fodiens*), is the one which has been improperly confounded with the water mole. It has many characters in common with the last-mentioned, which is also a water shrew, but there are distinctions between them. This one is generally about three inches in length, with the tail about half as much. On the upper part it is blueish brown, and on the under with a trace of ash-colour or of reddish, and the colours are distinct at the line of their junction, and do not melt the one into the other, as in the oared shrew. The outsides of the legs and the rump are of the same colour as the back; the upper lip, and a little spot on the place of each eye, are whitish, and there are sometimes traces of spots on the ears. The paws are reddish but the toes are whitish, and the incisive teeth are reddish toward the points; the tail is not unlike that of the species immediately preceding in its general form, but there is a white line along the under face, and the hairs which make the tail a swimming organ, are in proportion more produced. It is found along with the oared one, on the margins of pools and streams, and there are some accounts of combats between it and the frogs. This species is pretty generally distributed in the living state, and mention is also made of its fossil remains.

The Sacred Shrew (*S. religiosus*), is a species which has some fame, or at least name, in history, as it is understood to have been one of the animal gods of the ancient Egyptians. Mummies of more than one species have been found in the tombs at Thebes. That which is considered as the true sacred shrew is about the same size as the masked shrew of Europe, but with the tail larger, the ears larger, and the inner toe shorter. There is, however, nothing of interest about the animal, except in the eyes of antiquarians; and the Egyptians were so indiscriminate in their adoration of animals, that having been a god in their mythology is no great honour.

The cream-coloured Shrew (*S. flavescens*) is one which is easily distinguished by the peculiar colour of the upper part, which is a very pleasing shade of reddish cream-yellow, which passes gradually into bright ash colour on the tail. The head and all the under surface and insides of the legs are pale ash. There is a conspicuous line of brown on the forehead. The ears are longer than in the common shrew, but not so broad in proportion. All the teeth are white for their whole length, and the claws on the toes are whitish. This is, among shrews, a large species as well as a handsome one. The body and head measure fully four inches and a half in length; but the tail is shorter than in the majority. This species is abundant in Southern Africa, for which reason it is sometimes called the Cape shrew, though this name has been given to another species, which appears to be a native of India, and not of the Cape country. Its manners are as little known as those of most of the others.

The Indian Shrew (*S. Indicus*) is still larger than the cream-coloured; but if we know enough of shrews to be able to subdivide the genus, the two would fall within the same subdivision. This one is nearly six inches long in the head and body, and the tail is about an inch and a half. The tail is not flattened in any part of its length, which proves that it is a land shrew, and not an aquatic one. The general colour of the fur is greyish brown; but, on the upper part especially, the points of the hairs are reddish. There are, however, many species in the south and the east

which are but little known, and they appear to have been very much confounded with each other.

The Greater Shrew (*S. giganteus*) is one of these. It is about half a foot long, with the tail nearly half the length of the head and body. This species is common in many parts of India, where it lives in holes and other obscure places, reposing during the day, and coming abroad only in the night. It appears to have at one time been very generally distributed, if it is not so still; for it is one of those of which the mummies have been found in Egypt. As a living inhabitant of the world, however, its history is of very little importance.

The Rat-tailed Shrew (*S. myosurus*) is a species which appears to rest on very doubtful authority, and even its native country has not been clearly ascertained. It is described as having the muzzle thick, the tail round and quite naked of fur, and the fur on the body entirely white. The authorities are not altogether agreed about it; for some say that both sexes are white; while others say that only the female is white, while the male is brownish grey. The probability is, that the white ones are merely albinoes, and that the absence of hair on the tail is also accidental.

Besides those which we have enumerated, many other shrews are mentioned by authors, and there are probably many more that have not been noticed; but the history of the shrews is one of the most incomplete in the whole range of the mammalia. That they are very singular animals, and very generally distributed, is well known; but their habits are so obscure that half of even the little that is said respecting them rests very much on conjectural foundations.

SIALIS (Latreille). A genus of neuropterous insects, forming the type of the family *Sialidæ*, having the antennæ simple and filiform, the mandibles of moderate size, and the wings laterally deflexed when at rest. The type is the *Hemerobius lutarius* (Linnæus), a very common sluggish insect found in the early spring months in the neighbourhood of water, and by some persons regarded as the May-fly of the angler. It is of a dull blackish colour, with brown wings. The female deposits an immense number of eggs, which she attaches to different aquatic plants, or other matters near water, in which the larvæ reside, where they swim very slowly. When full-grown they leave the water and burrow into the earth at the edge of their former abode, where they undergo their transformations, the pupa being inactive.

The other genera belonging to the same family are *Corydalis*, having very large mandibles, composed of a North American species, and *Chauliodes*, having pectinated antennæ.

SIBBALDIA (Linnæus). A genus of hardy trailing shrubs and perennial herbs, belonging to the fifth class of Linnæan botany, and to the natural order *Rosaceæ*. The *S. procumbens* is British, and found on northern mountains.

SIDA (Linnæus). An extensive genus of herbaceous annuals and perennials, shrubs and undershrubs, natives of many tropical countries. The flowers are monadelphous, and the genus belongs to *Malvaceæ*. The genus is separated into four divisions, and many sections. They are free flowerers, and frequently ripen seeds in the stove; by which they are increased, or by cuttings.

SIDERITIS (Linnæus). Shrubs, under-shrubs, and herbaceous perennials, mostly natives of Europe, belonging to the natural order *Labiatæ*. These are the Ironworts of English authors, grow in any common soil, and are propagated by cuttings.

SIDERODENDRON (Jacquin). The Iron-tree of the West Indies, belonging to *Rubiaceæ*. It is valued for its timber, which is remarkably hard and durable. The plant is kept in the stove, and is propagated by cuttings.

SIEVERSIA (Wildenow). A genus of herbaceous plants found in the northern parts of Europe and America. They belong to *Rosaceæ*, delight in a dry sandy soil, and are increased by division or by seeds.

SIGARETUS (Lamark; Helix Haliotidea, Linnæus). This mollusc is concealed in the mantle of the animal producing it. It somewhat approximates the *Natica*, greatly resembling a very depressed shell of that genus, from which, however, the extraordinary width of the aperture, and its spiral short columella, render it perfectly distinct. This shell is nearly orbicular, but subauriculated, and very much depressed. The left side short and spiral; the spire flat; the aperture oval, entire; extremely wide, and exposing the whole of the interior; there are two lateral internal muscular impressions. But a few species of this genus are known, and their habitat appears unconfined to any particular sea. About three species are known in a fossil state.

SILENE (Linnæus). A very extensive genus of annual and perennial herbs, mostly European. The flowers are decandrous, and the plants belong to *Caryophylleæ*. From the gumminess of some of the flowers flies are entrapped. Hence the vulgar name of catchfly. By far the greater number of the species are mere weeds, but some of them are highly ornamental.

SILIQUARIA (Lamarck; Serpula Anguina, Linnæus). Linnæus classed this mollusc with the genus *Serpula*; but a more careful examination than he bestowed having been made by subsequent naturalists, points out distinctions sufficiently marked to constitute a separate genus. The shell is tubular, very irregularly twisted; sometimes in a spiral form at the base; open at the upper extremity, and having a subarticulated longitudinal dentated fissure the whole of its length, or sometimes closed at a short distance from the summit. The substance of the shell is thin, the aperture round, and the edges sharp. Their habitat is the Indian ocean, and some species are found in a fossil state.

SILK COTTON TREE is the *Bombax ceiba* of Linnæus. It is so called because the seeds are enveloped in a downy substance like silk. The substance serves for stuffing mattrasses in India, and has been tried to be worked by both spinners and hatters, but the fibre is found not to be of sufficient tenacity for such fabrics.

SILK-WORM. The ordinary name of the caterpillar of a lepidopterous insect belonging to the section *Nocturna*, and family *Bombycidæ*, and systematically known under the name of *Bombyx Mori* of Linnæus, or the mulberry-tree moth, which, in the winged state, is of a cream-colour, with several transverse bands of a darker colour across the anterior wings, and a crescent-shaped central mark. The caterpillar, when full-grown, is nearly three inches in length, and is too well known to need any particular description. The eggs, when good, are of a pale slate or dark lilac colour; they may be purchased in

Covent Garden market at 10s. per ounce ; and care should be taken to obtain them of the proper colour, because those which are of a pale yellow colour are imperfect. The caterpillars are very voracious, as may be observed from the observations of Count Dandolo, given in our article Insect, vol. ii. p. 837. During this period of its existence it undergoes four moultings, which succeed each other at certain intervals, dependent upon the temperature of the weather, or of the places in which the caterpillars are kept, as well as upon the quality and quantity of their food. Thus, if the worms be exposed to a temperature of 80° to 100° Fahrenheit, the moultings will be hastened, and not more than five days required between the third and fourth moultings ; whereas if the temperature be reduced, seven or eight days will be required. The period of the moultings is also regulated by the temperature at which the eggs have been kept during the winter. When the heat has been regulated, the first moulting takes place on the fourth or fifth day after hatching ; the second in four days more ; the third in five or six days more ; and the last in about eight days. Ten days more are required after this moulting, so that in about thirty-two days after hatching the caterpillar has attained its full size. —Rozier, Cours d'Agric. Paris : 1801. Ins. Arch. p. 313.

When full grown the caterpillar commences the spinning of its cocoon ; and it is this construction which is subsequently employed in the manufacture of silk, as will be more fully shown in the subsequent part of this article. The silk is elaborated in two long slender vessels lying at the sides of the stomach and intestines, and terminating in a single tube, through which the viscid fluid, of which the silken threads is composed, is forced by the peristaltic action of the muscles. This tube terminates in the centre of the lower lip of the caterpillar. Although, however, the two vessels unite into a single tube, it is evident that the silken threads are not united, since we learn from the recent microscopical investigations of Dr. Ure, (Trans. Ent. Soc. vol. i., Journ. of Proceedings, p. 50,) that each of the silk threads was found to be composed of two distinct cylinders, which in good silk are found to be perfectly parallel, and quite cylindrical. The unevenness or the want of parallelism producing inferiority in the raw material. Each of these cylinders varies in diameter from one-two thousand two hundredth part of an inch (the measure in silk of the best quality), to one-eighteen hundredth of an inch. When imported, however, several distinct threads are found to be reeled together, which is done by the grower of the silk-worms, the threads being passed through several eyelets, and then wound off. The imported raw silks are of various qualities, depending upon the mode and time of feeding, as well as upon the food of the silk-worms. These compound threads are one-five hundredth part of an inch in diameter, each being divisible into eight threads ; that is, into four pairs of cylinders in the best silk. The specific gravity of silk is, according to this author, greater than had been generally considered, being 1256 to 1000, and consequently greater than the strongest muriatic acid or water.

The cocoon consists of three distinct layers of silk ; the first is loose and flossy, and is unserviceable for the silk manufacture ; the second is closer, the silk crossing from side to side ; and the third is still finer, and is glued strongly together, so as to form a compact inner coating ; of course the more silk which is employed in the construction of the outer floss covering, the inner coatings are diminished in thickness ; and, acting on this principle, M. Hoffmann, of Munich, has informed the writer hereof that he has succeeded in obtaining considerably more than the ordinary supply of the middle layer, by placing the worms, when full grown, in very confined situations, their instinct informing them that, in such case, there is no necessity for a floss coating of the ordinary thickness. When this cocoon is completed, the inclosed caterpillar again casts its skin, with the head and jaws attached to it, when it appears under the form of a conical chrysalis of the ordinary shape. At first the chrysalis, when opened, appears to consist only of a yellowish mucus, but by degrees the various parts of the future moth acquire their proper consistence ; and in about a fortnight or three weeks a slight swelling of the chrysalis indicates the approach of another change ; a rupture down the back succeeds, and, by degrees, the moth bursts through its horny coating into the hollow chamber of the cocoon. The moth subsequently emits a fluid, which has the effect either of dissolving the gum or the threads at one end of the cocoon, and soiling that part where the moth makes its escape. This of course is a circumstance which would be injurious to the interest of the silk grower, and is remedied in the manner subsequently described. Previous to the egress of the perfect insect, the cocoon may be wound off without any interruption of the thread, so that it is evident that the whole is spun continuously by the caterpillar ; the length of the thread in a cocoon varies from six hundred to a thousand feet, and the whole does not weigh more than three grains and a half—ten thousand cocoons scarcely averaging so much as five pounds in weight. An ounce of eggs will produce about 40,000 caterpillars, which will consume 1073 lb. of leaves, and produce from 80 to 100 lb. of cocoons, or about 8 lb. of raw silk.

The perfect insect is remarkable for its dull and stationary habits ; indeed, it can scarcely be said to possess the powers of flight. In this respect a similarity of manners exists also in the caterpillar, which does not wander away from its food, although unconfined ; and it has been well remarked by Mr. Sells, that these interesting peculiarities materially favour the easy management of the insect, and beautifully harmonise with the consideration of its vast importance to mankind.

The history of the silk manufacture, and its introduction into this country, require some notice in a work like the present. The insect is an inhabitant of China, although now perfectly naturalised in other countries ; and the Chinese are supposed to have discovered the art of making silk 2700 years B.C., when the Empress Si-ling-chi is said to have first observed the labours of the silk-worms on wild mulberry-trees, and applied their silk to use. From China the art passed to Persia, India, Arabia, and the whole of Asia. According to Latreille, the city of Turfan, in Lesser Bucharia, was for a long period the rendezvous of the caravans coming from the East, and was the chief depôt of the silk-trade of China. It was the metropolis of Seres, in Upper Asia, or of Serica of Ptolemy. The expedition of Alexander into Persia and India first introduced the knowledge of silk to the Grecians, 350 years B.C., and, with the increase of wealth and luxury in the Grecian court,

the demand for silk prodigiously augmented. Thence it passed to Rome, probably about the time of Pompey or Julius Cæsar, the Emperor Heliogabalus, about 220, being the first emperor who wore a robe entirely of silk. Until about the beginning of the sixth century, silk in the raw state had alone been seen out of China, the exportation of the insects from China being prohibited under pain of death, and up to this period the real nature of the material was unknown. By some it was supposed to be a kind of fleece which grew upon the branches of trees, by others the bark of the tree itself; by some as the production of a flower; by others as the production of a shell-fish similar to a mussel; by others as the entrails of a sort of spider, which was fed for four years with paste, and then with the leaves of the green willow, till it burst with fat; and by others that it was the produce of a worm which built nests of clay and collected wax. But at that period two monks, under the persuasions of the Emperor Justinian, contrived to bring some eggs from China, hidden in the handles of their pilgrim's staves, having also obtained a thorough knowledge of the art of rearing the worms and manufacturing the silk. The eggs thus obtained were hatched in a hotbed, and being afterwards carefully fed, the experiment was fully successful, and the silk-worm became generally cultivated through Greece. In 1130, the growth of the white mulberry, and the removal of many of the silk growers from the Peloponnesus to Sicily, was effected by King Roger, which island became the great mart of nearly all the silk employed in Europe. In 1440, the white mulberry was first introduced into Upper Italy; and under Charles VII. the first tree of this kind was planted in France, where silk manufactures were established in 1480 at Tours. The great Henri Quatre greatly exerted himself to promote the culture of the silk-worm through his dominions; and a plantation of white mulberry trees was made in the garden of the Tuilleries, where a large building for the silk-worms was erected. By degrees the growth of the mulberry, and the rearing of the silk-worm, was tried with various success in different parts of Europe. At present the silk manufactures of France constitute a very important part of her commerce; and some idea may be formed of the silk goods annually sent to England from that country, by the fact, that the quantity on which duty was paid, from 1688 to 1741, averaged 500,000*l.* a-year. Notwithstanding, however, the great quantity of silk now raised in France, the manufacturers of that country still import to the annual value of 30,000 francs of raw silk from Piedmont and Italy.

In our own country, silk, up to the beginning of the sixteenth century, was scarcely known. At that period, however, it appears to have found its way to England more plentifully from France; for, although the silk manufacture had been introduced into this country in the fifteenth century, we find that Henry VIII. had the first pair of silk stockings ever seen in England, sent to him from Spain; and a similar present was made to Edward VI. by Sir James Gresham. In the reign of Queen Mary, however, an act was passed with the view of entirely discountenancing the importation of this article of luxury, and of assisting the consumption of our own productions, which enacted, that "whoever shall weare silk in or upon his or her hat, bonnet, or girdle, scabbard, hose, shoes, or spur-leather, shall be imprisoned during three months and forfeit ten pounds." The long and quiet reign of Queen Elizabeth which succeeded, together with the influx of the Flemings, occasioned by the disturbances in the Low Countries, gave a powerful stimulus to the silk manufactures of England. But it was in the next reign that a still greater impulse was given to them by James the First, who not only issued an edict recommending the cultivation of the silk-worm, and offered packets of mulberry seed to all who would sow them, but also planted these trees to a great extent himself, and established silk-worm houses as we learn from the two following entries in the issues of the exchequer during his reign. In the first, dated Dec. 5, 1608, payment was directed to be made of the "sum of 935*l.* for the charge of four acres of land taken in for His Majesty's use, near to his palace at Westminster, for the planting of mulberry-trees, together with the charge of walling, levelling, and planting thereof with mulberry-trees;" and the second, dated January 23, 1618, nine years subsequently, directing payment to be made of 50*l.* "for timber-board, glass, and other materials, together with workmanship for making a place for His Majesty's silk-worms, and for making provision of mulberry-leaves for them." Letters were also issued by this prince to the lord lieutenants, recommending the planting of mulberry-trees, and offering them at two farthings each. Although this attempt to introduce the growing of silk-worms into England proved unsuccessful (the reason whereof appears clearly to have been that the black mulberry was distributed instead of the white); the manufacture of silk had become so extensive, that in 1666 (tem. Carol. II.), not fewer than 40,000 individuals were engaged therein. In 1685, the prosecution of the Protestants in France drove above 50,000 French artisans to this country, by which the trade was still further greatly increased. These refugees chiefly settled in Spital-fields, which part of London has since been the head-quarters of the silk weavers in this metropolis. Notwithstanding this increase, the importation of silk in the manufactured state was very great, as from 1685 to 1692, from 600,000*l.* to 700,000*l.* worth was annually imported. In the latter year the refugees obtained an exclusive patent for certain articles; in 1697, parliament prohibited the importation of French and other European silk goods; and in 1701, the prohibition was extended to Chinese and Indian manufactures. From this period the silk manufacture has become a very important branch of commerce of which it would be here out of place to pursue the history. It will suffice in order to show the present state of the English manufacture, to state that in the year 1833, the quantity of silk imported for home consumption was more than four millions and a half pounds weight; whereas in 1814 it was only 1,580,000 lbs.; and in 1823, 3,650,000; and at the present time probably 700,000 persons are engaged in it. (Hope in Trans. Ent. Soc. 1, p. 124).

It remains, however, to notice, as connected with the natural history of the insect in connexion with its commerce, that in 1825, a company was established under the name of "The British, Irish, and Colonial Silk Company" with a large capital and under the direction of the celebrated Count Dandolo, whose Treatise on the Management of the Silk Worm is considered the best work on the subject in Italy. Extensive plantations were formed near Slough, in Devonshire, and near Cork in Ireland; but after

numerous trials, it was found that the climate of the British Isles was too humid for the production of useful silk, and the company was finally broken up. It has been observed, by way of accounting for the failure of this and other undertakings of a similar nature in this country, that although "the mulberry-tree is found in different climates; yet the juice of the leaves grown in the north is much less suitable for the production of good silk than that of the south. In this respect the mulberry-leaves and silk differ as much as wines according to the climate and soil in which they are produced. In general, every climate and soil that will grow good wheat will produce large succulent mulberry-leaves; but these leaves will, in many cases, be too nutritive; that is, they will have too much sap and too much substance and succulency. The wild mulberry with smooth leaves answers better for such a soil than the grafted mulberry with large leaves. A general rule, and one to be depended on is, that the mulberry, to produce the best silk, requires the same soil and exposure that the vine does to produce the best wine. Experience has proved that silk-worms nourished by leaves gathered from a dry soil succeed much better, produce more cocoons, and are less subject to those diseases which destroy them, than those which have been nourished by leaves produced by an extremely rich soil."—(Journ. d'Agric. des Pays Bas, quoted in Arboretum Britannicum, from which some of the preceding historical details have been abridged.) How far these objections are entitled to full weight, and how far any other plans (such as those suggested by the Rev. F. W. Hope in a Memoir upon Silk Insects, contained in the first volume of the Transactions of the Entomological Society) may succeed in this country, must be determined by future experiments; in the mean time it is certain that the severity of the climate cannot be an obstacle: even the climate of Pekin or China is much severer than that of Scotland; and that in America not only has the growth of the silk been effected, but double crops in the course of a single season have been obtained. It is objected, however, that the number of hands requisite, and the high rate of wages in this country, would be an obstacle; but children and old persons might be employed, especially in the rearing houses, which should be kept at a certain temperature.

A short account of the plans adopted in rearing the silk-worms in an artificial state will close our account of the *Bombyx mori*. Instead of the eggs being allowed to hatch at their own fixed time, they are preserved in a temperature of from 55° to 60° Fahr. To hatch them a temperature of 86° Fahr. is required, so that heated rooms are necessary; but in the southern parts of China, the East Indies, &c, the natural temperature of the air is sufficient for this purpose. The houses in which the insects are kept are built with numerous windows for the admission of air, and furnished with tables or shelves on which the insects are kept; these shelves have moveable ledges of an inch or more in height to secure the insects, and several stages are arranged one above another, care being taken to place them at a distance from the wall, so as to ensure a free current of air, which is essentially requisite, as well as great cleanliness in the removal of dead and unconsumed leaves and other litter. Indeed, the great care required to preserve them clean and warm is curiously shown in the following extract from an old Chinese work upon the subject:—"The place where their habitation is built must be retired, free from noisome smells, cattle, and all noises; a noisome smell, or the least fright, makes great impressions upon so tender a breed; even the barking of dogs and the crowing of cocks are capable of putting them in disorder when they are newly hatched. For the purpose of paying them every attention an affectionate mother is provided for the worms, who is careful to supply their wants; she is called Isan-mon, mother of the worms. She takes possession of the chamber, but not till she has washed herself, and put on clean clothes which have not the least ill smell; she must not have eaten any thing before, or have handled any wild succory, the smell of which is very prejudicial to those tender creatures; she must be clothed in a plain habit without any lining, that she may be more sensible of the warmth of the place, and accordingly increase or lessen the fire; but she must carefully avoid making a smoke or raising a dust, which would be very offensive to these tender creatures, which must be carefully humoured before the first time of casting their slough." During the first twenty-four hours of the creatures' existence, the patient Chinese feeds the objects of her care forty-eight times a day, or once in every half hour; during the second day and night thirty times, and so on, reducing the number of meals as the worms grow older.

According to Count Dandolo, 39,000 eggs weigh an Italian ounce: five ounces produce from 150,000 to 195,000 silk-worms. These require 8250 lbs. of grafted mulberry-leaves, and will produce 600 lbs. of cocoons, which in common years will sell for 1000 Milan livres. In Persia silk-worms are permitted to feed upon the boughs of the trees as well as the leaves; and it is asserted, though perhaps too loosely, that in some countries of the south of Asia, no less than twelve crops of cocoons are obtained in a year; whereas in Europe only one crop is capable of being produced. That crop, however, is so much more abundant, that Count Dandolo is of opinion that one good European crop equals in point of produce all the crops of Asia.

Soon after the cocoons are completed, a certain quantity is set apart for breeding, and the rest are used for silk, the enclosed insects being first destroyed, either by exposing the cocoons to the sun for three days when the temperature is not below 86° Fahr., or by being placed in ovens heated to the same temperature, or by placing them over the steam of boiling water or spirit. The floss silk is then removed, and the cocoons thrown into water, which then is almost suffered to boil, by which process the gum is dissolved, and the fibres of the silk loosened, so that the reeling of the silken thread is rendered very easy.

The following short estimate of expenses occurring in the produce of five ounces of eggs will give an idea of the proceedings of the silk-grower:—

	Milan Liv.	Sou
Five ounces of silk-worms' eggs	15	0
Fuel wood for hatching them	1	15
8250 lbs. of leaves	385	0
Expense of gathering the leaves	96	5
Shavings	16	0
Faggots and broom	22	10
Paper	18	0
Oil for lamps	9	0

Fumigating-bottle . . .	.	1	10
Day labour, men and women	.	109	0
Total	.	674	0
Ground rent and interest of capital . .		90	0
		764	0

which sum being subtracted from 1563. 18. the value of 600 lbs. of cocoons will leave a net profit of 799 livres (thirty of which equal a pound sterling).

In India considerable quantities of silk are obtained from the cocoons of several large species of moths belonging to the genus *Saturnia:* of these the most important are the Tusseh, Arrindi, Bughy, and Koligurra silk-worms; of the two former of these an interesting memoir is given by Dr. Roxburgh in the Linnæan Transactions, and of the last by Lieut. Col. Sykes in the Transactions of the Royal Asiatic Society. The Tusseh worms are the caterpillars of the *Saturnia Paphia*, Linnæus, and are found in such abundance in the neighbourhood of Bengal as to afford a constant supply of very durable coarse dark-coloured silk, which is woven into a cloth much worn by the Brahmins and some other sects, and which is of so great durability, that after nine or ten years' wear it does not show any signs of decay. The Arrindi silk-worm is the caterpillar of the *Phalæna Cynthia*, Drury, and feeds on the leaves of the Palma-Christi; its cocoons are exceedingly soft and flossy, so that it is impossible to reel it off, it is accordingly spun like cotton, and the thread thus manufactured is woven into a coarse white cloth of loose texture, but of such considerable durability, that the life of a single person is seldom sufficient to wear out a garment made of it. It is used not only for clothing, but for packing fine cloths, &c. (Introd. to Ent. i., p. 336).

SILPHEUM (Linnæus). A genus of North American perennial herbs, belonging to *Compositæ*. They are tall-growing plants, and suitable for the interior of shrubberies, and are increased by division.

SILPHIDÆ (Leach). A family of coleopterous insects belonging to the section *Pentamera*, and subsection *Necrophaga*, having five distinct joints in all the tarsi, and the mandibles terminated in an entire point, and not notched. The antennæ often terminated in a perfoliated mass of four or five joints; the maxillæ often armed with a corneous tooth; the anterior tarsi are often dilated, and the elytra are in general furnished with a raised lateral margin. These insects are generally of obscure colours, and subsist upon carcasses, bones, and other putrefying matters, they are consequently of great service in removing much infectious matter, which might otherwise render the atmosphere unwholesome. The larvæ reside in the same situations, and are furnished with six legs, and two or more anal appendages. The genera are *Necrophorus*, *Necrodes*, *Oiceoptoma*, *Silpha*, *Phosphuga*, Agyrtes, Peltis, *Spherites*, and Necrophilus; those printed in italics being inhabitants of this country. The most interesting genus is that which contains the sexton beetles Necrophorus, which see. The genus *Silpha*, as now restricted, comprises those species which have the antennæ gradually clavate, the club being four-jointed, the elytra rounded behind, and the body depressed and shield-shaped. The majority of the species are black or pitchy in their colours, and frequent carrion, &c.; but in the *Silpha quadrimaculata*, Linnæus, the thorax and elytra are pale, buff-coloured, with black spots; and, in accordance with its various hues, it is found in trees, amongst the foliage of which it lurks about for the purpose of seizing upon and devouring lepidopterous caterpillars.

SILVER. This valuable metal occurs in many parts of the globe, and in a variety of combinations. Native silver has the general characters of the pure metal. It is found in masses, sometimes ramifying into arborescent and capillary forms. At other times it is crystallised in cubes and octohedra. The richest known mines are found in Peru and Mexico. Europe also presents some valuable mines, but they are principally confined to Saxony, Bohemia, and Norway. It is true that both Cornwall and Devonshire present some fine specimens, but silver can hardly be placed amongst the mineralogical treasures of this country. It may, however, be proper to add, that silver was once found in considerable quantities in Stirlingshire, but the vein has been long exhausted.

SILURUS, or rather Siluridæ, a family of fishes which have no English name, nor is there any well-authenticated account of even a single specimen occurring in any part of the British islands, though Sir Robert Sibbald names it in his Appendix to the River Fishes of Scotland; and subsequent writers upon British fish have, upon this authority, included it in their lists.

The *Siluridæ* are soft-finned fishes with abdominal fins, and in Cuvier's arrangement they follow immediately after the pike family. They are very peculiar fishes, and may be looked upon as the family in which a section of the abdominal finned fishes terminates. They are wholly fresh-water fishes, or, at least, the only sea in which they have been found is the Baltic, and it contains much less salt than the ocean generally, and so little indeed in some places as to be available for culinary purposes. Generally speaking, they are of clumsy and unwieldy form and size. They chiefly inhabit the mud at the bottom of rivers and some lakes, but mostly the former; and their powers in swimming are sluggish, and performed by the flexures of the body, in the manner of those of an eel, rather than by the simple but vigorous action of the caudal fin. The character of their flesh corresponds with this sluggish habit, for, though generally of good flavour, it is too rich for being easily digested. They also accumulate a great deal of fat, and the fat upon them has some slight resemblance to the lard of pigs.

There is only one species found in Europe, and that chiefly in the larger rivers of the north, especially those which discharge their waters into the Baltic. But in the rivers of the warmer climates, especially in those of Africa, they are much more abundant both in numbers and in species; and they were placed among the sacred fishes by the ancient Egyptians. They are exceedingly voracious; but, in consequence of the inferiority of their swimming powers, they are unable to capture prey by chasing it, and therefore their habit is to lie in wait, and seize their food by surprise. As is the case with most, if not all, of the lurking fishes which wait at the bottom for such prey as may swim over them, they are furnished with barbules or feelers, which vary in number in different members of the family, but of which two in the upper jaw are generally in so far supported by the maxillary bones, by means of which

they have a considerable degree of motion. It is understood that these barbules are made use of as baits, or rather as lines for the fish, and that the points of them moving about in the water, while the fish is either covered with mud, or undistinguishable from it in consequence of its dull colours, is quite unobserved, until the prey is within reach of its great mouth, which is semicircular, and opens upwards rather than otherwise, the under jaw being a little longer than the upper one. The *Silures* are so large and powerful, that they have little danger to fear from any other inhabitant of the waters; and some of them, besides having a mouth sufficiently capacious for swallowing any ordinary fish, have a very formidable spine in the front of the dorsal fin, with which, as it is ragged and toothed in the sides, they can inflict very serious and even dangerous wounds.

The characters of the family are: the skin of the body covered with a slimy secretion, and without any true scales, though some of them have it covered with large bony plates; their intermaxillary bones are suspended under the ethmoid, and form the edge of the upper jaw; and the maxillaries are only rudimental, or produced to support those barbules of which mention has already been made; the intestinal canal is large, with many flexures, but without any cæcal appendages; the swimming-bladder is large, heart-shaped, and supported by peculiar bones; very generally the dorsal and the pectoral fins have a strong articulated spine for their first rays, and not unfrequently there arises behind the dorsal a second one, of an adipose or fatty consistency, as in the salmon family.

Taken as a family, the *Siluridæ* are exceedingly numerous, and varied in their characters. Cuvier divides them into four principal genera, *Silurus*, *Malæpterurus*, *Aspredo*, and *Loricaria*, and of these, especially the first, there are very many subdivisions. It would far exceed our limits to enter into the details of them, and for popular purposes this is not necessary, inasmuch as their history is exceedingly obscure, and they have no interest whatever to the English reader. We shall therefore only mention a very few particulars respecting the species found in Europe, and give simply the generic distinctions of the others.

Silurus. The fishes of this genus are exceedingly numerous, and require subdivision into many smaller sections. Their general characters are: the body clammy and without any scales; the mouth is at the extremity of the muzzle, or a very little turned upwards, and in the greater number of the subgenera there is a very strong spine answering to the first ray of the dorsal fin. This spine is articulated upon the bones of the shoulder in such a manner as to be moveable not only in the direction of the mesial plane of the fish, but also laterally. This spine is a very formidable weapon. In a large fish it is of considerable size, and the sides of it are ragged with teeth, so that it tears and lacerates in the most painful manner. As is the case with the spines on the bodies of many fish, it is often supposed to be impregnated with a poison; but there is no reason to believe so; for the mechanical injury which it is capable of inflicting is serious enough, and there is no doubt that it is quite competent to occasion lock jaw in those who have the misfortune to be wounded by it. It may not be useless to the public to mention, that, in the translation of Cuvier's Animal Kingdom, purporting to be done by "Edward Griffith, F.R.S., &c., and others," there is a very curious "doing into English" of the original text of that most observant and accurate Frenchman. Cuvier says, "et il y a très souvent en arrière une adipeuse comme dans les saumons," which the learned persons have rendered, "and there are often three more behind an adipose, as in the salmones." This translation, which repays the French rendering of "Love's last Shift," by "La dernière Chemise de l'Amour," or any other that has been or can be done or imagined, shows pretty clearly how large a licence may be taken by any man who can, by hook or crook, contrive to

"Shine in the dignity of F.R.S.;"

for, assuredly, if any mere mortal, unprotected by the coat of darkness which these mystic letters are supposed to wrap round their possessor, had dared thus to translate Cuvier, the naturalists and the critics would have been down upon him *en masse*, scalpel and scalping-knife. Such, however, is the fact, as any one may see by turning to p. 399 of the account of fish; and it is pretty clear that the parties, that is, the F.R.S. and others, must have become Homerised on the occasion, and "*nodding* at their duty." In the preceding part of the sentence Cuvier is speaking of the dorsal spine and the spines of the pectorals; and no person upon earth who should happen to read the translation, without having seen the original, could avoid concluding that the fishes have three *spines* more behind an adipose, though an adipose *what* is not said. What Cuvier does say is not that there are three spines in addition to the dorsal and pectoral ones behind an adipose, or behind any thing else; he merely says that there is very often an adipose dorsal-fin behind the rayed dorsal, as is the case in the salmon family, not the "salmones," which are fishes quite unknown to British ichthyologists, or even mentioned in Mr. Yarrell's work, minute and perfect as that work is. They have the head flattened, and the intermaxillary bones suspended under the ethmoid, and not protractile. The maxillary bones are very small, and in almost every one they terminate in fleshy barbules, more or less elongated; and there are other barbules, sometimes attached to the under jaw and sometimes to the nostrils. They have a gill-lid, but no gill-flap, from which it is inferred that they have but a limited respiration, and such a respiration accords with their sluggish habits, and their lurking at the bottoms of the rivers. Their air-bladder is very strong and heart-shaped, and the possession of such an organ by fishes that very seldom quit the bottom of the water is a proof that the common supposition, that it is useful in changing the specific gravity of the fish, is by no means well founded. The stomach is a simple cul-de-sac, and the intestine, though long, is without cæcal appendages. The rivers of the warm countries are their principal habitats. Though they are in general feeders upon animal matters, they are not exclusively confined to these, for they are understood to eat both the succulent roots and the seeds of plants, the latter of which have been often found in their stomachs. It is to be regretted that so little is known of their habits and their use in the economy of nature, as there is no doubt that, from their numbers, their size, and the places in which they are found, the part which they perform must be an important one. They are fishes of the beds of the rivers, only found in

those which are of large size, and they do not appear at the surface, or near the banks, except at the time when they spawn, which occupies about two months out of the twelve. In some of their habits they appear to resemble the eels, but the resemblance does not extend so far as the migratory habit of the latter; for it does not appear that the *Siluri* ascend or descend the rivers for any seasonal purpose, their principal motion being from the bed of the river, in order to deposit and fecundate their eggs, and back again when that object is accomplished. Cuvier divides them into nine subgenera, and some of them admit of a second subdivision. They all have the dorsal-fin forward on the body, and composed of but few rays, but the anal extends over a very considerable length of the under side, and reaches nearly to the tail.

Silurus *properly so called.* These have the dorsal-fin very small, and without any sensible spine in the first ray. Their teeth on the jaws are arranged like those of a card, and they have a third band of teeth upon the vomer. They are found in various parts of the world, but chiefly, if not exclusively, in Europe and Asia. The European one, and it is the only European member of the family, is the

The Sly Silurus (*Silurus glanis*). This, in as far as appearance is concerned, is a very ugly fish, lazy and lumbering in its form, and repulsive in its appearance. It is dark in the colour, and is altogether of a slimy character; while the flat head, the curious semi-circular mouth, the long barbules, and the small and projecting eyes, give it an aspect very unlike that of almost any other fish.

The head is shovel-shaped, flat, and the colour is of a deep green; the mouth very wide and deep; the jaws are circular; the lowest one the longer, but both are furnished with a number of incurved teeth; there is a long barbule on each side of the upper lip; the nostrils are round, and placed between these long barbules; the eyes are behind them, small, the pupils black, and the irides white; the back is of a deep green, and round; above the lateral line the sides are of the same colour, a fainter shade of green below it; and the body is covered with dark spots of no very definite shape; the body is long and thick; the belly short and expanded, and of a light yellow colour; the body is covered with slime; the pectoral-fins are deep blue at the base and at the extremities, the middle parts yellow; the first ray bony, strong, and serrated on the inner surface; the dorsal and ventral fins are yellowish at the basal part, and bluish towards the ends, and both are placed much nearer the head than the tail; the anal-fin is long, the tail rounded, and both are of a grey yellow, with lilac coloured or violet edges; the fin-rays, in number, are five in the dorsal, eighteen in each of the pectorals, twenty-four in the anal, and seventeen in the caudal.

It is a fish which is described as inhabiting many countries, but it is doubtful whether those of the tropical rivers, and also of the rivers of America, may not be different from the one which is met with in Europe. That they are different is rendered more probable by the fact that the European one is found in the rivers of the cold parts of the country rather than in the more southerly and western ones; and it is natural to conclude that, if a fish were common both to Europe and to Africa, it would be most abundant in those rivers of Europe which are nearest to Africa, and fall into the Mediterranean. Now, as a European fish, we believe that the *Silurus* is almost, if not altogether, unknown in the rivers of Spain, of Italy, and of the south of France, or indeed in any river of the last mentioned country; whereas it is abundant, and grows to a large size, in the rivers which fall into the Black Sea and the Baltic, even as far north as Sweden. Specimens have been mentioned in the north weighing seventy or eighty pounds, and it is in these northern countries chiefly that it is valued as an article of food. It is generally admitted, however, that, though its flesh is not disagreeable to the taste, it is in all cases difficult of digestion.

It is described as being a dull and sluggish animal, forming holes for itself in the soft mud, in which holes it spends a great part of its time lying in wait for its prey, and in general escaping observation. We have already mentioned the manner in which the barbules are supposed to attract the smaller river fishes so as to bring them within its reach. They have very much the form of worms; and, as the fish keeps them in pretty constant motion, one can easily understand how the fishes may be attracted by them. When the rivers are swollen and foul, it is said to be more active, to come out of its hiding place, and range about in its slow way in search of food. This is a habit with very many of the ground fishes, and river fishes generally are most on the alert when the water of the rivers is in a state of agitation. It is most frequently seen in the spring, at which time of the year the males and females come together towards the banks during the heat of the day, and for the purpose of spawning. The eggs are of a greenish colour, not very numerous in proportion to the size of the fish, and it is ascertained that they are hatched in the course of about eighteen days. This fish is called *Saluth* by the Swiss, *Wels* and *Scheid* by the Germans, and *Mal* by the Swedes. In the latter country it is dried for winter food, and the fat is made use of separately, being more like the soft fat of some of the mammalia than the common oil of fishes. There appear to be different species of this fish in the northern parts of the eastern continent, or else those which inhabit different rivers vary in their appearance. Some are also found in the fossil state, which is what we might be prepared to expect in fishes that lurk in the mud at the bottom of rivers, and which must be occasionally buried in the rubbish brought down by the floods. The particulars of these are, however, not worth stating, as the fishes have no history of a popular nature, and the one of which we have given some particulars has not much.

From the little action of these fishes, it will readily be understood that they are long lived; for it is a general law among vertebrated animals, that sluggish action and longevity go hand in hand; and the accumulation of fat is also a concomitant of the other two. It appears also that these fishes continue increasing in size for a very long period of years, and that, in fact, the time when they cease to grow and begin to feel the effects of old age is quite indeterminate. They grow to a much larger size than any other fish of the fresh waters of Europe; for although, as has been mentioned, seventy or eighty pounds in weight is a sizeable fish, individuals far heavier than that are occasionally to be met with. Some of these are as much as twelve or even fifteen feet in length, and weigh from three hundred pounds to four hundred. Some of the largest that are recorded wer

taken in the Oder. When they are once discovered they are not very difficult to capture, as their motions are slow; but they are very tenacious of life. It does not appear that they can be introduced with success into any rivers except those in which the water is very cold, which is an additional reason for concluding that they are not the same species which is met with in the warm countries.

Schilbeus. This is one of the subdivisions of the genus *Silurus*, and it occurs chiefly in the Nile, where there are two species, both much sought after on account of the flavour and wholesomeness of their flesh. Their characters, as distinguished from the European species, are: the body compressed vertically; the head small and depressed; the neck rising suddenly to a considerable elevation; the eyes very low, giving a singular expression to the head; the lips furnished with eight barbules, four on the extremity of each jaw; and the spine of the first ray of the dorsal very strong and toothed. There are at least two species in the Nile, the one called *Schilbé* by the Arabs, and the other *Schilbé oudney*, which last word means eared; and the systematic name is only the Arab one with a Latin termination. The chief distinction of the two species is that the first has seven rays in the dorsal, eleven in each of the pectorals, six in the ventrals, sixty-five in the anal, and eighteen in the caudal; while the second has eleven in the pectoral, six in the ventral, seventy-seven in the anal, and eighteen in the caudal. They appear to live more indiscriminately in fresh and salt water than the *Silurus* of Europe; for, according to the accounts, they are found in the Red Sea as well as in the Nile, and the Red Sea receives a smaller supply of fresh water than any other sea of the same extent; but, at the same time, it is one of the most productive of animal life any where to be met with on the surface of the globe. There appears to be an American species of this genus, which has the head small and blunt, and the eyes so very minute that they are hardly visible.

Mystus. The fishes of this subgenus are mostly found about the mouths of rivers in the tropical seas, especially in the Atlantic. They are covered with a smooth naked skin without any armature on the sides; and they have an adipose dorsal fin behind the one with rays. They are very common about the mouths of the rivers in the West Indies, and on the north coast of South America.

Pimelodus. These have the skin soft and smooth, and they are without teeth on the vomer, but they have some on the palatal bones. They vary considerably from each other in the shape of the head and the form of the barbules on the lips. There are some of them which have only a single row of teeth, and these have usually a bony plate on the upper part of the head, and another on the neck between that one and the spine of the dorsal fin. Others have these two osseous pieces meeting each other, and forming one large shield, which extends nearly the whole way from the muzzle to the first dorsal fin; and there are others which have the head covered with the common integument the same as the rest of the body. In fact, the varieties in the form of the head, and in the armature, whether of teeth internally or of plates on the outside, are numerous. The diversities in these respects are so great, that the fishes are quite a study, although, in their appearance to outward observation, they all have a very strong common likeness.

Porcus. These have the teeth in the upper jaw composed of two parallel bands of thickly-set small teeth, one upon the intermaxillary bones, and the other on the vomer; the head is smooth, and the plate on the nape very small; some of them have the snout extended similar to that of the pike. There are several species of them found chiefly on the shores of Africa and its islands, and also in the larger rivers of that quarter of the world.

Synodontis. The teeth of this division are very peculiar and quite unique among toothed animals, much as these differ from each other. They have in the lower jaw a patch of teeth very much flattened laterally, but ending in crooked points, and standing upon flexible peduncles; they have a rough helmet on the head which extends in a bony plate as far as the base of the dorsal spine; that spine is also very strong and toothed. They are found in the larger rivers of Africa, but their flesh is of comparatively little value.

Argeneisos resemble the *Pimelodus*, only they are without the barbules at the mouth, though some of them have the maxillary bones continued in a sort of horny projections.

Doras have a row of osseous plates along the lateral line, each of which has an elevated keel terminating in a spine. Some of them are found on the coasts of North America, but not in high latitudes.

Heterobranchus. The fishes of this sub-genus are named from the very peculiar form of their gills. They have the gill-openings, and especially the gill-covers, smaller than in most of the family; and on the superior branch of the third and fourth bronchial arches there are tree-like appendages, which have some resemblance to the gills of tadpoles, and to those of the young sharks, while they continue enclosed in the egg. They have a rough and flat plate on the head, broader than in any other of the family, and having lateral plates which extend over the temples and the orbits of the eyes. They have a strong toothed spine in the pectoral, but none in the dorsal. There are a good many species of them, some with a second dorsal, and some without. They inhabit the rivers of Africa and Asia, and are especially abundant in those parts of the two quarters which lie most adjacent to each other. Generally speaking, their flesh is of inferior quality; but there is one, the *Sharmuth*, or black fish, which is so abundant in Syria as to form a staple article in the food of the people.

Plotosus. The members of this sub-genus are distinguished from all the others by having two dorsal fins with rays to both. The second dorsal and the anal are both very long, and they meet at the extremity of the fish, forming a tail something like that of an eel. The lips are fleshy and prominent, their gape is armed in front with conical teeth, and behind these there are globular ones which, in the upper jaw, are situated upon the vomer. They have no naked plate on the head, but a covering of thick skin the same as on the body. The spines of the fins vary a good deal, some having them large and toothed, and others wholly concealed within the skin. They are mostly fishes of the oriental seas; and some, even of very small size, are very dangerous to handle, in consequence of the formidable character of these spines. One is mentioned, not above two inches in length, the wounds given by which are of so lacerated and ragged a character that, after handling it much, the hands cannot be moved for five or six days, and

every prick that it gives, though very minute, festers, and threatens gangrene. This is *P. ikapar*. It is deep black on the back, and white on the belly, with four yellow stripes extending from the muzzle to the tail.

Callichthys. These have the body completely covered on the sides by four rows of bony plates; but the muzzle and the under part are naked. The first dorsal has the spine short and weak, and the second dorsal has only one ray; but the spines in the pectorals are strong and rough. The opening of the mouth is narrow, and the teeth are very minute. The fishes sometimes crawl and climb out of the water in the same manner as eels.

The subgenera, of which we have now given a list, are those that make up Cuvier's genus *Silurus;* and, notwithstanding the extent to which it is subdivided, the subdivisions do not reach all the particulars of the characters of the species. Our information respecting them and the other genera that make up the family is, however, very imperfect, though the fishes are very numerous.

Malæpterurus. This genus gets its name from the only fin on the back being soft. There is no dorsal fin properly so called, but only a little adipose appendage near the tail. There is not a vestige of spine in the pectorals; nor any kind of armature upon any part of the body. The teeth are small, and cover a large crescent on the surface of the mouth.

There is only one known species of the genus, *M. electricus* (the *Silurus electricus* of Linnæus). It inhabits the rivers of the warmer parts of Africa, where it attains the length of from a foot to a foot and a half. It is a very slimy fish, and has the skin marked with very many black spots upon a white ground. The most remarkable character about it is an electric power, similar to that of the *Gymnotus* and the *Torpedo;* but, from the smaller size of the fish, not so formidable as it is in these.

The Arabs, who capture it in great numbers in the Nile, call it *Ruad*, or the "thunderer;" but so far are they from having any superstitious dread of it, that they readily eat its flesh, and apply its fat for medicinal purposes, chiefly fumigations by burning it. The electric apparatus appears to be the same in this as in all the other electric fishes, namely, a series of tubes divided into numerous cells by cross partitions, and filled with a fluid. This is so perfectly analogous to a common galvanic apparatus, that there seems every reason to believe that, in the one as in the other, the energy is obtained by a decomposition; but whether the decomposition of water we are unable to say. As is the case in the others, the electric apparatus is very amply furnished with nerves.

Aspredo. The characters of this genus are very well defined. Their head is very short, and the fore part of the body very broad, owing to the large size of the shoulder-bones; the tail is also very long; the eyes are small, and have an upward aspect. Their most remarkable character, however, and one which distinguishes them from all the other bony fishes, is the immobility of the gill-lid. The opening of the gills by which the water is discharged is a simple slit, at the back part of the side of the head. The species are not numerous.

Loricaria. This genus are named from the bony plates that cover the whole body and head; and they are distinguished from all the other armed *Siluridæ*, by the mouth opening under the muzzle. Among the other members of the family, *Synodontis* is the one which has the mouth most nearly resembling that of this one, but there are many differences. The intermaxillary bones are small, and suspended under the muzzle; and the mandibularies are transverse, not united, and furnished with long and slender teeth, crooked at the points. A large circular veil of membrane surrounds the mouth; and the bones of the pharynx are covered with teeth like a pavement. The gill-lids properly so called are as immoveable as they are in the genus *Aspredo;* but there is a small moveable plate jointed to the side of each, which appears to perform the function of the whole. They have four rays in the gill-membrane. The first rays of the dorsal, of the pectorals, and even of the ventrals, are furnished with strong spines. They have no cæcal appendages to the intestines; and it does not appear that they have any air-bladder, though every other genus in the family is provided with one. In consequence of considerable differences in the characters of the known species of the genus, it has been divided into two subgenera.

Loricaria properly so called. The fishes of this subgenus have only one dorsal fin, situated far forward on the body; the membranous veil or appendage to the lips is furnished with barbules, and in some cases it is roughened all over with papillæ; and the under part of the body is covered with osseous plates, as well as the upper and lateral parts.

One of the most characteristic species of this subgenus is *L. cataphracta* of Linnæus. It is an inhabitant of the fresh waters of South America. It has the caudal fin much forked, and the first ray of the upper lobe very long, often longer than the whole body of the fish; but this is apt to be broken in dried specimens, and thus the drawings taken from them give a very imperfect idea of the true character of the fish.

Hypostomus. These get the name of "under mouth" to distinguish them from the preceding subgenus. They have a second dorsal fin of small size, and with only a single ray. Their labial membrane is beset with papillæ; but it has no barbules, except a small one at each side of the upper jaw. The belly is also without osseous plates. Their intestinal canal is much convoluted, and at least five times the length of the body. Like the preceding subgenus, they are known only as inhabitants of the fresh waters of South America.

Such is a very brief outline of the family of the *Siluridæ*, which are, next after the salmon family, perhaps the most interesting of the fresh water fishes; and they far exceed them in size. They are among fishes what the hippopotami are among the river mammalia; and both races are most abundant in the same latitudes, and also in the very same rivers. They, however, lie too far from the scene of accurate observation for our being able to say much of their relations to the rest of nature, or the part which they more immediately perform in the system; but they are so numerous, so varied, and some of them of such size, that their function must be important.

SIMARUBACEÆ. A small natural order containing three genera and five species. The genera are, *Simaruba*, *Semaba*, and *Quassia*. They are trees or shrubs with an excessively bitter bark, a milky juice, and pinnated leaves. The *Simaruba officinalis* is well known as the most pure and intense bitter hitherto discovered. The same quality exists, in a milder degree, in the rest of the order. The flowers

are decandrous, with one pistil; the carpels are two-valved, and one-seeded. In our stoves they thrive in loam and heath mould, and are propagated by cuttings.

SIMPLEGAS. A fossil mollusc allied to the *Ammonites*, from which it is distinguished by the septa being plain, and not sinuous.

SIMULIUM (Latreille). A genus of small dipterous insects belonging to the family *Tipulidæ*, having the eyes large and internally notched, the ocelli obsolete, the antennæ short and eleven-jointed, and the proboscis pointed and perpendicular. These are minute insects like midges, which abound to a very great degree in damp situations, where they attack the inhabitants in the same manner as the real gnats (*Culicidæ*); indeed in South America it would appear from the recent work of Messrs. Pohl and Kollar, that the same name mosquito is given to both the *Culex* and the *Simulium*. In some of the Northern parts of Europe their irritating powers are so great, that the inhabitants are compelled to cover themselves with a coating of grease. The type of the genus is the *Simulium reptans*, Latreille. In North America they are distinguished from the mosquito under the name of the black fly.

SINAPIS (Tournefort). A genus of hardy annual herbs, several of which are cultivated for their pungent seeds, of which the common condiment mustard is manufactured. The flowers are tetrandrous, and belong to *Cruciferæ*.

SINNINGIA (Nees). A genus of South American under-shrubs belonging to the natural order *Gesneriæ*. This is a succulent genus, and succeeds in any rich dry soil; and young cuttings planted in the same soon make roots.

SINODENDRON (Fabricius). A genus of coleopterous insects, belonging to the family *Lucanidæ*, distinguished by having the body elongate and cylindric; the head of the male armed with an erect horn; the antennæ elbowed, ten-jointed, the first joint being very long, and the three terminal joints forming a deeply serrated club; the legs short, with the tibiæ spined. The genus comprises a single British and several exotic species, the former being the *Scarabæus cylindricus* of Linnæus. This species is found in Normandy in the rotten trunks of apple-trees, and in Flanders in decayed beech-trees. In England it appears to be more frequent in the ash and willow, as we learn from Stephen's British Entomology, and the following observations of the Rev. W. T. Bree, published in the Gardeners' Magazine:—A living ash-tree, standing on his premises, was blown down on the 3rd December, 1832. Its trunk, for about eighteen feet up from the part that had been level with the ground, was hollow and decayed at the centre, and afforded some twenty or thirty good barrow-loads of rotten wood. Throughout this carious portion of the tree there occurred numerous individuals, both in the larva and imago state, of the *Dorcus parallelopipedus* (another species of the *Lucanidæ*), and of its usual associate, the *Sinodendron cylindricum*, but not a single pupa was discovered; they had perforated it in all directions. Many were found pursuing their occupations in the decayed timber at the distance of eighteen feet from the ground, to which height they must have worked their way from the bottom. He was satisfied that they did not commit any injury on the living or sound wood, attacking such only as they found far gone in a state of decay. This insect is of a black colour, and varies in length from one half to three-fourths of an inch.

SIPHONARIA (Lamarck). A patelloid shell, elliptical, the summit well marked, a little on the left, posteriorly, a canal or gutter on the right side, the muscular impression in the form of a horse-shoe, the right lobe divided in two by the canal.

SIPHONIA (Richard). The *S. Cahuchu* is the Indian-rubber tree, called *Jatropha elastica* by Linnæus. The flowers are monœcious, and belong to *Euphorbiaceæ*:—cuttings.

SIPHONOBRANCHIATA constitute the first order of the second class *Paracephalophora* in De Blainville's Malacology. The leading characters of these molluscs is their organs of respiration being constantly formed by one or two pectiniform branchia, obliquely situated on the anterior part of the back, and contained in a cavity whose upper coating is provided with a tubular canal more or less elongated, and attached to the columella. The first family of the order is the *Siphonostomata* genus *Murex* of Linnæus, and includes the genera *Murex*, *Pleurotoma*, *Rostellaria*, *Fusus*, *Pyrula*, *Fasciolaria*, *Turbinella*, *Columbella*, *Triton*, *Ranella*. The second family the *Entomostomata*, is Linnæus' genus *Buccinum*; it includes the *Cerithium*, *Melanopsis*, *Planaris*, *Subula* *Terebra*, *Eburna*, *Buccinum*, *Harpa*, *Dolium*, *Cassi*, *daria*, *Cassis*, *Ricinula*, *Cancellaria*, *Purpura*, *Concholepas*. The third family, *Angyostomata*, includes th *Strombus*, *Conus*, *Terebellum*, *Oliva*, *Ancillaria*, *Matra* *Voluta*, *Marginella*, *Peribolus*, *Cypræa*, *Ovula*.

SIREN. A genus of *Batrachian* reptile, and the last both of the order and the class in the arrangement of the animal kingdom by Cuvier. To this place in the system it is unquestionably entitled, as the animals composing it partake of the characters, and even of the forms, both of reptile and of fish, though that of reptile, on the whole, predominates.

Animals of this genus are the only known ones that are true *Amphibia*, furnished with both lungs and gills, either of which they can use at pleasure. The characters are: the body elongated, and nearly in the form of that of an eel; three tufts of gills; no hind feet, and not the least vestige of a pelvis; the vertebræ of the spine very numerous, and articulated something in the manner of those of a fish, that is, with the proximate ends concave, and united by cartilage which forms the joint, so that there is no motion of bone upon bone, and there are only eight ribs upon each side. The body of the siren may thus be regarded as consisting of only a thorax and a tail; the former being that of a reptile, and, as such, furnished with feet; and the latter that of a fish, producing fins only. The head is flattened, the muzzle blunt, the opening of the mouth small, the eye very small, and the ear hidden in the skin; the lower jaw is furnished with teeth all round, but the upper jaw has none, though there are several rows upon two plates, one on each side of the palate.

There have been many disputes respecting the siren, and not a few have been disposed to regard it as the tadpole of the salamander. But Cuvier has demonstrated that the gills are part of the permanent structure of the animal, and not temporary organs, like the gills of tadpoles, to fall off or be absorbed when the animal comes to maturity; and he remarks that some of the sirens are much larger than any salamander even in the full-grown state. This struc-

tural demonstration is completely borne out by the physiological fact that the siren breeds while the gills on it are perfect, and in no one instance has one individual been seen in which there was the slightest symptom of decay in the gills. The capacity of breeding is the most complete evidence that we can have of a perfect animal; and in the whole of the animals that undergo transformations, whether they pass from the water to the air as their element or not, there is not one which has the faculty of breeding until it has gone through its last and completing change. From this it is obvious that, physiologically considered, the siren is a complete and perfect animal; and what more than this could it become by any subsequent transformation that it could possibly undergo?

That both systems of respiratory organs are perfect in the siren has been proved by observation. The gills are as complete in all their parts as if the animal were a fish, and never could breathe but through the medium of water; and the lungs are also perfect, with an abundant ramification of blood-vessels. Either system can therefore be used as occasion requires, and this is not the case with any other known species of vertebrated animals. A siren must not, therefore, be confounded with any kind of tadpole; for, whatever may be the external appearance of these, they never have the two modes of respiration perfect at the same time. That the tadpole must pass from the state of a breather by gills to that of a breather by lungs, is quite evident; but the transition is one of those momentary mysteries that we can never hope to understand, but must satisfy ourselves with a simple statement of the fact.

Among vertebrated animals the sirens thus stand alone as the most peculiar of the whole in their vital system; and from this we may be prepared to find them inhabiting a singular part of the country, or rather of the world. Such is the fact. They are found chiefly in the warmer and more southerly parts of the United States, where much of the surface is covered with marshes, but marshes which are in a great measure seasonal, covered with water at one period of the year, and as dry as dust at another. While they are humid the sirens have the habit of fishes, and when they are dry these animals breathe air; and thus they can pass the whole year in situations where no other animal can. They live upon worms and small mollusca, larvæ, and other minute animal matters. There are three species, but there is not much of interest in them beyond that double power of breathing to which allusion has been made; and therefore a very brief notice of them will suffice for our purpose.

The Larger Siren (*S. lacertina*). The name *lacertina* is inaccurate, as it implies that the animal bears a resemblance to the saurian reptiles, when in reality it does not; and there is really nothing lizard-like in its appearance. It grows to the length of three feet, is generally of a black colour, has four toes on each of the fore feet, and the tail compressed, with the fin blunt. When in the water it swims by lateral flexure of the tail, in the manner of a fish, and not by vertical motions, as in the air-breathing animals that find their food in the water. It is very common in the marshy parts of Carolina, especially the rich grounds that are cultivated for rice, and which are of course laid under water at certain periods of the year. Such places abound much in worms, and these constitute the chief food of the siren. It is a dull and sluggish animal, not very agreeable to the sight, and crawls and pokes about in the sludge, which appears to be much better suited to it than either the dry land or the free water. Here we find one of those remarkable coincidences of animal and place which are so demonstrative of design in the whole system of nature. The proper locality of the siren is neither water nor land, but both by turns, and the animal is organised for both of them as they may happen to present themselves in turn.

The other two known species are,

The Intermediate Siren, of the same colour and form as the above, but with the gill-tufts less developed, and the whole length of the animal only about a foot; and

The Striped Siren, which has two lines of yellow along the whole of each side, the gill-tufts still less developed, only three toes upon each of the feet, and not above nine inches in length. These are perfect animals as well as the larger one, and their gills are a perfect breathing apparatus, though less perfect than in the large one. It is probable that there are, in the obscure haunts of these animals, many species yet to be discovered.

SIRICIDÆ (Leach). A family of hymenopterous insects, belonging to the section *Terebrantia securifera*, and having the abdomen united to the thorax by its whole breadth; the mandibles short and thick; the labrum entire; the ovipositor of the females generally exserted, composed of two external sheaths, inclosing a horny, elongated, and pointed dart; the antennæ are filiform or setaceous, and composed of from ten to twenty-five joints; the body generally cylindrical. The family comprises the genus *Sirex* of Linnæus (*Urocerus* Geoffroy), from which the genus *Tremex* of Jurine has been separated, and Oryssus (which see). The typical genus *Sirex* has the antennæ frontal, from thirteen to twenty-five-jointed, the maxillary palpi very minute, the wings with three sub-marginal cells, and the abdomen produced into an acute point.

These insects, which are of considerable size in general, inhabit the pine and fir forests of cold and mountainous countries, to which they are occasionally injurious, the females depositing their eggs, by the assistance of their long ovipositor, in the substance of the wood, and the larvæ eating into the solid substance of the trees, forming cylindrical burrows.

In certain years these insects appear in great numbers, so as to occasion alarm amongst the ignorant and superstitious. During flight they make a loud buzzing noise like humble bees. It is not an uncommon circumstance for them to make their appearance in the winged state in newly-built houses, having been brought in the deals of which the floors, &c., have been made, in too new a state, whilst they were still larvæ or pupæ, occasioning alarm from their slight resemblance to hornets. The larvæ have six very short legs, and the extremity of the body is armed with an acute horny point; it forms a cocoon in its burrow, in which it undergoes its metamorphoses. The Count Saint Fargeau, in the Encyclopedie Methodique, and his recent work on the *Hymenoptera* (Suites à Buffon), has considered this tribe of insects as parasites, but he is certainly mistaken, as we have abundant proof to the contrary. The species are not numerous, the type being the

Sirex gigas of Linnæus, the female of which is more than an inch long, black, with the second and three terminal joints of the abdomen orange-coloured. The male has the abdomen of a darker orange, with the extremity black. It is very rare in this country, a more abundant species being the *Sirex juvencus*.

SISON (Linnæus). A genus of annual and perennial herbs, natives of Europe. It belongs to *Umbelliferæ*, and in English lists is called honeywort.

SISYPHUS (Latreille). A genus of coleopterous insects, belonging to the subsection *Lamellicornes*, and family *Scarabæidæ*, having the four hind legs very long; the elytra have not a notch at the shoulders, and the antennæ are eight-jointed; the body sub-convex. This is a curious genus of dung-rolling beetles, nearly allied to, and having similar habits with, the genus GYMNOPLEURUS, which see. The genus are chiefly confined to the arid parts of the south of Europe and Africa. The most remarkable species is figured in our plate of beetles, *Sisyphus spinipes* of Gory (Monograph. Sisyph., p. 8). It is of black colour, slightly pilose, with the front of the head notched, the middle thighs with one tooth, and the posterior with four. It is from the Cape of Good Hope.

SISYRINCHIUM (Linnæus). A genus of ornamental herbs, natives of various parts of America. The flowers are tetrandrous, and the genus ranks among the *Iridaceæ*. Some of the species are nearly hardy, but they are generally potted in light soil, and kept in frames.

SIUM (Linnæus). A genus of herbs, mostly aquatics, and commonly called the water-parsnep. The genus belongs to *Umbelliferæ*, and one has been introduced into the kitchen garden, and cultivated for its roots, under the name of Skirret.

SLATE, or SHALE, as it is frequently called, is a very abundant and useful mineral. The slate district of England is of considerable extent. In Cornwall it is seen immediately incumbent upon granite, and the slaty districts form very beautiful scenery upon many parts of our coast. But this mineral appears on the large scale, and in peculiar grandeur, in the mountain-chain which includes Snowdon, Plynlimmon, and Cader Idris. These mountains have an enormous elevation, their summits are jagged and irregular, their declivities steep and barren, and the neighbouring passes and valleys of slate formation are of the most romantic character. London is chiefly supplied from Caernarvonshire and Westmoreland. Argyle and Dumbartonshires also produce vast quantities.

SLIPPER-WORT is the *Calceolaria pinnata* of Linnæus, a fine genus of South American annuals, perennials, and undershrubs, belonging to *Scrophularineæ*. The species are highly ornamental, and the varieties numerous. Cuttings, seeds.

SLOANEA (Linnæus). A genus of trees and shrubs, natives of South America, and named in honour of Sir Hans Sloane, P.R.S., and belonging to *Tiliaceæ*. One species is a timber tree, but they may be kept and propagated in our stoves.

SMERINTHUS (Latreille). A genus of lepidopterous insects, belonging to the family *Sphingidæ*, having the antennæ somewhat prismatic, and serrated with a terminal brush of hairs. The spiral tongue is almost obsolete; the palpi compressed, covered very closely with scales; the wings, with the external margins, notched and angular; the caterpillars are covered with very minute tubercles or warts; the terminal segment armed with a conical horn, and the head somewhat triangular; they feed chiefly on the leaves of trees; the chrysalis is slightly rugose, and pointed at the extremity of the body, and is subterranean. These are dull heavy-bodied hawk-moths, which seldom make much use of their wings, thus differing from the generality of the family. This peculiarity is entirely dependent upon the obsolete structure of the spiral tongue, which (instead of being of very great length, as in the true *Sphinges*, which derive their name, hawk-moths, from their habit of hovering over flowers, and extracting their sweets by means of their proboscis) is in the *Smerinthus* so extremely short, as to be useless to the insects. There are three British species, the eyed hawk moth (*Sm. occellatus*), the poplar hawk-moth (*Sm. populi*), and the lime hawk-moth (*Sm. tiliæ*). They are all sufficiently common, and are handsome insects of comparatively large size.

SMILACEÆ. A natural order comprising twelve genera, and above one hundred species. This order, including *Smilax*, *Ruscus*, *Trillium*, *Paris*, &c., are, on one hand, associated with the *Dioscoraceæ* by their broad leaves, and on the other with the *Asphodelaceæ*, by their generally perigynous anthers and superior three-celled ovarium. The characters, however, which associate them with either distinguish them from each other. Thus the superior ovarium takes them from *Dioscoraceæ*, and the broad leaves from *Asphodelaceæ;* and such genera as have the foliage not reticulated are known by the triple style and membranous testa, which latter is characteristic of all the *Smilaceæ*. Various species of the order are esteemed for their alterative properties; they are tonic, diuretic, and demulcent. *Smilax aspera* is by some preferred to the drug sarsaparilla; which drug is the produce of the *S. sarza*. The genera are mostly hardy, and increased by division.

SMYNTHURUS. See PODURIDÆ.

SMYRNIUM (*Gærtner*). A genus of biennial and perennial herbs, natives of cold countries. The flowers are pentandrous, and the genus belongs to *Umbelliferæ*. One of the species was formerly a kitchen garden vegetable, and cultivated under the name of Alisanders, and used in the stead of celery, which last has superseded the former.

SNIPE (*Scolopax*). A genus of the longirostral family of Echassiers in Cuvier's arrangement, and the typical one of the whole family, as one may infer from the name *Becasse*, or "beaky," given to it by the French. The characters of the genus, as taken generally to include the subgenera, which do not, however, comprise nearly all the birds that were included in the Linnæan genus *Scolopax*, may be stated as follows: the bill long, straight, enlarged at the tip, with the upper mandible larger than the under one, and the enlarged part of it bending over the tip of the other like a hook. The mandibles forwarded for half their length, and the lower one caniculated and truncated at the tip. The nostrils basal and lateral, cleft longitudinally, and covered by membrane; the feet of mean length and slender, and, in the true snipe, having the tibiæ feathered down to the tarsal joint, and three toes to the front and one to the rear; the wings are of mean length, the second quill the largest in the wing, but the first one nearly equal to it; the eyes are placed so far backwards in the head that the birds can command the whole horizon without turning, and it is in this that their

safety lies, for they are without any weapons of defence; they are feeders upon small animals, and their flesh is much esteemed.

Snipes are birds that make very little noise in the world, excepting the cry of the male in the pairing time; and they spend the greater part of the day in concealment among the herbage. They are found in marshy places, and generally where there is an abundance of tall aquatic herbage to conceal both themselves and their nests.

The bill of the snipe is a very curious instrument, and seems to be possessed of very high powers of sensation, both of smell and of taste. The animals bore into the soft sludgy ground for no inconsiderable portion of their food, and as they bore down directly upon it, and do not dabble along, and sift the sludge for it, as is done by the flat-billed birds, they must scent it from the surface, or, at all events, before they reach the depth at which it is situated. Dabbling would not answer in the places where they find their subsistence, as it can be performed only where there is water to wash away the substances which are not edible. The dabbling birds are accordingly all web-footed, have their bodies boat-shaped, and are otherwise adapted for swimming while they feed at the bottom of the shallow water, or if their habit be to get upon deeper water they can dive; but the snipes always have the feet on the ground while they feed, and though they are birds of moist places they are not formed for swimming or for diving. The working of such a bill as theirs would, in part, be impossible in the case of a bird floating on the water; the form of the head is peculiar, and the peculiarity is of course adapted to the action of the bill. The head is square in the profile, and extends over the base of the bill in all directions, so that in whatever way the bill may work in the ground, the weight of the head is ready to assist it in its lateral twistings, as the animal bores into the sludge. The feet of the snipes are much better adapted for walking upon the surface of soft mud than an elastic vegetation, as they are without the long hind toe, which is so essential in the latter, they are in fact birds well adapted to those pastures; and, when on a pasture properly adapted to them, they have no great deal of labour to perform in the finding of their food. The nature of the places to which they are best adapted renders them migratory birds in most parts of the world, as they are equally liable to be frozen out by the cold and parched out by the drought; accordingly they migrate either from country to country or from one part of the same country to another, at the opposite seasons of the year. We need hardly mention, that when they migrate, in latitude, their migrations are southward from the winter cold, and northward from the summer heat; and that if the country be so diversified with plain and mountain as that they can find the seasonal range adequate to their wants, they merely shift from mountain bog to lowland marsh in the winter, and back again in the summer; by this means they enjoy, even in the countries where they are resident the whole year round, a much greater uniformity of climate than most other birds, except those that live actually upon the waters. They are, however, so close in their cover during the day that they are seldom seen, and many of them may be found in places where they have never been suspected of visiting.

The species are rather numerous, and they are distributed over very many countries; but as their manners differ little, it will be sufficient to notice those that are found constantly or occasionally in the British islands, and merely to name some of the others.

The common Snipe (*S. gallinago*). This may be regarded as the typical bird with us, though the woodcock, which is a larger bird, and one in more esteem with epicures, is the *Becasse* of the French, and this one is the *Becassine*. The common snipe is about nine inches long in the head and body, and the bill is about three inches. The weight, when full-grown, is about a quarter of a pound; the bill is dull reddish at the base, yellowish in the middle of its length, and brownish at the tip; from its soft consistency, as containing much more living substance than a hard bill, it becomes shrivelled and loses its colour after the bird is dead; the colours are much broken and mottled, and thus not easily described; the top of the head is dark brown, marked with three longitudinal lines of cream colour, a bright one along the middle, and a more obscure one on each side over the eye; from the gape over the eye and down the side of the neck there is a brown streak, which is broken into a row of spots after it passes the eye; the back is black with glosses and reflections of green and brown; and the feathers on the shoulders have the one striped longitudinally, and the other barred across with yellow; the wings are dusky with some brown bars, and white tips to the quills; the tail-coverts are reddish brown; and the feathers which appear only a little way beyond the coverts, have black bars; the chin, throat, and fore neck are whitish with irregular markings of brown, and the rest of the under parts are white.

In winter they are very common in the fens and marshes, and by the tangled banks of streams in the low and warm parts, and not one remains in the mountain bogs, and it is probable that a considerable number come from countries further to the north, especially when the winter in these is early and severe. In summer the departure, or, at all events, the disappearance, from the low grounds is quite as complete; and, indeed, unless when one comes upon it accidentally, a snipe is very rarely to be seen in summer, even in those places where the cry of the male in the spring shows that they are in the country. On their migrations their flight is always lofty; and, though they are occasionally heard on their march, they are rarely if ever seen.

The Snipe.

The cry of the male begins in March or April, according to the place and season, and he continues to call until a partner answers; but after this he only treats her with a nocturnal song. The sound is shrill but harsh and trilling, and it has been alleged that the bird can trill upon the air with its wings, as is done by many of the insect tribes; but this is by no means probable, as no feathered wing is competent to the performance of such an office. The nest is always in close concealment among the thickest of the rushes or other herbage, and rudely constructed of vegetable

fibres. The eggs are four in number, of a pale greenish grey with brown spots, and they are placed in a cross with the four mall ends at the centre. The young, as is the habit in all ground birds, come out of the shell covered with down, but with their feet so well developed, that they are very speedily able to find their own food; but they do not come to full maturity till the following spring.

At all times they lie close in the bushes and other herbage, and cannot be raised to the wing without much difficulty, they are also very short and "twitchy" in their flight; and thus snipe-shooting requires some training both in the dog and the sportsman. Birds of prey also find the snipes laborious game. In the first place they have to beat a long time before they can "flush" a snipe, that is, make it take to the wing; and then if it gets the start but a little way, its wheels and doubles so often and so rapidly, that if the hawk is not altogether thrown out, the chase is often a very protracted one.

The Woodcock (*S. rusticola*). The woodcock is a much larger and more celebrated bird than the snipe. The total length of it is about one foot three, and the weight from three-quarters of a pound to nearly a pound; the bill is considerably longer than in the snipe, but formed in much the same manner; the forehead is ash-colour, and all the rest of the upper part barred with black and grey; the under parts are yellowish, with longitudinal dusky streaks; the tail consists of twelve black feathers with rust-coloured margins to their outer webs, and ash-coloured tips; their under surface is whitish. There are, however, very great varieties both in the size and colour of these birds; and, according to some of the authorities, the female bird is larger than the male.

The woodcock is in the great majority of its numbers, a bird of passage in Britain, and it was long a question whether any remain to breed. The point has been settled by the actual discovery of nests and broods both in England and Scotland. The eggs and young have not been found in any considerable number, but they have been met with at points along almost the whole length of the country.

They are birds of wild marshy copses, where they can find food in the sludge by the sides of the pools and runs of water. Solitude, shelter, and humidity are the three essentials of the woodcock; and it requires them all jointly. Hence, as cultivation changes the character of a country, these birds shift. Drainage, cultivation, and increased population drive them from the richer parts of the country, however well these may be wooded. On the other hand, the uncultivated moors, however humid they may be, are as ill-adapted for them; and thus when such places are planted with copses in lonely spots near the water, the woodcocks will come, and if the places continue humid enough during the summer, they will remain and breed. The first of these changes has gone far to banish them from some parts of Britain even as visitants, and the other has made them partially resident, and plenty as visiters in places where none formerly existed. In Scotland this has been especially the case on the southern slopes of the Grampians towards Strathmore, and in Ross-shire about the head of the frith of Cromarty; and no doubt there have been instances as remarkable in other places, both in the north and the south of Britain, and especially where plantations have been formed in Ireland.

The grand resort of the woodcocks in summer is, however, understood to be the marshy woods to the north of the Baltic, and the farther north, so that the place is wooded, the better, as the insect food for the birds is not only more numerous, but the sludge of the marshes is more exclusively the *nidus* of the larvæ. Hence, to make sure that woodcocks shall breed in any place, the best way is to make it "as like Lapland" as possible. The birds remain in concealment in the woods during the day, and come out only when the evening begins to get damp, at which time they utter their peculiar cry which resembles that of the snipe, but is less harsh and shrill. They are more social birds among each other than the snipes, and generally come to the feeding grounds, and also quit them in little parties, and they follow the same paths. Their flight on these occasions is always low, as if they sought cover even when they are flying. From this habit they are easily taken by means of nets. Springes and nooses were also much in use in former times, when there were far more neglected pools and marshy places in England than there are now; and the ease and certainty of this mode of capture are alluded to by Shakspeare, when he mentions "Springes to catch woodcocks," a kind of sporting which the bard himself had no doubt often tried.

Woodcocks are very expert in finding out where there are worms and other little animals in the ground, and they are just as dexterous at drawing them out. The first discovery must be made by the scent, because there is no other sense which the bird can exercise; and then, the worms are so quick in perceiving any agitation of the earth, that the securing of them by means of a bill boring and poking in the ground, is a very curious matter.

The nests of these birds are usually placed in the thick underwood at the roots of the trees, or in bushes, and they are formed of dry vegetable matters, such as moss and leaves, and withered stalks; the eggs are four in number, larger than those of the common pigeon, of a dull yellowish white colour in the ground, and spotted with ash-colour and reddish brown most abundantly at the larger ends. Such nests as have been met with in Britain have generally had eggs in them in June; and it is highly probable that, in all countries in which they breed, the longest days are their favourite season. The long twilight of such times is advantageous to them; and in those latitudes where they breed most abundantly there is twilight all the night through for a considerable time, and for some time sunshine. There are frequent fogs in such places, and while they are on the surface is the feeding-time of the woodcocks. The quantity of food, especially of earth-worms, which the woodcock consumes, is perfectly wonderful; and those who speculate about the matter come to the conclusion that it would be hard labour for a man to find, in this way, the food of three woodcocks. This even exceeds the labour which is said (satirically most likely) to have once fallen on the ladies of honour and the courtiers of a certain royal establishment, in consequence of a gift of lizards having been made to a queen. These lizards would eat nothing but flies; and the attendants at the royal palace were so completely worn out with fly-hunting, that it was at last resolved to call in the aid of the household troops; but, fortunately, a severe frost put a period to the life of the lizards, and thus the fly-catching was at an end, much to the joy of the exhausted courtiers.

It is in the autumn and winter that the woodcocks

feed chiefly upon earth-worms, for at those times of the year the number of other living creatures in the sludge and mud is much less than during the warm time of the year. In all probability it is from being composed of earth-worms that the "trail," or contents of the stomach of the woodcock, is reckoned so very savoury a mess by the epicures; for those gut-birds which feed nearer the water, and consequently more upon insects, larvæ, and mollusca, are said to have the trail far inferior. This is a matter, however, which can hardly be said to belong to the natural history of the birds. We may farther mention, as indicative of the fact that the woodcock is not an inhabitant so near the water as the common snipe, that it has the tibiæ feathered down more closely to the tarsal joints.

The Great Snipe (*S. major*) is not nearly so large as the woodcock, not being above an inch longer than the common snipe. It has the head of a deep black colour, with three light stripes like those on the common one; the upper parts are black, and pretty clear red, variously mottled together; and the under parts are reddish white, with some longitudinal dusky streaks on the belly and flanks; the shaft of the first quill of the wing is white. This is a European bird, breeding in the north, and removing southward in the winter; but it belongs to the east of the country as divided by the central heights, and thus the grand line of its migration is that of the Black Sea and the Archipelago, and not of the shores of the Atlantic. It does come a considerable way to the westward, and sometimes, but not very frequently, straggles into Britain, but on its southward journey, and not its northward one. It is a much heavier bird than the common snipe in proportion to its lineal dimensions, and therefore it is not so well suited for very long migrations. The marshes of the northern parts of Europe, to the east of the Baltic, are said to be the places to which the greater number resort in the nesting time; and the economy of their nests is said to be very much the same as that of the common snipe in our own marshes. It is possible, however, and even probable, that it may be only a climatal variety of the common snipe, for we believe that it is not unusual for birds to be larger in size, and more intense in colour, in the east of Europe than in the west. Snipes are, altogether, rather puzzling birds, for they are so much concealed, that they may be in many places where we never suppose them to be; and there may also be many species of them in Europe, and even in Britain, which have not yet been noticed.

Sabine's Snipe (*S. Sabini*). This is a species of which we have the knowledge only of late years; and thus it is one of those that show us how careful we ought to be of coming to hasty conclusions in the case of birds of such hiding habits as the snipes. This is a smaller bird than the common snipe, but with the bill very considerably longer in proportion. The general colour is brownish black, relieved by chestnut and rust-colour on the margins of the feathers, which give it a very rich, and, at the same time, a very pleasing mottled appearance. It is a small species, but a very pretty one, and has in some particulars much more resemblance to the jack snipe than to the common snipe. For instance, the feathers on the tail of this one are twelve in number, the same as in the jack snipe, while the common snipe has fourteen, and the great snipe sixteen. This comparatively limited number of feathers in the tail points out that the bird is one of hiding habits, and fond of concealing itself in the tall vegetation; for, almost without a single exception, birds which have broad tails inhabit open places. Specimens of this snipe have been met with in different parts of both Britain and Ireland at such times as to show that it could hardly have been a straggler from any migration; and therefore, if it is not a mere variety of the jack snipe, which is not impossible, the probability is, that it is a resident species breeding in some parts of the British islands.

The Jack Snipe (*S. gallinula*) is a very pretty little bird, only about half the volume of the common snipe, that is, not more than two ounces in weight. The bill is about two inches in length, and of a lead-colour in the general part of its length; but the tip is black, and the culmen of the upper mandible is horn colour; the irides are dusky black; the upper part of the head is black, with very faint margins of rust colour to the feathers; there is no line on the middle, but a yellowish streak on each side, with a dusky one below it, and another pale coloured one over the eye; there is also a dark line from the angle of the gape to the eye; the back, the scapular feathers, and the rump, are of rich green and purple, varying in tint as the light falls differently upon it, and the scapular feathers have buff margins, forming two very conspicuous lines on the shoulders of the bird, which run all the way from thence to the tail; the neck is marked with rusty brown and dusky, with some cloudings of ash colour on the upper part; the coverts of the wings are dusky, marked with ash colour and brown, and the quills are dusky; the tail is wedge-shaped, consisting of twelve feathers of a dusky colour, but more or less clouded with rusty red; the under parts are nearly white; and the legs are of a greenish colour.

There are few British birds concerning which there have been more mistakes than the jack snipe. As is the case with very many birds which, on account of their dispersion over the wild parts of the country, and their concealed habits during the breeding season, the common describers of birds cannot easily see at those times; the jack snipe has been packed off "bag and baggage" to breed in the polar regions, without sufferance to remain in any decently southward climate during the summer. But it is one thing to write a bird into the polar regions, and another to send it personally there; and there is no truth in description, if the writer of this article has not seen the jack snipe full fifty times and more, in the reedy pools upon the first uplands of Britain many times in the course of the summer; and he once caught it with hook and worm by the tangled bank of a wild stream, at the head of a mill-pond, when angling for quite another sort of game. The smallness of the bird, the lightness of its motions, and the two lateral stripes on the back from the shoulders to the rump, are not to be mistaken; and thus the only sound conclusion is, that, though this bird unquestionably leaves the places near the sea, and moves into the uplands in the summer, it breeds, and that in no stinted numbers, within the country. The fact is, that though the authorities, who have been generally men of the south, or of the sea-coast, where the birds do not breed, have represented the jack snipe as a comparatively rare species, it is perhaps one of the most plentiful of the whole genus, and one of the most generally distributed over different countries.

In Britain the jack snipe takes its departure from the marshes in the low and warm parts of the country, near the shores, as early as March, or even as February, according to the season. Now, even the latest of those times is not exactly the one at which a bird should set out from Britain to the polar regions, because there is little for a bird there until June, or May at the earliest. But the objection does not hold in the case of a bird moving by stage and stage from the margins of the sea to the marshy moors in such a country as Britain. There is another consideration: if the jack snipes of this country went off to the far north, we might expect them in considerable numbers in the Orkney and Shetland isles; but this is not the case. They are mentioned as occurring in some of the Orkneys, but they are described as being rather rare birds, much more so than in places farther to the south. The case would be very different if the birds, *en masse*, passed over the latitude of these islands, for migratory birds, as might be expected, never omit halting to rest and feed on any islands that may be in the line of their march.

The grand foundation of the difficulty appears to lie in the retiring habits of these snipes. In the district where, as we have mentioned, we saw them so often, we never by any chance saw one on the wing, or in any other way than by the direct invasion of the tangled pools in which they find convenient nesting places, and an abundant supply of food; and there is no doubt that any one, who chances to look for them in such places during the breeding season, will find them in abundance, though not congregated in the same place; for under all circumstances, and at all seasons of the year, they are solitary and retiring birds, not to be "flushed," or raised from their hiding places, without very considerable effort, and also knowledge of the ground. The places in which these snipes are found, in the breeding season, are of the most difficult character; that is, where no predatory quadruped can go, and where the ordinary birds of prey cannot easily find them, in consequence of the closeness of the cover. But these, and many of the other ground birds which breed in the marshes, find destroyers of their eggs that would not be suspected, in those gulls which breed in the same places. The place of which the gulls take possession is safe in this way; for the gulls inhabit closely in large societies, and no other bird will or can breed in the same locality. But they prowl about in the neighbourhood, and are terrible robbers of nests.

The Jack-snipe is one of the prettiest of all our marsh birds; and when it whisks about among the tall grass and *equisetums*, the fine gloss on the back, and the two lateral stripes give it a most lively appearance. The nest is very difficult to find, as it is always so placed as that the bird can glide to some distance from it before it disturbs the grass. To seek for either nest or bird is a hopeless matter; and at the pools of which they inhabit the margins, one must take the chance of finding them without an actual beating of the course.

Though these birds resort to the pools on the elevated moors, they are not found in the higher mountain bogs; and if there is cover enough they keep their place, though the labours of the agriculturist and the grazier are going on around them. But a country favourable for them is most unfavourable for agriculture, as the tangled bogs, which they frequent, occasion blights in the latter part of the spring and early in the autumn; and thus where snipes nestle, unless in places wholly abandoned to wild nature, there is a strong admonition to man to commence draining; and the drainage of those little bogs which spot the fields, in many of the farming districts that have been neglected, is doubly profitable—the soil is taken away, and it furnishes a rich dressing for the thin and light lands.

As one might suppose, from the marshy nature of great part of the surface, snipes are very plentiful in North America. They do not differ greatly from the snipes of Europe, but they are not exactly the same; no native animal of America is exactly the same as the analogous one of the eastern continent, and man himself does not appear to be an exception to the general rule. Our limits will not admit of a full enumeration of even the known snipes of America, but we shall notice one or two.

American Woodcock (*S. rubicola*). In its form and manners, this has a considerable resemblance to the woodcock of Europe, but it is smaller in size and differently coloured. The under parts are rusty red, instead of yellowish white with dusky lines; and the female weighs half a pound, and the male two or three ounces less. It is a migrant, wintering in the southern parts, and appearing in the central states about the beginning of March. It does not appear that they proceed to the very extreme north, indeed they cannot be expected beyond the woods and brushes, and there are abundance of these to the northward of the great lakes, for sheltering all the woodcocks in the world.

The male of this species is ten inches long, and sixteen in the stretch of the wings; and the female is twelve long, and eighteen in extent. The upper mandible of the bill is reddish brown, with the enlarged knob or nail black; and it is about two inches and a half in length, and projects a tenth of an inch beyond the truncated tip of the lower one. Both mandibles are grooved. The front, a streak over the eye, and all the under parts of the body, are tawny red, the sides of the neck ash colour. The top of the head black, with three bands of brownish white. The back and scapulars deep black, with narrow rust coloured margins to the feathers; but these parts pass into bluish white at the edges; and all the back has zig-zag lines of black on the lighter parts. The quills are brown, and the insides of the wings reddish rust colour. The tail feathers are black, with a row of reddish brown spots along the outer web of each, and the tips narrow and of a pale drab colour. The under side of the tail-feathers is silvery white. The legs and feet are flesh colour; and the eyes, which are situated much further back than in the European woodcock, are very prominent, and of a deep black colour. The weight is generally rather less than six ounces. In the female, the colour on the back is of a paler tint, and there are dusky bars on the under sides of the wings. These differences in colour, together with the great disparity in size, has occasioned these birds to be considered as two distinct species.

Woodcocks breed earlier in the season in America than they do in Europe. Wilson mentions that nests with eggs have been found in February, but that the usual time is early in April. In consequence of this the birds are on the ground, and sporting commences as early as July, through which month and the two following ones, the best season for them continues. In Britain

they do not make their appearance on the low grounds till the end of September, and they are not numerous till November, the time at which the American ones quit the middle states, and proceed to the south. The following description of the manners of these birds, by Wilson, is worth quoting as illustrative, not of them only, but, with slight variations, of the whole genus. "The woodcock is properly a nocturnal bird, feeding chiefly at night, and seldom stirring about till after dark. At such times, as well as in the early part of the morning, particularly in spring, he rises, by a kind of spiral course, to a considerable height in the air, uttering at times a sudden *quack;* till having gained his utmost height, he hovers around in a wild irregular manner, making a sort of murmuring sound, and then descends with rapidity as he rose. When uttering his common note on the ground he appears to do it with difficulty, throwing his head toward the earth, and frequently jotting up his tail. These notes and manœuvres are most usual in spring, and are the call of the male to his favourite female. Their food consists of various larvæ and other aquatic worms, for which, during the evening, they are almost continually turning over the leaves with their bill, or searching the bogs. Their flesh is reckoned delicious, and prized highly." The summer, which is much hotter, and more rainless in many parts of America, than it is in Europe, and especially in Britain, dries up the waters and hardens the earth much more early in the season. This is obviously the reason why the woodcocks, adapting themselves to the climate, breed so much earlier than those with us. In consequence of the drought, they are compelled to descend to the margins of the larger streams in July; and thus, if they bred as late as the same birds do in Europe, the young would perish for want of food, as they, like all the other ground birds, have their feet perfect, and are able to find their food long before they can fly.

SOJA (Moench). A Japanese plant, belonging to the *Leguminosæ*, the seeds of which are made into a sauce, which is preferred to the kitjap of China; "both, however, are imported into England in large quantities, and are here known as soy. In bond it is worth six shillings a gallon, but, after it has been adulterated, it is sold at three shillings a pint."—(Burnett). This plant was the *Dolichos Soja* of Linnæus.

SOLANDRA (Linnæus). A genus of evergreen and climbing shrubs, having pentandrous flowers, and belonging to *Solaneæ*. These are favourite stove plants, and if potted in loam, encouraged to grow into bulk, and afterwards kept dry till their leaves fall off, they will soon produce flowers. They are easily increased by cuttings.

SOLANEÆ (Linnæus). A natural order, containing thirty-three genera, and above four hundred and sixty-one species. Although there is great diversity of properties in this order, it is still a truly natural one. For notwithstanding the deadly nightshade and the esculent potato, the acrid capsicum and the bland tomato, the wholesome egg-plant and the poisonous tobacco, with the stramonium, the henbane, the mandragora, and various other equally deleterious or equally innocuous plants, are found here associated, they afford evidence of relationship. The deleterious principles prevalent in the *solanaceæ* are narcotics of a peculiar kind. Several of these have been separated, and named from the plants in which they are found, as *atropine, solanine,* &c. The narcotic principle which is so deadly a poison in the mandragora and belladonna, is present in the potato and the egg-plant, but in the latter in such small quantities as to be altogether innocuous when prepared for food.

Many plants belonging to this order are very handsome. The verbascums, daturas, and solandras, are all plants of great beauty, and mostly bearing pentandrous flowers; they are also almost all easy of cultivation and propagation.

SOLARIUM (Lamarck; Trochus Perspectivus, Linnæus). Linnæus and his disciples considered this genus to be a species of *Trochus*, with which it certainly appears nearly allied, particularly when compared with such of them as have the base terminating in a sharp edge at the outer circumference. In form this genus also resembles the *Planorbis*, and from the examination of some fossil species, it is very difficult to draw a distinct line between them. Lamarck's division, however, cannot be mistaken for either of the above-mentioned genera, the umbilicus of the shell being always dentated or crenated at the edge of the internal whorls. These shells are of an orbicular depressed conical form; the umbilicus very wide, *with dentated spiral whorls running interiorly from the summit to the margin;* the aperture is nearly quadrangular, and there is no columella. The writer has seen a calcarious operculum said to belong to this genus. In appearance it closely resembles the thick stony operculum of many of the *Turbines*, but its shape was more quadrangular, which seemed to characterise it as belonging to this genus. These molluscs sometimes attain a considerable size. We have seen them three inches in diameter; they are elegantly sculptured, and delicately marked with black and straw colour, and the beauty of their symmetry is not surpassed by any other shell. The perspective *Solarium* is from the Chinese and Indian seas, but one small species of *Solarium* is found in the Mediterranean. Several fossil species are known and described. The animal constructing this shell appears unknown, or at least it is so to us, no author we have met with giving any account of it. This occurrence will now become less frequent, as the present impetus given to this branch of natural history will enable the scientific writer to examine the animals as well as their habitation; and from such an examination the only true classification can be accomplished.

SOLDANELLA (Linnæus). A genus of humble alpine herbs, but bearing beautiful pentandrous flowers, and belonging to *Primulaceæ*. They should be in every flower-garden, thrive in peat-earth and loam, and are suitable for rock-work or placed in small pots; division or seeds.

SOLIDAGO (Linnæus). A numerous genus of perennial herbs, mostly natives of North America. They have invariably yellow and rather showy heads of flowers, and belong to *Compositæ*. In English lists they are called Golden Rod, and are usually planted in shrubberies, as they are tall-growing plants.

SOLOMON'S SEAL, is the English name of the *Polygonatum vulgare* of Desfontaines. The flowers are hexandrous, and the genus belongs to *Smilaceæ*. Common in every collection, and increased by division.

SOMMITE. This highly interesting mineral is the rhomboidal felspar of Mohs and the nepheline of Haufy and Werner. It is generally of a white

colour, and the primitive form is rhomboidal. The most common secondary forms are exhibited in the sketches beneath.

Sommite is strongly translucent, and one of its most curious properties is that a few moments' immersion in nitric acid will produce a cloudy and waved character throughout. The finest specimens are brought from Monte Somma near Naples.

SOPHORA (Linnæus). A genus of very ornamental plants, natives of Eastern Asia, Siberia, and of the tropical parts of America. The flowers are decandrous, and the form of their fruit associates them with *Leguminosæ*. *S. Japonica*, a very handsome species, requires protection from frost when young, but becomes hardy enough when old. Seeds.

SORGHUM (Willdenow). A genus of tropical cereals, bearing polygamous flowers, and belonging to *Gramineæ*. These plants produce the small grain called Indian millet, and for which it is cultivated in most warm countries. In the West Indies it is called Negro Guinea corn.

SPAR. This name is employed to designate some of the most beautiful mineral productions. Thus, *calcareous spar* is of an obtuse rhomboid shape, and in its secondary characteristics it forms fine stalactites, of which the Derbyshire caverns furnish magnificent specimens. A beautiful fibrous variety of carbonate of lime, called *satin spar*, is found in Cumberland; and another still more beautiful, called *Arragonite*, is found in Arragon in Spain.

Flour spar is a mineral found in many parts of the world. In Derbyshire it is called *Blue John*, and it there varies much in its colour. It is highly phosphorescent at a red heat. In its ordinary state it is made into ornamental vases, &c.

SPARAXIS (Ker). A genus of bulbs, natives of the Cape of Good Hope, and belonging to *Irideæ*. The species thrive well in light sandy soil, and with a covering in winter, stand and flower well on a south border, if planted deep.

SPARGANUM (Linnæus). A genus of British aquatics, belonging to the natural order *Typhinæ*. The plants are known as the bur reed.

SPARROW (*Passer domesticus*). Though the common house-top sparrow is a bird which every body knows, as it is the only wild bird that inhabits the very heart of the largest cities, yet there is an interest about it which demands a short notice. It is the closest companion of man among all the feathered race. There are others which come to the neighbourhood of houses in the evil day, when food fails them in the fields or the woodlands, among which is the common red-breast. But the sparrow is a more close and constant companion, keeping company with man summer and winter, and never being found at any distance from a human habitation. To find a sparrow on the hill, or in the forest, is out of the question, and it is rare to meet with one upon a wide common, or a large field, when distant from the farm-house. Thus, to observe a sparrow, is almost as sure a sign that there is a dwelling near as to observe a cat.

What should make this particular bird so constant an attendant at houses is a point not very easily settled, but the fact cannot be doubted. It is not for the mere purpose of getting safe footing on the house-tops, and nestling under the eaves, for the sparrow can perch upon trees, and also build its nest there, though it prefers a situation where the nest can be under cover. When it does build in trees its style of building is very similar to that of the tree-sparrow; and yet the latter does not appear to have any propensity to collect about houses, but rather the reverse. During the night the sparrows roost in trees, or in any elevated shelter that they can find about buildings or banks. The race always nestle in holes when they can, and never have a nest quite open at top; for if there is not a natural covering to throw off the rain, they make an artificial one, and they appear to do this jointly for their own shelter and that of their young; for, if the nest is left undisturbed, the pair that built it occupy it as a house during winter as well as for a nursery in the warm season. The young are, however, sent abroad to seek winter protection for themselves.

Sparrows are birds of very ardent temperament, and therefore they consume a very great deal of food. In the spring they are very destructive to gardens, as they not only eat the seeds of vegetables, if these are not deeply covered with earth, but they watch the young plants, and pull them out of the ground, so that, in the course of a single morning, all the young plants in a bed of radishes will be left lying on the surface; and where small seeds of cabbages, onions, and other plants are grown, they are equally destructive. But really the advantage and the mischief very nearly balance each other, at least in some of these cases; for the covering up of the plants with straw or branches, till they have formed their leaves, is worth all the labour that it costs, even if there were no sparrow to be guarded against. But the labours of the sparrows at other times are very valuable, and the number of insects and larvæ which they consume is immense—quite sufficient to eat up the whole of the vegetation, were it not for the labours of these birds. They thus afford another proof of the adaptation of the whole of nature to the use and advantage of man; and if there is any animal, whether large or small, which thus attaches itself to the human race, it will always be found that that animal consumes something that is more destructive than itself; and the sparrow is one of the cases in which human labour cannot be substituted.

SPARTINA (Schrœber). A genus of perennial herbs, belonging to *Gramineæ*. *S. stricta* is a native of Britain, and found in salt marshes.

SPARTIUM (Linnæus). The spartium was once a very numerous genus, now reduced to one only, viz. *S. junceum*, the Spanish broom. It belongs to *Leguminosæ*.

SPARUS, or rather SPARIDÆ—the sea-bream family—the fifth of the families into which Cuvier divides the spinous-finned fishes. They have some resemblance to the *Perches*, and still more to the *Scienoidæ;* but they have also characters of their own, on account of which they deserve to be treated as a separate family. The general characters of the family are: no teeth on the palate; the general form of the body like that of the *Scienoidæ;* the body covered with scales of greater or less size, but no scales on the fins; the muzzle is not turned, and there are no cavernous enlargements in the bones of the head; they have no toothing, and no spines to the gill-lid, and they have never more than six gill rays. They are divided according to the form of the teeth, and in this way they admit of being formed into three families. The first of these, the *Sparidæ* properly so called, have the teeth in the sides of the jaws, round and flat in the crowns, like a sort

of pavement, and they admit of subdivision into five genera. Of these, and also of the other tribes, some occur more or less rarely on the British shores, and some not at all. We shall confine our notice chiefly to those which are found on the British shores. Taking them generally, the fishes of this family are not much esteemed for the table.

Sargus—the Sargue. There is no English name for this genus, and the fish, we believe, has not occurred on the British shores. There are, however, several species in the Mediterranean, and they also occur on the shores of the American States, where they are called sheep-heads. They have the front teeth with trenchant edges, something similar to those of man, but they differ in these respects, for some have them divided into several points; the cheek-teeth are always in the form of a pavement; the colour is in general silvery, marked by cross bands of black.

Chrysophris—Gilt-head. The generic characters are: the body compressed laterally, and deep in the vertical section; only one dorsal fin, with the rays partly spinous and partly flexible; six conical incisors in each jaw, and oval teeth, like a pavement, in the sides of the mouth, three rows below and four above; the cheeks and gill-covers scaly, and six gill-rays.

The common gilt-head (*C. aurata*) is the one best known. It is exceedingly abundant in the Mediterranean, and not rare on the west coast of Spain, Portugal, and France. It is occasionally found on the south coast of England, and strays, sometimes wanders, along the west coast, and even the east. They are, however, fishes of warm climates, and cannot bear the cold of winter very far to the north. The generic name, and its synonym gilt-head, have been given on account of the bright golden yellow of the space over the eyes in these fishes.

The back is of a silvery grey, shaded with blue, the belly shining steel blue, and the two colours are parted by golden tinted lines on the sides; the fins and tail are bluish, the latter darker than the others; the scales stand up at each side of the dorsal and anal fins so as to give them the appearance of being seated in grooves; the body is sloped at the anterior end of the dorsal-fin; the head high and short; the eyes have golden irides and black pupils; the gold spot over the eye is crescent-shaped, and there is a violet spot on the upper edge of the gill-lid. This fish rarely exceeds a foot in length. Shelled mollusca form a principal part of its food; and its teeth, and the action of the jaws, are so powerful that it can break the hardest shells—mere crushing, not mastication, is, however, the proper function of its very powerful mouth.

There is another species which has the teeth much smaller than the one which has been noticed, the *C. micradon* of Cuvier. It is of the same colour as the common gilt-head, but smaller in size, and with only two rows of teeth in the lower jaw; the great oval cheek-teeth are wanting, but still the habit of the fish is nearly the same as that of those with the larger and more numerous rows of teeth, namely, that of a feeder upon shelled mollusca and various species of sea-weed.

Pagrus—Braise. The characters of this genus are nearly the same as those of the gilt-head, only the teeth are different. There are four or six strong conical teeth in the front of each jaw, with two rows of smaller ones behind them, and two rows of molar teeth in the lateral parts. Like most others of the family, the fishes of this genus feed upon sea-weed and crustacea and shelled mollusca. They are consequently found in the deep water on the rocky shores and not on the banks or the beaches. They come to the shores in the summer and autumn, but retire to the deep water in the winter and spring. Like most of the family, they are impatient of cold, and therefore more abundant in the low than in the high latitudes. In the Mediterranean there appear to be many species; and there is one, the common braise or becker (*P. vulgaris*), which is not rare on some of the British shores. The muzzle is blunt, as in the gilt-head; but the body is a little longer in proportion. A small part of the dorsal and the anal fins is concealed by the projecting scales at their bases. This peculiar application of the scales tends much to stiffen the fins at their bases, and thus enables the fish to maintain its place steadily in the turbulent waters in which it feeds, and where there are currents and turmoil more violent and to a greater depth than where the bottom is comparatively level. Silvery white with a tinge of red are the general colours of the braise; and there are no metallic glosses on the head, or dark spots on the gill-covers at the commencement of the lateral lines, as in the gilt-head; the membranes of the fins are also white, with a tinge of red; and the rear of the dorsal is rather darker than the rest. The pectorals have generally a tinge of violet, and sometimes a red spot, near their origin. The eyes of this fish are very large, with the irides of a golden-yellow colour, and the gape is wide, indicating the voracious disposition of the fish. The authorities indeed say that the name *Pagrus* is expressive of this, being derived from the Greek *phagon*, a devourer; but there are many fishes which are much more voracious than this one, though as its food, the seaweed part of it, is not nearly so nutritious as the animal subsistence of the greater number of fishes, therefore it needs an increase in the quantity. It is doubtful whether all the fishes caught on the British shores, and called by the local names of this one, are of the same species, although there is not much doubt of their belonging to the family of the *Sparidæ*, which are not very likely to be mistaken for anyother.

Pagellus—Sea Bream. The characters of this genus are: the front teeth conical, small, and numerous; the laterals also small and round in their form; the first part of the dorsal with spinous rays, and the remainder with soft ones; they are abundant in the Mediterranean, and two are enumerated in the list of the British fishes, one not rare on various parts of the coast, and the other very much so. The one which is found in abundance on some coasts is not much esteemed for food when dressed by the common methods; but Mr. Yarrell praises it when broiled in such a manner as that the scales and skin shall retain all the juice. This is a good plan with all fish, and a most essential one in the case of the wide ranging spinous fishes. Thus a perch, when boiled or dressed in any way by which the substance can be let out, is dry and tasteless, and eaten for the sauce which is used with it fully as much as for the fish. But after a hard morning on the hill, "first catch" a perch, next set up three sticks gipsy fashion, and suspend him by the tail, taking care that no part of the skin is broken, and that he is simply wiped, not soaked in water; then involve him in the flame and smoke of sticks till the skin and scales form a

black crust, after which finish the dressing more slowly. Roll him in a clean cloth to cool a little, and by gentle pressure on the cloth the crust will peel off; and you will, in all time coming, be able to tell what a perch really is. It is the same in all the wide ranging *Acanthopterygii*; and as matters are usually managed, we have an exemplification of the adage "food from *above*, cooks from *below*."

The jaws of the sea bream are short and of equal length, and the head is also short, and descends suddenly to the point of the upper jaw; the sides of the head are scaly; and there is a portion of the anterior part of the gill-lid of a dull silvery metallic appearance; the upper part of the body is reddish-grey, the sides golden-grey, passing into white on the belly; the dorsal and anal fins are brown, the pectorals and the caudal red, and the ventrals grey. It is very common on some parts of the south coast of England, and on various parts of the east coast. It is also common on some of the shores of Ireland; and it is not unknown as far to the northward as Norway. They are most common in the summer and autumn, about the latter end of which season they deposit their eggs, and then retire into the deep water till the summer again comes round. The young, which are called *chads* on the coast of the Channel, appear then in vast numbers as early as January, at which time they are about an inch long. As is the case with all sorts of fry, they are eaten in great numbers by the larger fishes; and they themselves are very voracious in proportion to their size. They are easily caught with hook and line, as they bite at any kind of bait. Indeed, when adult they are among the most miscellaneous of fishes in their feeding. They browse the finer sea-weed from the rocks, and they eat small fishes, crustacea, and shelled mollusca; but it does not appear that they swallow very large fishes, as their mouths, contrary to those of the majority of fish, are much more of a browsing than of a swallowing character. Their side teeth are, however, very improperly called molars or "grinders," for the jaws merely open and shut without any lateral motion, which is the true grinding one. The other species which has been noticed as a rare straggler on the British shores, is

The Spanish Bream (*P. erythrinus*). It has been but recently observed on the shores of this country, and that only on the south; and we had best allow Mr. Couch to give his own description of it. "It is the size of a small sea-bream; the body rather more slender; head flatter on the top; eyes smaller, inclining to oval; before the eye the head is more protruded; the mouth with a under gape; front teeth as in the sea-bream; grinders more broad and blunt; scarcely a depression before the nasal orifices, though in the sea-bream they are conspicuous; fins as in the sea-bream, even to the number of rays, except the pectoral, which in the sea-bream reaches opposite to the third ray of the anal fin, in this only to the vent; there is no lateral spot."

There are many species of this genus in the Mediterranean, some of them with the muzzle larger than in those that have been described; some of a silvery colour, and others the same in the ground, with cross bands of black.

Dentex. These are Mediterranean fishes, which very rarely indeed wander as far as the British shores; and at present there is only one recorded specimen, which was caught off Hastings, and brought to the London market, in April, 1805, which was obtained and described by Donovan. This was

Dentex vulgaris—the four-toothed species, which may be considered as the typical species of the genus. The specimen above alluded to was a fish of considerable size, being two feet and a half in length; but in the Mediterranean they are often found three feet in length, and weighing from twenty to thirty pounds, while the one mentioned weighed sixteen; and it must have been in good condition notwithstanding its long journey, for twenty-eight pounds is the proportional weight of a three-foot fish, when a two feet and a half one weighs sixteen, that is, taking them as the cubes of the lineal dimensions, which is the accurate mode of estimation.

The characters are, the body deep in the vertical section, but compressed laterally; the fins in number and arrangement as in the rest of the family, but with one very strong spine in the part of the ventrals, and thence in the anal; the head large, all the teeth conical, and placed in a single range, and four in the front of each jaw, very long and strong, resembling the canines of a beast of prey; teeth also over the gill-arches, but none on the palatal bones or the vomer; the head in front of the eyes without scales, and six rays to the gills. This fish has been long known in the Mediterranean, receiving the name *Dentex*, "toothy," from the great size and strength of the fore-teeth, which have also obtained for it the name of *Cynodon*, or "dog-tooth." As it is a fish of some celebrity in its locality, we shall quote Donovan's account of it. "A more voracious fish is scarcely known; and when we consider its ferocious inclination, and the great strength of its formidable canine teeth, we must be fully sensible of the ability it possesses in attacking other fishes, even of superior size, with advantage. It is asserted, that when taken in the fishermen's nets, it will seize upon the other fishes taken along with it, and mangle them dreadfully. Being a swift swimmer it finds abundant prey, and soon attains to a considerable size. Willoughby observes, that small fishes of this genus are rarely taken; and the same is mentioned by later writers. During the winter it prefers deep waters; but in the spring, or about May, it quits this retreat, and approaches the entrance of the great rivers, where it deposits its spawn between (in?) the crevices of stones and rocks. The fisheries for this kind of sparus are carried on upon an extensive scale in the warmer parts of Europe. In the estuaries of Dalmatia and the Levant, the capture of this fish is an object of material consideration, both to the inhabitants generally as a wholesome and palatable food, when fresh, and to the mercantile interest of those countries as an article of commerce. They prepare the fish, according to the ancient custom, by cutting it in pieces, and packing it in barrels with vinegar and spices, in which state it will keep perfectly well for twelve months." This appears to be the only, or at all events the best, way of preserving the flesh of these fast-swimming spinous fishes generally; and though there does not appear to have been much, or indeed any, attention paid to it, it seems that the flesh of all fishes which gets dry in the ordinary modes of cooking cannot be advantageously preserved by salt. The salting is more successful in the soft-finned fishes, and some of the cartilaginous ones can be preserved by simply drying them, or at most by watering them once or twice with salt water.

Cantharus. The characters of this genus are:

the body compressed, and deep in the vertical section; only one dorsal fin; the teeth not large, but very numerous, of a conical form, and placed in several rows, the external ones larger and more curved than the others; the gape not very wide; and the gill-rays six in number.

The species of this genus are not numerous, even in the Mediterranean, which appears to be the head-quarters of the family of the *Sparidæ;* and there is only one known as a British fish, to which our notice must be restricted. This one is

The Black Bream (*C. griseus*). This fish cannot be said to be rare, and yet it is not a very common one, even upon the coasts of the Channel, where spinous fishes are much more abundant than on any other part of the coast. The end of summer is the time when they are most plentiful, and then they are very bold, and resort close to the shores. They are very voracious fishes, biting readily at any kind of bait. They are not of very large size, a foot and a half being about the average. The general colour of the body is bluish-grey, with longitudinal stripes of light and dark, and the scales relieved at the edges with lighter colour than the central parts. The dorsal fin is brown, and all the other fins are of the same colour as the body, only darker in tint. This species is not uncommon in many parts of the Atlantic, but it does not, we believe, occur in the high latitudes.

There are a few more members of the family, which differ from the last mentioned by having the teeth more or less trenchant, the body of an oval form, and much compressed, and the colours bright, generally with golden coloured stripes upon a silvery or bluish-brown ground, with metallic lustre.

SPATALLA (Dr. R. Brown). A genus of evergreen shrubs, natives of South Africa. The flowers are tetrandrous, and the genus is included among the *Proteaceæ*, of the general character of which the different species largely partake, requiring exactly the same treatment.

SPERCHEUS (Fabricius). A curious genus of coleopterous insects, placed in the family *Hydrophilidæ*, having the body short, oval-hemispheric, and very gibbose; the antennæ only six-jointed; the mandibles bedentate, and the legs formed for walking. There are but very few species, the type *Sp. emarginatus*, Latreille, found, but very rarely, in damp situations at the sides of water.

SPERGULA (Linnæus). A genus of annual and perennial herbs, mostly natives of Europe. It belongs to the twelfth class of Linnæus, and to the natural order *Caryophyleæ*. They are mostly weeds, though, under the name of *spurry*, one of the species is cultivated for sheep food.

SPERMACOCE (Linnæus). A genus of herbs, chiefly annuals, for the most part natives of the tropics. They belong to tetrandia monogynia, and to the natural order *Rubiaceæ*. The English name is button-weed. Some of the species are met with in our stoves, where they are easy of management.

SPHACELE (Bentham). A pretty plant from Chili, belonging to *Labiatæ*, and which succeeds well under the ordinary greenhouse management.

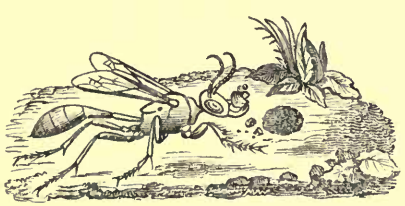
SPHÆRIDIIDÆ (Leach). A family of minute coleopterous insects belonging to the section *Pentamera*, and related to the *Hydrophilidæ*, and dung-feeding *Lamellicornes*, having the body short, rounded, and convex; the prosternum pointed behind, the tibiæ spined, the antennæ eight or nine-jointed, and the maxillary palpi a little shorter than the antennæ. These insects are of small size and very frequent occurrence, residing in the midst of the excrement of cattle and horses, round which they may be observed hovering almost as soon as it is fallen. Some of the species reside at the edges of water. There are two genera; *Sphæridium*, Fabricius (anterior tarsi dilated in the males), of which the *Dermestes scarabæoides* of Linnæus is the type, and which is a very common insect of a shining black colour, with a blood red spot at the base of the elytra, and the extremity pale reddish. The other genus is *Cercyon*, Leach, having the anterior male tarsi simple. The species are very numerous and minute.

SPHÆROLOBIUM (Smith). A genus of evergreen shrubs, natives of New Holland, and belonging to *Leguminosæ*. They are greenhouse plants, and are increased by cuttings.

SPHEGIDÆ (Leach). A family of hymenopterous insects belonging to the section *Aculeata*, and subsection *Fossores*, having the collar narrowed in front so as to appear like a joint, and the basal joint of the abdomen, and sometimes part of the second, narrowed into a long and slender footstalk or peduncle of considerable length; the anterior wings have always three complete submarginal cells, and the commencement of a fourth. The habits of these insects are similar to those of other fossorial families. (See the articles FOSSORES and HYMENOPTERA.) They are exceedingly active, their stings are very powerful, and they are altogether the most interesting, as well as curiously constructed of the fossorial tribes. The genera are *Ammophila*, *Miscus*, *Sphex*, Pronæus, Chlorion, *Dolichurus*, Ampulex, Podium, and PELOPÆUS (which see); those printed in italics containing British species.

The genus *Ammophila* of Kirby is distinguished by the elongated form of the lower jaw and lip, forming a long kind of tongue elbowed about the middle; the mandibles are toothed, and the palpi filiform and of nearly equal length; the second submarginal cell receives two recurrent nerves; the abdominal peduncle in some of the species is very long. There are several British species (some of which appear to be doubtful as regards their rank as species). They are of large size, and generally of black colours, with the abdomen more or less red. The type is the *Sphex sabulosa* of Linnæus, a very abundant species, varying from two-thirds of an inch to an inch in length. Another equally common species is the *Amm. hirsuta*, of the economy of which the following details have been published in the new part of the Transactions of the Entomological Society. The writer having disturbed one of the females whilst engaged in forming her nest, "she quitted it and proceeded to commence a fresh one close to the former; when she had proceeded about the depth of her head, I observed that her jaws constituted her chief tools; with these she brought up particles of sand and bits of stone, creeping backwards to the mouth of the cell; when a little mound of sand had been accumulated, she set about brushing it farther from the orifice by means of her fore legs, and it was droll to see the celerity with which these limbs were moved, and the shortness of the time required to remove the sand which was thrown with force beyond the body of the insect, the head of which was kept near to the opening of the burrow. In this manner she proceeded

to a depth greater than the length of her own body, so that she was entirely hidden from view for several moments at a time, reappearing backwards as usual, with her mouth laden with sand and stone. During these operations, a considerable buzzing noise was occasionally made. Notwithstanding my interruptions she proceeded in her work, and at length flew off, and I shortly afterwards observed her at about a yard's distance from her burrow engaged in dragging along a large smooth green caterpillar, found I think upon the broom, and being that of one of the *Noctuidæ*, and I noticed that it was only by the assistance of her jaws and fore legs that she had secured her prey, the latter, which served her as arms, being clasped round the body of the caterpillar, and the four hind legs used in walking. When about half a yard's distance from the burrow she set down her prey, and flew off towards her nest to see that all was right, and returning again seized the inactive caterpillar as before, and ascended the bank in a more direct and easy way than she had previously gone. On arriving at the mouth of the cell she again laid down her prey and crept into the hole, but instantly reappeared head foremost, seized the head of the caterpillar with her jaws, and dragged it down. As these proceedings did not occupy more than a quarter of an hour, I feel inclined to think, that as there was not sufficient time to dig a deep burrow, the cell thus made was intended only for the reception of a single larva, and that, as the sand was very loose, and so little time occupied in the operation, a fresh nest is made for each larva.



"*Ammophila sabulosa* (*Vulgaris*, Kirby) was also flying about the same situation: its attitudes when in flight are very droll, the abdomen being held out at an angle with the rest of the body. In walking I observe that the hind pair of legs are almost useless, being dragged along behind the others, and nearly motionless. This species differs from the former in its mode of digging its burrow. It indeed uses its jaws like the *Amm. hirsuta* in burrowing; but when they are loaded, it ascends backwards to the mouth of the burrow, turns quickly round, flies to about a foot distance, gives a sudden turn, throwing the sand in a complete shower to about six inches' distance, and again alights at the mouth of its burrow." (Trans. Ent. Soc., vol. i., p. 200.) Mr. Shuckard, in his valuable Essay on the Indigenous Fossorial Hymenoptera, just published (p. 77), has observed the female of this species dragging a very large inflated spider up the nearly perpendicular side of a sand-bank, at least twenty feet high; it dragged its prey backwards, and solely by its mandibles.

The genus *Miscus* differs from the preceding in having the third submarginal cell petiolated; it contains one British species, *M. campestris*. The genus *Sphex* has the mandibles large, curved, and bidentate; the lower parts of the mouth rather short and elbowed nearly at the lip, the second submarginal cell receives the first recurring nerve, and the third receives the second. This is a very extensive genus, comprising many large and fine exotic species, together with *Sphex flavipennis*, of which a single British specimen has been captured. It is in the collection of J. F. Stephens, Esq.

SPHINGIDÆ (Leach). A family of large lepidopterous insects, belonging to the section *Crepuscularia* of Latreille, having the antennæ prismatic, and terminated by a small bundle of scales; the palpi are large, and closely clothed with scales, the third joint being very minute; the body is in general robust, and the flight very powerful; the spiral tongue is also often of very great length. These insects are ordinarily known under the name of hawk-moths (see HAWK-MOTH). The genera are: *Sphinx*, *Acherontia* (see DEATH'S HEAD MOTH), SMERINTHUS (which see), and DEILEPHILA (which see). The genus *Sphinx* comprises those species which have the wings entire, the antennæ acute at the tips, the spiral tongue very long, and the antennæ not clavate. The species are generally of large size; the abdomen is generally gaily varied with coloured transverse bars, but the wings are often of dull colours; their flight is extremely rapid. The British species are: *Sph. convolvuli* (the *Convolvulus Sphinx*), *Sph. ligustri* (privet hawk-moth), and *Sph. pinastri* (pine hawk-moth). Several others have been introduced, but they are considered as doubtful natives, being probably importations. A subgenus, containing the beautiful *Sph. nerii*, was published by Mr. Curtis on the first of February, 1837.

SPIDER. The ordinary English name of a very extensive tribe of arachnidous insects, constituting in the Linnæan system the genus *Aranea*, but forming, in the modern arrangements of Latreille and Leach, a distinct order, named *Araneides* by the former, and *Dimerosomata* by the latter, divisible into several families and numerous genera. In the article ARACHNIDA will be found numerous details relative to the structure and physiology of the order; and in the article EPEIRA is given a sketch of its distribution into families. The present article will, therefore, be more exclusively confined to the details of the economy and habits of this interesting but too much neglected tribe.

An insect destitute of a distinct head, and wanting antennæ, in which one half of the body is suspended from the other by a very slender peduncle, in which the integuments are so soft as not to bear the least pressure, whose limbs are so slightly attached to the body that they fall off at a very slight touch;—an insect thus destitute appears but ill adapted of itself either to escape from the dangers which threaten it on all sides, to secure for itself a sufficient supply of food, or to protect its brood from injury. Such are the conditions of the existence of the spider in general, which, however, are amply compensated by means bestowed upon them by an all-wise Creator for their apparent want of power, and by which they are not only enabled to entrap and secure insects much larger than themselves for their subsistence, but also to construct habitations for their abodes, and to defend their offspring against the inclemencies of the seasons and the attacks of their enemies. The means by which these effects are produced are exceedingly simple; namely, the secretion of two fluids by internal organs, one of which is a gummy fluid exuding from an apparatus

near the extremity of the body, and the other is of a poisonous nature, and flows from the mandibles. With the first they are enabled to construct webs or nests of various texture and form, serving for the purposes of habitation, of traps for their prey, or of covering for their eggs and young; and with the latter they are enabled to destroy insects larger than themselves in a very short time for food.

A very great diversity exists in the modes in which the nests or webs of these insects (for we consider them as such for the reasons given in our general article Insect) are constructed, and the situations in which they are placed. The internal apparatus for secreting the silk is lodged within the abdomen near its posterior extremity, and consists of a small number (four or six, according to the species) of twisted, elongated, and unequal-sized vessels, being thickest in the middle, at the extremity of which is a great number of similar vessels, but of a much smaller size, and considerably shorter, and which are pressed against each, uniting in a common base, which is in connection with the *external* apparatus. The latter is visible to the naked eye on the under side of the abdomen, appearing, when pressed, in the shape of a small star, having several small oval-shaped or subconical appendages, teats, or spinnerets, as we may call them, placed near the extremity of the body, their extremities, when at rest, being brought into contact. In the greatest number of spiders there are four of these spinnerets, but in some there are six, two of which, however, appear to have neither pores nor papillæ. The matter discovered in the internal vessels is analogous to a gum, or transparent paste. In *Epeira diadema* it is of a yellow colour; in *Clubiona atrox* white; and in *Aranea domestica* brown. It is not soluble in spirits of wine or in water; it breaks when it is attempted to be bent, and, like glass, can only be made flexible when it is divided into very thin threads. On examining the spinnerets more minutely, it will be found that each is surrounded with several series of minute bristles, like points, about one thousand to each spinneret. From each of these points or spinnerules is discharged a thread, so that it may be easily conceived of what an immense number of distinct threads the apparently simple thread of the spider consists. According to a calculation made by Lecuwenhoeck, the celebrated microscopist, on a young spider, not larger than a grain of sand, it would require four millions of the threads discharged from its spinnerules to make a cord the thickness of a hair of his beard. The first object which the spider has to accomplish is to attach her thread to some object, as the commencement of a ground-work for her future operations. In doing this it appears that she extends her spinnerets as widely as possible, presses them against the object to which it is intended the thread should be attached, and then discharges a thread from each of the spinnerules; the spinnerets are then withdrawn, and the threads, by degrees, are united into a single cord; the insect uses her hind legs as a reel to draw the threads out of her body. It appears, however, that the threads are of different kinds; for in the webs of the geometric spiders those threads, which are arranged in circles, are composed of more viscid materials than the radii, the former being evidently intended for securing the prey of the spider, and the latter serving merely as its frame-work, and destitute of gluten. This viscidity is produced by an immense number of globules of viscid matter, arranged at visible distances along the elastic spiral lines of the net, and which are so fluid that they run together the moment they are brought into contact. Mr. Blackwall has given a calculation of the number of these viscid globules in the web of one of the *Epeiræ* of a moderate size, and which conveys some idea of the elaborate operations of the geometric spiders. The mean distance between the radii in one of these nets is about *seven*-tenths of an inch; there are twenty viscid globules on *one*-tenth of an inch, so that there are $7 + 20 = 140$ globules in a *single* line between two contiguous radii seven-tenths of an inch apart; this product, multiplied by 24, being the mean number of circumvolutions formed by the spiral line, will give 3360, being the number of globules contained on *all* the lines between two contiguous radii; this number, being again multiplied by 26, the mean number of radii, produces 87,360, the total number of viscid globules in a finished net of average dimensions. But larger nets, by a similar calculation, will contain upwards of 120,000 viscid globules, and yet the time occupied in the construction of this net is not more than forty minutes. Moreover, the threads with which the spider composes the retreat in which it takes up its abode, or the nest in which it envelopes its young, does not appear to be of the same nature as the net-threads, neither are the threads of which it forms the case for its eggs similar to the former, the texture of these cases being in some species quite firm and smooth, resembling parchment. This case is also sometimes covered with a coating of loose flossy silk, which also seems of a different texture; hence it is evident that the vessels at the extremity of the abdomen, which serve for the secretion of the silk, as well as the structure of the spinnerets and spinnerules, require a much more minute investigation than has hitherto been given to them, in order to discover the precise manner in which these various kinds of silk are elaborated and discharged.

The nest of *Epeira diadema* is one of the most beautiful and most common of the spider constructions in this country, being found in every bush or tree, between hedges and shrubs, &c., during the autumnal months. The top line of this web appears to be first spun, either by attaching a thread as above described, and then carrying it along until it is of sufficient length, when it is attached to some adjacent object to which the spider has crawled, or by throwing out a floating line, whilst the spider remains stationary, the action of the air carrying this line on until it becomes attached to some object, when, in either case, it is doubled and redoubled, until it is of sufficient strength to bear the weight of the intended fabric, together with the spider itself. The other outer threads of the frame-work are then added, and then a cross line is carried from one point of the web to another exactly opposite. From the middle of this cross line the insect ascends or descends, having first glued another thread at the centre, which she draws out until she reaches the frame-lines, and then, going along the latter to a certain distance, she fastens the thread which she has been spinning to one of the frame-lines. In this manner she constructs a complete series of spokes or radii, which she then attaches together by a spiral series of transverse bars of a more glutinous thread, as above noticed. In spinning this spiral web she first attaches a thread to one of the radii, and then drawing it out with her hind legs,

ascends along the radius until she is able to lay hold of the next radius, down which she descends until she reaches the spot exactly opposite to where the thread had been attached; she then quits her hold with the hind legs, and the thread is immediately glued to the proper spot in the next radius. In this manner she proceeds until the whole of the net is completed; and it is quite an amusing sight to watch one of the small geometric spiders engaged in this construction; the rapidity with which the cross spiral threads are fixed in their proper places is quite astonishing.

Another interesting spider is the *Clubiona atrox*, which builds its web in the corners of windows, the crevices of walls, or in the branches of shrubs growing near buildings. We are indebted to Mr. Blackwall for a very valuable Memoir on the Structure and Economy of Spiders, published in the Linnæan Transactions, in which a description of this nest is given, from which the following is an extract. "On the objects surrounding the spot selected for its retreat it extends to a considerable distance, but without any apparent regularity of design, a number of fine shining lines intersecting each other at various angles, to which it attaches other lines, or rather fasciculi of threads, of a more complicated structure, and of a pale blue tint, nearly approaching the colour of skimmed milk. These compound threads or flocculi, which in exposed situations retain their delicate hue for a short period only (old webs being generally of a dull or sullied white, not at all advantageous to their appearance), are arranged on the first spun glossy lines, both in longitudinal and transverse directions. When recently produced, they adhere strongly to such insects as come in contact with them, and, though perfectly inelastic, may be drawn out into fibres of extreme tenuity. A communication between the snare of this spider and its retreat, is established by means of a funnel-shaped tube of a slight texture, whose smaller extremity is in immediate contact with the latter, and indeed sometimes constitutes the animal's abode. Not unfrequently two or more tubes occur in the same web, by one or other of which the spider usually effects its retreat when disturbed."

The same author has noticed the curious fact that those species of spiders, which form geometric nests, are furnished with several claws on each foot, whilst some of the jumping spiders, and some others, have only two claws. In several species of *Epeiræ* it will be distinctly perceived that the inferior part of their feet is provided with several claws which have a degree of curvature, are finely pointed, and are furnished with tooth-like processes in the under side. In *Epeira apoclisa* there are as many as five of these claws, which, in addition to the three upper claws previously known, give a total of eight to each foot. There is also a strong moveable spine inserted near the termination of the tarsus of each *posterior* leg on the under side, which curves upwards at its extremity, and which by the action of the flexor muscles is brought in immediate opposition to the claws, by means of which the animal is enabled to hold with a firm grasp such lines as it designs to attach itself to; and hence it is obvious why these spiders usually direct their heads downwards when they occupy the centre of their nets.

Spiders, in regard to the construction of their webs, may be naturally divided into two great groups, which have been named the sedentary and the wandering spiders. The latter do not construct regular webs, but either live a vagabond life, as indicated in the article Salticus, or merely throw out a few loose and irregular lines in the neighbourhood of their nest. The sedentary spiders comprise two divisions, those which form nets and those which weave webs. The net-weavers are again divided into the geometric species, and those which construct webs of an irregular form, the meshes being at certain distances apart, but not arranged in concentric circles. This group, which is in general composed of minute spiders, is the most curious on account of the singular and astonishing variety in the operations of the species of which it is composed. The genus *Theridion* may be mentioned as the typical group. The web-weavers spin a closer material than the former, and, like the net-spinners, are divisible into two groups, the cloth-weavers which suspend their hair or mat-like webs horizontally between plants without any circular retreat (genus, *Linyphia*, &c.), whilst the other section may be called tapestry workers, suspending their webs in the angles of walls, &c., furnished with a circular retreat formed like the rest of the web. The domestic spider is an example of this division.

During the summer and early autumn months, it is not an uncommon circumstance to observe numerous long floating threads in the air, at one end of which a minute spider is found to be attached; the mode in which this is effected has been the subject of considerable discussion. Some authors contend that the spider has the power of directing these threads at pleasure towards a determined object. Others maintain that the thread is discharged independently of any influence from the atmosphere. Others again, that it is entirely electrical. But the most generally received opinion is, that the spider, directing its spinnerets in the direction of a current of air, discharges a thread which, being exceedingly light, is carried on by the air to such a length as to be able, from its buoyancy, to support the slight weight of the spider itself. Thus Gilbert White says, "every day in fine weather in autumn do I see these spiders shooting out their webs, and mounting aloft; they will go off from the finger if you will take them into your hand," although he adds, "but what I most wondered at was that it went off with considerable velocity in a place where no air was stirring, and I am sure that I did not assist it with my breath."

Leslie made the same observation on nearly thirty different species of spiders, and found the air filled with young and old, sailing on their threads, and doubtless seizing gnats and other insects in their passage; there being often manifest signs of slaughter, legs and wings of flies, &c., on these threads, as well as in the webs below. These threads are, however, often found without any attendant spider, and it is not improbable that these are threads which have been in the first instance woven amongst the grass and low herbs, which are sometimes observed to be almost completely carpeted with these productions, and which, being dried by the sun, and raised by currents of air, are wafted about in the atmosphere, until a perfect calm brings them to the surface again. In France the floating threads, which support the small spiders, are called *fils de la Vierge*, and it has been supposed that they were exclusively formed by a spider which has been named *Aranea obstetrix*; but this is not correct, neither is the species here noticed anything else than a young and imperfectly described individual belonging to the genus *Epeira*.

Nearly all the different species of spiders envelop their eggs in a covering of silk. The mass of eggs thus protected, of the *Epeira diadema*, may be constantly observed during the winter months in the angles of walls of rooms exposed to gardens, frequented by the perfect insects, which, after impregnation, make their way into the houses for safety. These cocoons, as they may be called, differ in the different species. In some they are globular, in others oval, and in some depressed. The care with which these cocoons are guarded by some species is quite astonishing. Some of the species carry them about with them beneath the abdomen, and it is a matter of the greatest difficulty to compel the mother to quit her charge, and even then she wanders about the spot searching for it with the greatest solicitude. The egg cocoon of the very handsome species *Epeira zebra*, as well as the perfect insect, are described and figured in the Field Naturalists' Magazine, vol. ii., p. 57.

The silk of the spider has been supposed to be, on account of its strength, a material adapted for the ordinary purposes in which silk is employed, and to be scarcely inferior to that of the silkworm. M. Bon, of Languedoc, indeed, contrived to manufacture from it a pair of stockings and mittens of a beautiful natural grey colour, which were almost as strong as common silk. But Reaumur, to whom the subject was referred, considered that it was impossible to succeed with the growth of this kind of silk, on account of the great ferocity of the spiders, which causes them to kill one another as soon as they are confined together. Moreover, it would require 663,552 spiders to produce a pound weight of silk, or, if the largest species were employed, 55,296 would be requisite.

The harmony which nature has established between the colours of these insects and the places which they inhabit, must not be passed in silence. The species of *Epeira*, which weave their webs in the air, the *Thomisi*, which hide themselves in flowers, and the *Sparassi*, which run over the green sward, have the body either of an uniform lively green, yellow, or purple colour, or varied with handsome markings; whilst the *Mygale*, *Lycosæ*, and *Araneæ*, which conceal themselves under stones and in obscure situations, are of brown, black, or other obscure colours, like the places where they reside. We have already in several parts of our work noticed the same harmony reigning in other parts of the insect world.

The nature of the poison of these animals, which in the commencement of this article was alluded to, as the other means whereby Nature had ensured their existence, will be treated upon in the article upon the *Tarantula* spider, which is the most redoubtable of the poisonous species.

SPIGELIA (Linnæus). A genus of two species of plants, one a tropical annual, and the other a half-hardy one, from Maryland. The flowers are pentandrous, and from their character belong to *Gentianeæ*. The *S. Marylandica* is a favourite in our collections, and is propagated by cuttings.

SPILANTHES (Linnæus). A genus of tropical annuals, belonging to *Compositæ*. The *S. oleracea* is cultivated in the East Indies as a pot-herb. In British collections they are grown in rich soil, and raised from seeds.

SPINACIA (Linnæus). A genus of annual herbs, belonging to *Chenopodeæ*. Of this genus the well-known spinach is the type.

SPIRÆA (Linnæus). A genus of deciduous shrubs and perennial herbs, natives of various parts of the globe. The flowers are icosandrous, and belong to *Rosaceæ*. Several of the herbaceous sorts are British, and many of the shrubs are in our shrubberies, and are increased by suckers, layers, and cuttings.

SPIRALEPIS (D. Don). Undershrubs and herbs, natives of the Cape of Good Hope, formerly included in the genus *Gnaphalium*, and belonging to *Compositæ*. The species thrive best in a mixture of sandy loam and heath mould, and are propagated by cuttings.

SPONDIAS (Linnæus). A genus of tropical fruit trees, bearing decandrous flowers, and belonging to *Terebinthaceæ*. The fruit of the several species are eatable, being slightly acid and aromatic, but they are chiefly given to hogs; hence the name of hog-plum given by the colonists.

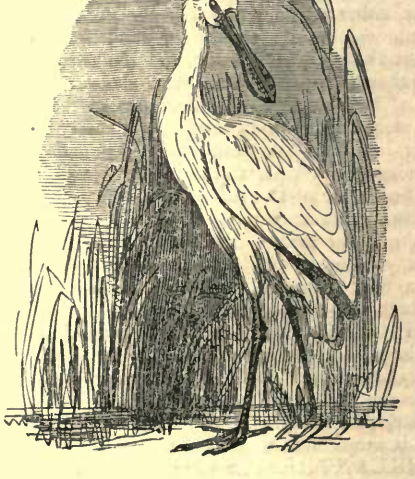
SPOONBILL (*Platalea*). A genus of stilt or wading birds, belonging to the cultrirostral family, and the last genus of that family, and the one immediately bordering on the long-billed races in Cuvier's arrangement. The characters are these: the bill very long, stout, much depressed, and enlarged and rounded to a spoon-shape at the extremity; the upper mandible channelled, and furrowed transversely in the basal part; the nostrils on the upper surface of the bill, and near to each other, open, of an oblong shape, and bordered by a membrane; the face and part of the head naked of feathers; the legs long and strong; the feet with four toes, three to the front and one to the rear, the three front ones united as far as the second joint by a deeply-notched membrane; the wings are of mean length, and the first quill a little shorter than the second, which is the longest in the wing.

The spoonbills live by the edges of the marshes, or near the sea where the ground is shaded by thick bushes, and sally from their cover only to seize the small fishes which are brought near the land by the waves. They also eat aquatic insects and small mollusca and crustacea. They are birds of gentle dispositions, and live in small troops, except during the nesting time, and even then the pairs are not very far from each other. Like most other birds of the banks and shores, they are migratory, moving in the direction of the poles in the spring, and back again toward the equator in the autumn. For their march, they assemble in larger troops, as is the case with the cranes and storks, and they either accompany these birds, or move about the same time. Even when they are in a state of confinement, they very strongly evince their autumnal migratory instinct; for though they are, during the greater part of the year, dispersed through various parts of the old continent, and even into high latitudes, yet, as autumn comes on, they collect in larger troops, and move southward. In the places where they pass the summer and rear their broods, they do not appear much on the open grounds, but prefer woods and shaded spots. They nestle in various places, according to the situation. Sometimes the nest is in lofty trees, sometimes it is in close bushes, and sometimes again it is in the tall annual herbage. It is formed externally of small sticks, and carelessly lined with vegetable fibres. The eggs are generally two or three in number, of a dull whitish colour, marked with a few russet spots. The female sits very closely during

the incubation, and when the young make their appearance, they are covered with down, and capable of running about. When they are alarmed, or otherwise excited, they make a snapping noise with their bills.

On their southern migration, the valley of the Nile is their first retreat from Europe, and they probably range from the head of that valley through the whole of the fertile parts of Africa; for they are found as far south as the region of the Cape, where they are sometimes called "serpent eaters," which name they probably deserve, as their bills, though flexible, are set with tubercles on the inside of the mandibles; and their length enables them to close at the points with great rapidity, and of course with proportionate effect.

White Spoonbill (*P. leucorordia*). This is the species which is found on the eastern continent, over which it is very generally distributed, though not in great numbers at any one place, and not very conspicuous on account of its retiring habits. Early in the morning and late in the evening are its feeding times when the weather is dry; but during rain it comes abroad at other times. As is the case with most, if not with all of the larger birds of the banks of rivers, it eats very voraciously when food can be had, but it is also capable of enduring long abstinence. This is necessary in order to adapt it to those localities in which nature has placed it. They are subject to drought and partial inundations, even during the summer. In the last of these the food of the spoonbill comes out in considerable numbers; but in the drought it disappears, or comes out only in the twilight. The total length of the full-grown spoonbill is about two feet and a half; and the length of the bill is between eight and nine inches; the plumage is white, with the exception of a large collar of reddish-yellow, which extends downwards in front, and forms a breast-plate; the forehead, the cheeks, a space round the eyes, the chin and the middle of the throat, are naked, and of a pale yellowish colour, with a shade of reddish on the lower part of the throat; the bill is black, with waved furrows across the upper mandible, the deepest parts of which are bluish; there are triangular lateral grooves for the basal half of the length, and these pass into thread-shaped furrows for the remaining part; the enlarged portion toward the point is yellow with a border of black; and the lower mandible is wholly black, with a triangular furrow in the basal half, and a narrow groove in the remainder; the hind head is furnished with a long crest of awl-shaped feathers. The female is of smaller size than the male, has the crest on the occiput considerably shorter, and the red on the naked part of the throat is not nearly so conspicuous. The young of the year have the shafts of the quills black, and are without the crest and the reddish colour on the neck, which last does not make its appearance till after the second moult; on account of this they have been sometimes described as a different species from the old birds. Differences of appearance have been noticed in some specimens from southern Africa, but it is doubtful whether any of them are of sufficient consequence for entitling the birds to be regarded as distinct species from the common one. As a British bird, the common spoonbill can be looked upon only as a straggler, although it straggles into the south-east of England more frequently than some of the other occasionally visiting marsh birds. It sometimes appears on its northward passage, and sometimes on its southward, but there is no very clear evidence of its having, in any instance, remained to breed in the country. It probably did so in former times, when marshes were much more abundant and marsh birds more plentiful, than they are now, but at present it cannot properly be regarded as a British bird. It is, however, by no means so rare, or, at all events, so solitary in its coming, as some others of our straggling birds. Spoonbills certainly do not come so often as to make the looking out for them an occupation in which any person in the British islands needs to engage in the hope of being certain that the result of his watching shall gratify even his curiosity; but when they are seen, they are generally in considerable numbers. Generally speaking, however, it is but a sight and away; and though the casual appearance of continental migrants upon our shores has not been very carefully noted along with the state of the weather, and the set of the wind preceding their appearance, yet there is little doubt that spoonbills, cranes, storks, and all birds of that family, which are occasionally seen with us for a little while, are blown to our shores by cross winds from the east, which compel the birds to make lee-way; and that the fatigue of struggling against these, compels them to alight and rest themselves before they again take to the wing. As a show bird in collections, the spoonbill is by no means rare; and the large size and irregular form of its bill render it an interesting bird whenever it makes its appearance. The specific use of the very peculiar form of the bill in this bird is not known with any certainty, and all that we can positively say about it is, that it is intermediate between the cultrirostral, or knife-shaped bills of the other wading birds of the family, and the flat bills of the dabbling birds, which have the toes entirely



Spoonbill.

webbed, and are launched upon the waters. As little do we know the precise part which these birds act in the general economy of nature; but from their general distribution, their size, and their power of

wing in migration, we are led to conclude that it must be an important one. The flesh of the spoonbill is more agreeable as food than that of most others of the same family. It wants the rankness which is commonly indicated by what is called a "fishy taste"—though any thing but like the taste of fish; and in this also it approximates to the flat-billed birds, the greater part of which are both wholesome and palatable.

The Roseate Spoonbill (*P. ajaja*), is a native of South America, and considerably smaller in size than the spoonbill of the eastern continent, though, according to the accounts, its habits are much the same. Its general plumage is of a rosy tint, and the upper parts of the wings and the coverts of the tail are red, of a tint rather bright. It is a native of South America, found in the valleys of the great rivers, and also, on the level plains which are subject to inundations in the rainy season. In old age the red tints of the plumage fade, and the old ones are nearly all over of a dull white colour. The bill is yellowish-green, but dull whitish in the dead subject, and also, as is said, when the bird is alarmed. It is said to be a most assiduous and successful fisher, and to stand in the water up nearly to the tarsal joints, sweeping around it in semicircles, and very dexterously catching at the fry and small fishes that come within its reach.

SPOROBOLUS (Dr. R. Brown). A genus of tropical herbs, bearing triandrous flowers, and belonging to *Gramineæ*. None of them are cultivated.

SPREGELIA (Smith). A pretty flowering evergreen shrub, from New Holland, belonging to *Epacrideæ*. The plant thrives best in a shady situation during summer, and at all times requires to be cautiously watered.

SQUALUS, the common systematic name of the sharks. See the article Shark.

SQUAMIPENNES. The name which Cuvier has given to his sixth family of spinous-finned fishes, and which is given them on account of their fins being covered with scales (*Squamæ*), not only on the parts which have soft rays, but frequently also on those that have spinous ones. They were all included by Linnæus in the genus Chætodon, in consequence of the hair or bristle-like form of their teeth; and we have given a short general sketch of the family under that title. We now revert to the subject for the purpose of introducing a representation of one of the most singularly formed of the genus; and we may at the same time mention that, notwithstanding the singularity of their forms, these fishes are, in point of colours at least, among the greatest living beauties of the sea. The ground colour of their bodies is generally silvery, with a very rich metallic lustre; but this is marked with every colour that can well be named, and always of the most glowing tint. They show clearly the intimate connexion which there is between those beams of the sun, which are the immediate cause of the appearance of the colours, and the modification of the surface, by means of which the coloured light is reflected to the eye of the observer. No fishes of the high latitudes have any colours so brilliant as are found upon these, neither have any which inhabit the depths of the tropical seas, or range over them in their breadth. These fishes remain near the shores and rocks in the shallow waters, and they are always near the surface. They are chiefly small fishes; but their flesh is, generally speaking, as wholesome and palatable as their colours are beautiful; and, from the nature of their haunts, they are easily captured, though some of the species have formidable spines, by which they wound those that incautiously handle them.

The following is a representation of the chelmon which remains near the aquatic vegetation and shoots the flies, by projecting upon the fly one large drop of water, which brings it down to the surface, where the fish swallows it.

This fish is found indiscriminately in the salt water, and at a considerable distance up the rivers.

C. rostratus.

One very singular member of this family is the buffalo fish of the oriental isles, so called by the Malays, who are the chief inhabitants of the coast, and the people most conversant with the sea in those parts of the world. In some of its characters it resembles the *Ephippii*, or horsemen, noticed in the article already referred to; but it has a projecting horn above each eye, and a prominent crest on the forehead, with various other characters, which entitle it to be the type of a separate genus of this most singular family. Cuvier has given it the name of *Taurichthys*, which is of course only the Greek for its Malay name of *Ikan-carbauw*, buffalo-fish, or bull-fish.

The remaining principal genera of the scaly-finned fish, exclusive of those that have been hinted at in the former article and in this, which may perhaps be considered as subgenera of *Chætodon*, are as follow—:

Brama. These have scales on the vertical fins, and only a few spinous rays in these fins almost wholly concealed under the membrane. They have slender bent teeth placed like those of a card on the jaws, and also on the palatal bones; they have the muzzle very short and blunt, the profile descending rapidly, and the mouth when shut directed upwards, so as to be almost vertical; they have scales on the edges of the jaws, inner gill rays, and their stomach and intestines are rather small, with five cœcal appendages to the latter. One species is found in the Mediterranean, and sometimes in the Atlantic, though

only as a stray. It is of considerable size, bright steel blue in the colour, and excellent eating. Very little has been mentioned with regard to its habits; but from the position of the mouth it appears to live under its food, and is in all probability a bottom fish, unless when it comes to the surface or the shallows for seasonal purposes; and, as is the case with eels and various other bottom fishes, it is much infested by intestinal worms. It is held in so much estimation, that, for its size, it is one of the most costly fishes taken in the Mediterranean. According to Risso, it winters in the deep water, where small troops are found assembled together. At these times it is healthy and in excellent flesh; but after it has spawned, which it does on the shores in the summer months, it is sickly and subject to the attacks of the parasites, which take possession of the intestines, and also bury themselves in the flesh. This and some others of the present family have sometimes been described as belonging to the *Sparus* family: but they have the general characters of the scaly-finned family.

Pempheris. The fishes of this genus are found in the Indian seas, and our knowledge of them is exceedingly limited, as it indeed is of most of the curious fishes which are so abundant in that great and fertile expanse of the oceanic waters.

Psettus. These are deep and thin fishes, having no inconsiderable resemblance to *Platax*, only the teeth are very small, and set like the pile of velvet; and the ventral fins have only one spine, without any soft rays. They are fishes of a silvery colour, found in the southern ocean, but very little respecting them is known.

Pimpeloptorus—Thick Fins. These have teeth of a form different from almost any other fishes. They form only a single row in the jaws, with the front edges sharp and cutting, but have a projecting heel at the posterior side of the base; they have the body oblong, the outline of the muzzle blunt, and the fins scaly and thick—whence their name. They are found in the tropical and southern seas, and have the habit of following ships, in order to catch any thing that is thrown overboard; but they do not bite readily at a bait, and they are not of great value even if they did.

Dipterodon, are fishes found near the Cape of Good Hope, they have the teeth bevelled off like chisels, and two dorsal fins, the spinous one separated from that with the soft rays by a deep notch.

Toxotes (*Archers*). These have the body short and compressed; the dorsal fin on the last half of the back with very strong spines in the anterior portion of it, and the posterior portion scaly; the anal fin is placed nearly opposite to the dorsal one, and agrees with it in character; the muzzle is short and depressed; and the lower jaw projects beyond the upper one; the teeth are short and velvety; but they are abundantly supplied, being found in both jaws, on the anterior part of the vomer, on the palatal and pterygoïd bones, and on the tongue; the suborbital bones and those of the preoperastum have their lower margins finely toothed; the stomach is wide but short, and there are twelve cœcal appendages to the intestine near the pylorus.

There is only one known species *T. jaculator*, the throwing archer, which name it obtains from the ease and certainty with which it knocks down its insect prey with drops of water. Its mouth is not drawn out into a pipe like that of the chelmon; but it does not appear to be less dexterous in squirting the water, which it can do with certainty to the distance of three feet or more, and instantly bring down its game to the surface of the water. It is said to be equally successful when the insect is reposing on the herbage or the bank, and when it is on the wing. It is a very amusing little fish, and admits of being kept in a jar of water, where it will shoot the flies presented to it with the same alacrity as when it is at its freedom in the sea. The shores of India, China, and the oriental islands, where vegetation grows close to, or in, the water, are the favourable situations for these curious fish; and they are not timid or suspicious, but will allow one to stand by and see the dexterity of their archery.

Taken altogether, the scaly-finned fishes are a curious race, differing in many respects from any others of the class; but we are too little acquainted with them for being able fully to understand their economy, or trace their connexion with the rest of nature.

SQUILLA (Fabricius). A genus of crustaceous animals, belonging to the order *Stomapoda*, having the body long and semi-cylindric, somewhat resembling that of a lobster, being arched above and flat beneath, the last segment rounded and spined, or toothed, on its posterior margin; the eyes are placed on very short footstalks, the interior antennæ have three filaments, the exterior single, but covered at the base by a broad scale; the thoracic shield is broad and somewhat depressed; the first pair of legs, or rather leg-like organs, are long and strong, and formed for powerful prehension; the last joint shutting upon the preceding, with strong spines, in the same manner as the fore-leg of one of the *Mantidæ;* the four following pairs of legs are short, especially the third pair, terminated by a small, flattened, and rounded plate, and a curved apical spine, the three posterior pairs of legs being very slender, the femora being furnished with a long and slender filiform appendage. The species are somewhat numerous. They are chiefly inhabitants of the seas of warm climates, but one or two of the species have occasionally been taken upon our own coasts; some of them are of considerable size, and are employed for food by the inhabitants of the Mediterranean, in the same manner as lobsters. The typical species is the *Squilla* (Cancer) *mantis*, Linnæus, which is very common in the Mediterranean ocean. It grows to the length of seven inches. The genera *Coronis* and *Gonodactylus* have been separated from *Squilla* by Latreille, upon slight structural modifications.

SQUIRREL (*Sciurus*). A numerous, very pretty, and highly amusing genus of rodent animals, of small size, which reside and find their food chiefly in trees, and are as much at home there as the handed animals, which they in general beat in the velocity of their motions, while their aspect is as pleasing as that of the monkeys is repulsive. Squirrels are exceedingly numerous as a genus, and their characters at once distinguish them from all the rest of the *Rodentia*, and yet they differ so much from each other, that they admit of division into subgenera or groups, besides their distinction into species.

They are all possessed of clavicles, which enable them to use their fore legs like arms, either in grasping or in conveying substances to the mouth, but in doing so they have to use both legs, as the paws are not sufficiently prehensile for being used as hands.

The character from which they get the name *Sciurus*, which means "shadowing tail," and of which the common term squirrel is merely a corruption, is the form of the tail. This tail is very long, and it is usually covered with very long hair or fur, which diverges into two parts on the under side, something after the manner of the two webs of a feather; and the length is generally sufficient to overshadow the whole body, when the tail is brought forward curving over the back. The gnawing teeth in the lower jaw of the squirrels are very much compressed. The hind feet have five toes, and the fore feet four, but sometimes the inner toe also appears on the fore feet as a simple tubercle; they have four tuberculous teeth on each side of both jaws, and a small one in advance of the rest in each side of the upper jaw, but it falls out at rather an early age. The claws upon their toes are crooked and very sharp-pointed, so that they can take hold of small inequalities of the bark of trees, and the toes have a certain degree of lateral motion, by means of which they can grasp toward the centre of the foot.

They are very agile animals, formed for climbing and leaping; and even when they are in a state of confinement, and abundantly fed, they do not feel at home unless they have in their cage a small mill, or tread-wheel, upon which they can exercise themselves. Their spine is very elastic, and accords well with the ready action of the joints of their limbs, so that they are nearly as nimble on the ground as they are in climbing and scrambling about among the branches. Their action upon the ground is not running but leaping, in which the elasticity of the spine comes into play at every step; and their action is something intermediate between that of the hare and the jerboa, less of a running action than the first, and less of a set of boundings from the hind feet than the second. Their limbs are all articulated, so that they can be stretched outwards, which prevents that steady motion parallel to the mesial plane of the body, which is essential in an animal which has habitually to walk the ground. But while their members are thus not of a walking character, neither do they resemble the flying extremities of the bats, nor the climbing ones either of the handed animals or the sloths. Their feet, both the fore ones and the hind, are fitted for making a firm plant on a very slender branch, either longitudinally or across. This of course is done by a sort of grasping; but still it partakes much more of the character of a mere plant than that of the handed animals, and is performed in a correspondingly shorter time. Their motion along the small twigs near the top of a row of tall trees is thus a kind of running, and running which is very neatly as well as very swiftly performed. Their hind legs are a little longer than their fore, but only a very little longer, as their running style of motion requires that they should have nearly equal command and use of all their legs. In this may be seen the difference between them and the hares and jerboas on the one hand, and the tree apes which have not the tails prehensile on the other. The leaping animal has the hind legs long, and the muscular action of the body very much concentrated upon them. The climbing animal has the fore legs long, and the concentration upon them. The squirrel holds an intermediate place, and this is the reason why we consider its motions on the ground more graceful than the leaping of the jerboa, and its motion in the tree more so than the climbing of the ape. Their motions are quite a study in animal mechanics; and on account of the lightness, the gentleness, and the cleanliness of the animals, they are a very pleasing study.

The eyes of the squirrels are very large and bright for the size of the animals; and there are some peculiarities in them which are worthy of attention. The pupils are large and rather oval, with the largest diameter placed in a horizontal direction; and there is no colour reflected from the choroid membrane. Hence it is probable that their vision is very keen, and that they can see an object clearly with very little light. They require this, for they have to find their food and also their footing, the latter often very quickly, in the close shade of the leaves. It is probable that their hearing is as acute, for their ears are remarkably well developed, and they often terminate in tufts of fur, which are generally regarded as increasing the acuteness of hearing.

In woods, their chief food is nuts and other small fruits; but they are also fond of the saccharine juices of plants; and it is said that, in some parts of the United States, where they are particularly numerous, they do very serious damage to the plantations of Indian corn, by gnawing the straw at the time when there is sweet juice at the nodes or joints. They are animals of temperate and even of cold countries, as well as of warm ones, though the greater number are found in countries which are rather warm, and they do not occur in the mountain forests of countries near the poles, and are but rare in the lower and warmer places. But they abound so much in many places of the north that they are caught in traps, as well for their flesh as for their skins. The great natural forests are their chief abodes, where they dwell in solitude or in society, according to the species. But even the most solitary of them are usually found in pairs, which pairs are understood to associate for life. Their nests are usually little spherical cabins, formed of twigs near the tops of the highest trees, and with the opening above. In such places they and their young are out of the reach of all quadruped foes; but they occasionally become the prey of ravenous birds, when these roam on the wing over the forest; and yet the situations in which they are placed render them pretty secure from these foes also. Some species, however, form burrows at the roots of the trees. The nests are not accessible, and indeed not easily found out, and so the number of young at a litter is not accurately known; but we may presume that they are pretty numerous; for the females of some of the species have eight mammæ, six on the belly and two on the breast.

With the exception of Australia and the remote islands, squirrels of one species or another are found in all parts of the world; in Europe from Lapland to the extreme south; in all parts of Asia, Africa, and North America; and they are as abundant as they are widely distributed, for the woods which suit their economy literally swarm with them. They admit of convenient division into three sections founded on very obvious characters—the absence or the presence of cheek pouches, and the divergence or non-divergence of the fur on the tail, from a mesial line on the under part.

I. Without cheek pouches, and with the hair divergent along the whole length of the tail. These are regarded as the true squirrels; and of them the typical, or at all events the best known, species is

The Common Squirrel (*S. vulgaris*). There is perhaps no animal which has stronger claims to being a native of every country of Europe than this one; for, with the exception of the English "squirrel," and the French *ecureuil*, which are both obviously derived from the Greek, it has an original name in almost every part of Europe, at least where any vestige of an original language is retained, which is not a character that can be given either to the English or the French. It may not be amiss to mention one or two of these names, because it will be perceived that, though they differ considerably, there is something very expressive of quickness of motion in the sound of each and all of them. The Gaelic name is *Feoragh*, which means hurry or bustle; the Welch is *Gwiwair;* the Germans call it *Eikhorn*, and the Swedes *Ikorn*, which are obviously the same word; the Slavonians and Bohemians, and also the natives of the mountains to the south of the Lower Danube, call it *Wewerka*, which sounds something like the Welch; but the Hungarians call it *Eart;* the tribes near the Ural mountains call it *Ur*, the Finlanders *Arorva*, and the Laplanders *Arre;* the names given by the Asiatic tribes are different from any of these, *Kerma* is the Kalmuc name, *Tijia* the Kirghese, and *Line* the Mongol.

An animal which has so many original names, in countries differing so much from each other as these, and being abundant in them all, must of course have no ordinary facility of adaptation to climate; and accordingly it varies much both in the colour and the thickness of its fur. In France and the south of Germany it has various shades of reddish on the upper part, and white on the under; but the pile of the fur above is red at the points only, and annulated with alternate white and brown in the remaining part. Even there, there is a considerable difference in the colour at different seasons; but when we go farther to the north the difference increases; and in the most northerly forests of Europe, and in those of Siberia, the winter colour is slate grey, with small points of black, the coat being very close and thick, and forming no contemptible fur. The pile of the fur is then annulated with a mouse-grey and light grey alternately. In this state it is more abundant in Siberia than in the north of Europe; and the fur is thicker and of superior quality. It is chiefly obtained in the wild woods on the banks of the Obi and Jenessi; and it is called grey squirrel, or Siberian squirrel in Britain, and *Petit-gris*, little grey, in France; the *Grison*, of which it is the diminutive, being one of the gluttons (*Gulo*), a carnivorous animal, and of course quite different from the nimble and gentle squirrel. There is another change which takes place in the north part of Siberia; in Europe the squirrel is very nearly of the same size, in all its range, and all its variations of colour; but in Siberia it becomes considerably larger. This, however, is no proof whatever of a different species, or of any thing more than a mere climatal variety; and that it is only this is proved by the example of the foxes, vealens, and other animals there, which are uniformly of larger size, though the same identical species as those of the north of Europe. According to Pallas, there are squirrels nearly of a black colour in the mountain forests of Daouria, and other places near the lake of Baikal in the south of Siberia eastward; but it is not very clearly ascertained that they are the same species. In Britain the squirrels are not so bright in the red colour as they are in France and the south of Germany.

Squirrels are provident creatures, and lay up stores of provisions against the winter, consisting of nuts, acorns, beech-mast, the seeds of pines, peas, beans, and all other large seeds which they can collect. These are generally hoarded in some hollow of a tree near the abode of the animal; but there does not appear to be much truth in the common saying, that the squirrels are the great planters of the oak, by the acorns which they bury in the ground, and are afterwards unable to find out; for, when an animal has the instinct of hiding any substance as a supply of food, it has, as a matter of course, the instinct of finding it again; and that a squirrel should range the forest burying acorn after acorn in places where they would be apt to germinate, is very incredible. The store is always in a dry place, where it can be preserved from growing.

There are few matters more tantalising than to attempt watching the motions of a squirrel among the thick branches of lofty trees. Both its eye and its ear are so very sharp, that it generally sees the observers or the pursuers fully as soon as they see it; and then it is "once and away," for one can hardly tell the direction which it takes, and it doubles so nimbly, that while it is looked for in one direction, it is very apt to be off in another. When pushed to extremities it can take very astonishing leaps for so small an animal, for in Europe it is not above seven, or at most eight inches in length, and yet it can leap twice as many feet with great apparent ease. The tail appears to be of great use to it, both in balancing the body while it runs, and in serving as a parachute when it leaps, in doing which it also spreads out the limbs, and so presents the greatest surface possible to the air. Upon such occasions the tail is always curved, reflected forward over the body, in which position the furry side of it is against the fall. When occasion requires, the squirrel can take to the water and swim well, for which it is qualified by the lightness of its body and the breadth of surface which it presents. Some have alleged that it uses the tail as a paddle, or, at all events, as a rudder in swimming; but the character of the organ renders this very unlikely, if not impossible. The probability is that, whether it answers the purpose of a sail or not, it is borne much in the same situation as one, namely, over the back of the animal.

The sitting position of the squirrel is as graceful as its motion is fleet. It rests on the hams with the tail recurved, and in that situation it can bear itself entirely on the hind quarters, so as to have the free use of the fore paws; but if any sight or sound arrest its attention, the tail is lowered, and perhaps that organ may assist it in springing into an active position in case of the necessity of a rapid escape from danger. In the middle of the day squirrels are commonly at rest, but they are active among the branches toward evening. The young are produced about the middle of the summer; and until they gain strength for enabling them to seek their own food, both parents are equally assiduous in bringing them a supply. The squirrels, by the time that their stores are exhausted, are busy little creatures until these are again filled; for, by the time that the young are so far advanced as not to need any farther supply from their parents, the collection for the following winter begins. It is supposed that the young associate in pairs as

soon as they leave their parents, though the fact has not been established, and there is of course no physiological impulse to the association at that early period of their lives; but as there remains an attachment of the old ones, without any immediate reference to sexual causes, it is probable that the young may possess the same. The squirrel is so neat and orderly an animal, that it is one of those to which there has been a strong disposition to ascribe reasoning powers; but there is of course not the slightest foundation for such an ascription. That a neat animal should have more reasoning faculty than a clumsy animal, rests on no better foundation than that a regular crystal should have more speculation than an amorphous lump. When the weather begins to get warm in the spring, the squirrels shed their winter coats; and though the period of their gestation is not known, this appears to be done before the pairing time, so that, with them as with other mammalia, the new fur is the nuptial attire; but it does not acquire its full beauty till the season is pretty far advanced. It has been said that the squirrel has bred in a state of captivity; but the fact is a little doubtful, the more so that, had this been the case, the time of gestation would have been observed and mentioned.

When squirels are introduced into a place favourable for them, and not molested, they increase very fast. A good many years ago they were very numerous in the park at Dalkeith-house, one of the seats of the Duke of Buccleugh. At that time there were all the securities of a city of refuge in that extensive park to every living creature which took up its abode there. Whether the case is not the same now we are ignorant; but at that time the park was rendered very pleasant, and also highly valuable as a menagerie of British natural history, by the quiet and security in which the animals lived, and their perfect confidence even when one came almost close upon them. The hares might be patted on the back, the birds let you do every thing short of absolutely touching them; and the squirrels would sit upon not the very high branches of the tall trees by the shady walks, as if they were showing themselves for your special observation. If you passed on perfectly silent, or even conversing with a friend, they would keep their posts without any symptom of apprehension; but if you gave a loud whistle, or slapped your hands together, they would scamper off a bound or two to a higher pitch, while a dozen more which you had not previously noticed, would be put in motion, all getting higher, but peeping down at you with the most perfect confidence and good nature, as if every one challenged you with "good-bye—catch me now if you can." There are indeed few of our wild mammalia so interesting as squirrels; and as there is no case of doing any serious mischief made out against them, it would be highly desirable to see them in every wooded park in the country. It is doubtful whether they might not be turned to account in an economical point of view, for although they are small animals, their flesh is remarkably delicate and wholesome. It is true that it might run a little counter to the notions of those that have admired the lively motions of a squirrel, confined and condemned to the tread-mill, to think of killing so very pretty and engaging an animal; but the feeling is probably much the same with those who are fond of a pet lamb; and yet lambs are killed by hundreds of thousands, and the most refined and sentimental persons in the country seek after their flesh with the greatest avidity.

In the plate, Squirrels there are graphically represented several species, which afford an illustration of some of the distinctions of the different sections. They are well worthy of attention, and we refer to to them thus generally, in order to avoid repeated allusions.

The Alpine Squirrel (*S. Alpinus Pyrenaicus.*) This species is, as its name imports, found in the upland woods of the Pyrenees; and it is certainly also to be met with in many other alpine districts of the south of Europe; but no mention has been made of it as occurring in the north. Mere difference of colour would not of course constitute a difference of species, in an animal so subject to variations of colour as the common squirrel. But to change the tint of a colour, especially in cases where the pile of the coat is annulated, and to find new colours which never break out in any of the known climatal changes, are quite different matters. Besides, there are some differences in form for which no climatal cause can be readily assigned; the head of the alpine squirrel is smaller than that of the common one, though the size of the body is nearly the same; the upper part of the alpine squirrel is dark brown, mottled with small dots of yellowish white; and the under part of the body and inside of the legs are pure white, as are also the borders of the lips; the outside of the legs is grey, the feet are yellow; and there is a yellow line upon each side separating the brown of the back from the white of the under part, and the grey of the limbs; the hairs on the tail, which are long, and divergent in the same way as those on the common squirrel, are black for some distance at the points, and annulated with yellow and black in the rest of their length; and those at the tip of the tail are wholly black when the tail is seen in profile, with the points of the hairs overlaying each other; but when seen from above it appears brown; the colours change with the season, being more black on the upper part in the summer when the fur is young, and more brown in the winter. This is a very common case with alpine mammalia. Cattle and sheep, which have the new covering of the body pure black, and the old one dull reddish-brown, especially at the tips of the pile, are to be met with abundantly on the Scotch mountains. It does not appear that there is any, or, at all events, much difference in the appearance of the alpine squirrel in respect of age; for those which were kept in the menagerie at Paris, renewed exactly the same colours at every change of their coats, which were changed in the spring in the same manner as those of the common squirrel. No difference of habit is known between the one of these squirrels and the other; farther than that the alpine one has been met with only in the south of Europe and as a mountaineer, while the other is more abundant in the middle latitudes and the north, and is found in the low and sheltered places rather than in the lofty and exposed ones. It is possible that the squirrels approaching to a black colour, which Pallas mentions as occurring in the south of Siberia, are the same as the alpine squirrel of Europe; for the colour on the upper part approaches to black during the summer. The black appearance of the tail on the lateral view, and also of the ear tufts and the whiskers would farther agree in favour of the identity of these. Nor is there any

geographical obstacle; for as the more northerly squirrel of Europe ranges into the north of Siberia, so may we expect to find the squirrel of the Alps and the Pyrenees on those mountains of Siberia, which have nearly the same climates; and it is to be borne in mind that the climate of the mountainous part of Siberia, near such an expanse of water as the Lake of Baikal, does not partake of the arid character of those mountains on the same parallel of latitude, which are remote from any considerable expanse of water. There may, however, be very considerable climatal differences of these squirrels as they are found on the mountains of south-eastern Europe and those of north-eastern Asia, even on the supposition that they are the same species; for we have seen that there are great differences in this respect among the squirrels of the north. There is a tendency to grey in the winter months, even when these squirrels are in the alpine woods of Europe; for the tails, which in summer appear as if the blackest parts of them, become greyish in winter. Little is known of them, however; for in addition to the difficulties that there are in the way of attentively studying squirrels in a state of nature any where, there are the additional difficulties of the places which they inhabit.

Grey Squirrel of Carolina (*S. Carolinensis*). Buffon confounded the Carolina grey squirrel with the common squirrel in its grey state, under the common name of *petit gris*, and as he has been followed by the compilers, there is in the books no small quantity of error upon this as upon many other points of natural history, where they have arisen from the same source, and been propagated by the same means. Now, if it had been once considered that it is only in high latitudes and during the cold season of the year that the common squirrel is grey; and that Carolina has almost a tropical climate in the summer, and that this squirrel is grey then, it would have shown that there must be a greater difference between the two animals than any that could arise from exposure to climate. There are, however, still greater differences of appearance; the Carolina squirrel is subject to more variations of colour in the same individual, at the same season and in the same place, than the common squirrel is at considerable differences of season and latitude. Sometimes it is whitish-grey; at other times it is much clouded with yellowish, and at other times again the flanks are almost wholly of a yellow colour; so that if there is any resemblance to any known squirrel of the eastern continent, it is to the alpine one and not to the common, at least so far as colour is concerned. In confinement, too, its colour changes very much, which is not the case with the common squirrel. The ears are also without tufts; the long silky hair and the soft wool which compose the fur, are nearly in equal proportions; and the insides of the fore legs are covered with the same kind of hair as the whiskers. It is also, sometimes at least, much larger than the common squirrel, three times the size according to some of the authorities, which has led to the supposition that those very lage ones may be a different species from the smaller. In a state of confinement, this species is very active at some times; but it is fond of constructing a round nest of hay or straw in the corner of its cage, in which it lies quietly for great part of the day. The woods of the Carolinas are very extensive and very difficult to explore, so that there may be many varieties, species, and perhaps even genera of wild animals in them, of which, at the present time, we have obtained no knowledge. We should bear in mind how it stood with the natural history of most parts of Europe, when they were as little known in their topography as the wilds of America are at present.

Masked Squirrel (*S. capistratus*). There appear to be at least coloured varieties of this species also. It inhabits the same parts of America as the preceding one, but not the same kind of grounds, being more an animal of the dry and sandy places, of the pine burrows and the maple woods. It is a large animal as compared with the common squirrel, being often two feet in length including the tail, which is rather longer than the body and head taken together. Its colour is usually black, with the ears, the muzzle, the toes, and the tip of the tail white; the black is, however, in the points of the pile only; for the rest is annulated, and, like most annulated hair and fur, it is subject to considerable variations. It is more seen than the squirrels of the richer parts of the woods, and thus it falls a prey to foxes, rattle-snakes, and birds of prey. When discovered in a tree, it seeks to conceal itself by crouching closely to the surface of a branch.

There are many other species or varieties of squirrels in the North American woods, varying from each other in colour and size; but very little is known of their habits farther than as they may vary to suit the animals to all the characters of country, from the sandy height to the perpetual swamp, in which one or other of them is to be met with. It is worthy of remark, however, that the mountain races in North America have often stripes along the flanks parting the upper colour from the under, as is the case in the alpine squirrels of Europe.

On the table land of Mexico, the squirrels are richer in the colour than they are in the United States, and especially than they are in Canada. This is true of all widely distributed animals; their colours are always brighter in proportion as their localities are more tropical; and the squirrels being animals which are very susceptible to the colour of climatal causes, we may be prepared for more remarkable changes of colour in those than in animals which are constitutionally most stubborn and permanent. We shall notice one or two of the Mexican species.

Variegated Squirrel (*S. variegatus*). This is the *Quauhtecallatl-quapachtli* of the native Mexicans; and its habits differ considerably from those of the squirrels that have been hitherto mentioned. It rarely if ever climbs trees, and never nestles in them, but in holes of the ground, though generally under cover of bushes or the roots of trees. It is an animal about twice the dimensions of the common squirrel of Europe; variegated with black, brown, and red on the upper part, and also on the upper side of the tail, with the exception of a few white markings toward the tip; the under side orange red; and the ears without any tufts. It is likewise probable that this species is also found in some parts of the United States; for a red-bellied squirrel is mentioned as occurring there without ear-tufts, but of much smaller size than this one is described as attaining in Mexico. Indeed, the succession of squirrels from Canada to Mexico is a subject which is worthy of some attention. There seems to be a regular gradation in their appearance, more so than there is in most animals of the same genus inhabiting different parallels through

a large portion of the quadrant. There seem also to be longitudinal differences of these animals in the severe latitude of America; for those which occur on the right bank of the Mississippi are richer in the colour than those that are in the Atlantic side of the country. This we might perhaps be led to expect, as the western country is more dry and also more tropical in all its characters.

The Black Squirrel (*S. niger*) is coloured very similarly to the masked squirrel already mentioned, but is not above half the dimensions. Its face is described as being in general black, but with some white markings very differently placed in different individuals. In some the nose is white, in others the feet; in others, again, the tip of the tail; yet, again, there is a white collar round the neck; and these markings may all appear in the same individual, or any number of them may appear in any of the combinations which they can form. These circumstances render the history of the species uncertain; but it appears, if a distinct species, to be pretty widely spread, for it has been obtained in the States and also in Mexico. It is described as being a much more social animal than the grey squirrel of Carolina.

The squirrels of the tropical parts of America, and also those of the extreme north of the States and of Canada, appear to belong to the other section of the genus.

The squirrels of Africa and Asia, especially those of the south-east part of the latter, and of the adjoining isles, are very numerous, and some of them are of much larger dimensions, than the greater part at least of those which we have noticed. The greater number of them, however, have little more history than what is to be found in a museum catalogue, and could not, therefore, afford much interest of a popular kind. We shall, accordingly, restrict ourselves to very short notices of two or three of them, which we shall take in places considerably wide of each other, as this will give the best idea as to how they are diversified, so as to be adapted to the very wide range to which we have alluded.

Barbary Squirrel (*S. getellus*). This is a small species, one-third less in its dimensions than the common squirel of Europe; that is to say, the total length of the head, body, and tail, is only about nine or ten inches, of which the tail occupies more than one half. It inhabits the woods on the slopes of the mountains of Atlas, and is said to occur also near the south-western deserts in Asia. The upper part of the body is brown, with four longitudinal stripes of white, extending from the shoulder to the base of the tail; the belly is white; the tail reddish ash, mottled with small points of black. Its habits are little known.

Madagascar Squirrel (*S. Madagascarensis*). This species is about double the dimensions of the common squirrel. It is deep black on the upper part, yellowish white on the cheeks and under part of the neck, and yellowish brown on the belly; the tail is black, and there are no tufts to the ears; it has the tail very long, considerably exceeding both the body and the head; and in this, as well as in some other particulars, it resembles the squirrels of some parts of the East.

Palm Squirrel (*S. palmarum*) is a small species, not much, if at all, exceeding the Barbary squirrel in size, and having a considerable resemblance to that in some other respects. The hair upon this one is short and rather coarse, and there are no tufts to the ears. The ground colour is reddish brown, mottled with grey, and marked by two or three longitudinal lines of white along each side; the under part is yellowish white; the tail is reddish brown on the upper side, and whitish bordered, and sometimes striped with dusky black on the under. As is the case with many of the others, this species appears to be subject to many varieties of colour, for the stripes are sometimes lighter in the colour than the rest of the upper part, and sometimes darker. They vary in number too, being sometimes five, or a dorsal one and two lateral ones on each side; sometimes three, and occasionally nearly obliterated. The hairs on the sides of the tail are erectile, so that it spreads out in the form of a leaf; but, though it can be raised to a considerable angle with the axis of the body, it cannot be completely removed, as in the common squirrel, and indeed in most of the species. It has been chiefly, if not exclusively, found in western Africa, near the banks of the Senegal and the Gambia, and in the Cape Verd islands. It is a very pretty little animal, and the expansions and contractions of the breadth of the tail, by the erection and pronation of the hair, is curious, though not peculiar to this animal. As to what difference of habit is connected with this peculiarity of the tail, we have no positive information.

The Gingi Squirrel (*S. Gingianus*) is a native of the south of Africa, and, though it has some resemblance to the other African species that we have mentioned, it also differs from them in many respects. The upper part is greyish brown, the hair is pure white on the basal part, and annulated with black and brown towards the tips; it is short and coarse; and on the under part of the body, which is pure white, there is very little hair; the basal part of the tail is nearly the same colour as the back; but the distal part has the hairs white, with the exception of a portion of the middle of the length, which is brown. Specimens of various other squirrels have come into Europe from Africa, and it is by no means unlikely that there are many in the country of which we are ignorant. It is also very probable that African and Asiatic species have been confounded with each other by the dealers at the Cape. When both Java and southern Africa were in the hands of the Dutch, there was no possibility of wholly avoiding blunders of this kind. The dealers at Cape Town got skins in the country from the settlers, and they had them also from Java and the other parts of the East. Sometimes specimens of the one place were most in demand, and sometimes specimens of the other, and the dealer generally named his commodity so as to suit the best market; and, as those about which nobody knew anything were the most prized on account of their novelty, matters went on, and there were no means of detecting the mistake till people began to travel and observe for themselves. In a merely mercantile point of view, there could not be said to be any very great fraud in this mode of proceeding; for the skin of a squirrel is of exactly the same intrinsic value as a commodity, in whatever part of the world the animal may have lived; but in settling the geography of the animal it is a very different matter.

The rich and wooded parts of India, and the Oriental isles, especially the latter, are, however, the

grand head-quarters of the squirrels; and the chief reason seems to be, that fruits are more plentiful in the woods there than in those of any other parts of the world. They are also of more ample dimensions than in almost any other part of the world; but some of them belong to the round-tailed section, and not to the pure squirrels, which have the tail divergent, broad, and shading.

Malabar Squirrel (*S. maximus*). A figure of this species is given in the plate "Squirrels." It is the largest animal of the whole genus, being as large as an ordinary-sized domestic cat. The top of the head, a band along the cheek, the middle of the back, and the flanks, are very bright reddish brown; the shoulders, the rump, and the thighs, are pure black; and the muzzle, the lower part of the neck, the breast, and the belly, the under sides of the hind legs, and nearly the whole of the fore legs, are bright yellow. It is one of the brightest in its colours of all the squirrels, though, like most of the rest, it is subject to considerable variations. It occurs in several of the richly wooded districts of India, but it is said to be most plentiful on the west or Malabar coast, to reside chiefly among the palm trees, and to be particularly fond of the milk of the cocoa nut.

Leschenault's Squirrel (*S. albiceps*). This is a native of the Oriental isles, and called *Jeralang* by the natives of Java. For a squirrel, it is rather a large animal, being more than a foot long in the head and body, and with the tail still longer. The hair on the whole of the body and the legs is close, coarse, and thin, so that the form of the animal is better seen than in the furry squirrels of the cold latitudes. The upper part is dull yellowish grey, the hairs being brown at the bases and yellowish at the tips; the tail, which is very flat and feather-like, though not nearly so broad and bushy as in many of the squirrels, is the same colour on the upper part as the basal portion of the hairs on the back of the animal; the under side of the tail, and also the feet, are brownish yellow; the nape is pale grey, and all the under parts white. The colours of this species, as is the case with most of the others, are subject to great variations, some having the whole of the head and neck, and a portion of the flanks, white, and others being much darker than as above stated.

The two-coloured Squirrel (*S. bicolor*). This species is found on the mainland of the south-east of Asia, especially in the Malay peninsula, which has so many points of resemblance to the eastern islands, and it is found in those islands themselves. It is still larger than the preceding, being three feet in length, including the tail. It has obtained its name from one instance of the very variable colours which it shows in different individuals. As giving origin to the name, all the upper part, and also the outsides of the legs, are dark coloured, inclining to black, and the under parts are yellow. These colours are far from being generally descriptive of the animal; for the upper part is all shades from almost black to dull yellowish grey, and the under part is of all tints from dark tawny to pale cream-colour. The ears are of moderate size; the head rounder than that of many of the squirrels; and the thumbs on the paws are rudimental, with a little flat nail; the other dimensions of the fore feet, and also the fore toes on the hind feet, have the claws rather strong and very sharp. The great differences of colour which occur in the same species of these animals render the history of all the large squirrels of the East a matter of no little perplexity. Many persons visiting those eastern countries have named and described species of squirrels; and we have no doubt that any person who goes there, in order to earn the renown of having found a new squirrel, will hardly fail in procuring one different from any that has hitherto appeared in Europe. It would not conduce to any more useful purpose, however, to take note of the almost endless variety of these animals, than it would do to attempt a minute description of all the spots or markings upon a numerous herd of our variegated cattle.

II. Without cheek-pouches, but with the tail round, or having only a small portion at the tip flattened, with the hairs diverging from a mesial line on the under side. These are chiefly, if not wholly, the squirrels of the tropical parts of South America; but they occur also in the East.

Guiana Squirrel (*S. æstrans*) resembles the common squirrel of Europe very much in the form of its body, only it is rather larger in size. The upper part is maroon brown, and the under part russet. The tail is of the same colour as the upper part, with clouded rays of yellow, and the tip is black; the whiskers are also black, and so are some long and coarse hairs on the insides of the fore-legs. It is found in palm trees of different kinds, on the fruit of which it in great part subsists; but it is also found upon the ground, where it leaps about with no inconsiderable agility, though the tail does not form so perfect a parachute as in the true squirrels.

Small Guiana Squirrel (*S. pusillus*). This is a very little species, the body and head not exceeding three inches in length, and the tail being about the same. It is called the "wood-rat" in Guiana. The upper part is mottled ash colour and yellow; the breast mouse-grey; and the rest of the under part fawn colour. There are no ear tufts, but the insides of the ears are furnished with hairs of the same fawn colour as the body of the animal. The whiskers are black. This is a very pretty little animal. There are several specimens mentioned as occurring in museums, the native countries of which are not known; and it is probable that some of them which are now well ascertained to be natives of the Eastern Archipelago have been set down as inhabiting South America. The oriental ones, which were observed and described while Batavia was in the hands of the British, are much more clearly and satisfactorily made out. Of these we shall notice one or two.

Javese Squirrel (*S. insignis*). This animal is called *Bakkal* by the Javese. It is between seven and eight inches long in the body, and nearly the same in the tail. The ground colour is tawny or greyish brown, passing into white on the under part; and a rusty streak extends along each side, all the way from the angle of the mouth to the hinder part of the animal. There are also three well defined stripes of black, about an inch in breadth, each extending from the hind head to the tail, one on the ridge of the back, and one on each side of it, the distance between the stripes being equal to their breadth. The front and muzzle are blackish-grey; and all the under parts white. The feet are of the same blackish-grey as the forehead and the muzzle. The tail is deeper in tint than the body, clouded with brown and black, and slightly interspersed with grey hairs, the hairs being rather long and loose, but not divergent on the under side.

SQUIRRELS.

Flying Squirrel. Malabar Squirrel.

Gray Squirrel. Raffleian Squirrel.

Raffles' Squirrel. A figure of this is given in the plate. It was discovered on the island of Sincapore; but it is probably found in many other of the adjacent places. It is greyish-brown above, with cross bands; white on the head and the whole of the under part, and with a rusty-brown streak along the side, as in the preceding species; the tail is dark coloured, quite round, rather thicker at the middle than at the origin, and tapering to a point. The hair upon it is loose, but it is not well adapted for acting as a parachute, and there is no enlargement of the skin of the sides to assist in the performing of that operation. The body and head are about nine inches in length, and the tail is an inch or an inch and a half shorter. Little or nothing is known of their habits; but it is supposed that all the round-tailed squirrels are more or less ground animals.

The Slender Squirrel (*S. tenuis*) is another species of the oriental isles, first noticed in Dr. Horsfield's interesting account of the animals of that part of the world. It has much resemblance to the preceding species in its general form, but it is much smaller and differently coloured. Altogether the length of it is only about ten inches and a half, of which the tail measures five. The upper part is clouded with black, dark brown, and tawny, passing into tawny on the sides, and into yellowish-grey on the under part. The colours all melt gradually into each other, without any line on the side. The neck and the sides of the head are tawny. The tail is greyish with obscure black bands and minute spots of tan colour; and the single hairs are annulated, tawny at the base, black in the middle, and grey at the points. The tail ends in a long slender brush of a grey colour. It appears that the habits are, partly at least, those of a ground animal; but little is known of them with any thing like certainty.

From the great quantity of food that there is in the forests of the oriental isles, both for tree squirrels and ground ones, it is highly probable that there are many more species in them than have been described; and also that they are very generally distributed. They are, however, subject to so much variation in colour that their history could not be rendered perfect, without more research than can be expected in places so difficult to be explored, so unhealthy in the humid places, and so infested with dangerous animals, and with men hardly less dangerous in some of the inland fastnesses. The early notices of the animals of this portion of the globe are but little to be depended on; and thus it is possible that the gingi squirrel, formerly mentioned, may belong to the present section, and to the eastern isles.

III. Squirrels with cheek-pouches, and the hair on the under side of the tail divergent, from the mesial line for the whole length of that organ.

The squirrels with cheek-pouches are very widely scattered over the world, although they do not inhabit continuously in any one locality. Some are mentioned as inhabiting far north in America, and a very analogous species, if not a mere climatal variety of the same one, occurs in Siberia. In the United States there are several, and some are found in Mexico, though we are not aware of the existence of any in South America. There are, however, some in Africa and in central Asia; and we may be prepared to meet with all sorts of squirrels in the oriental isles. Squirrels of this third section chiefly gather their food upon the ground; and carry it to their young, or to their hoards in the collecting season, in their cheek-pouches. We must do little else than name a few of the species.

Striped Squirrel (*S. striatus*). An American and an Asiatic variety of this species have been described; but it is probable that they inhabit a continuous zone in the two continents, from Carolina westward to the central longitudes of Siberia, with only the interruption of the Strait of Behring and the narrow part of the North Pacific. The American variety is a very small animal, not above half the dimensions of the common squirrel of Europe, though resembling it in colour, only there is a yellowish-white band along each flank, bordered at each side with a stripe of black; and there is another black stripe down the ridge of the back. The hairs on the tail are much shorter than those on the other squirrels, so that that organ is but ill adapted for acting as a parachute. The Asiatic variety is described as being rather larger in the body, being about five inches in length, but the tail is only three. The general colour of the upper part is tawny-brown, marked with stripes similar in colour, in number, and in arrangement, to those on the American variety. The shoulders and the fore paws are dull tawny, and so is the rump between the lines. The outsides of the thighs, the hind feet, and the hair of the tail, are bright russet. This variety extends over a very great range of longitude in the north of Asia, indeed over the greater part of Siberia. The species, whether as American or as Asiatic, is intermediate in its habits between the hamsters and the squirrels properly so called. The individuals are rarely, if ever, found climbing trees; they are ground animals, collecting the seeds of various kinds of plants from the surface of the earth, and making use of their cheek-pouches to carry the food to their magazines. They nestle in burrows, which they usually construct under bushes, or the spray at the roots of trees. The burrow generally has two entrances and two chambers, one of which is the dwelling and the other the store; and the spray, whether of bush or of tree, under which they are placed, helps to defend both against the rains. With their collected store in the magazine, they contrive to live tolerably well under the snow, which lies long above their dwellings in the inclement season of the year.

Thirteen-lined Squirrel (*S. tridecemimbricatus*). This is an American species, about the same size in the body as the American variety of the preceding, and with a tail about three inches in length. The body is very slender, and the muzzle pointed. The colour on the upper part is dark chestnut, with a white line down the middle of the back, formed of little spots nearly confluent with each other. On each side of this line there are three continuous ones, alternating with three rows of spots; and this, with the portions of the ground colour between, make up the thirteen lines, from which the name of the squirrel is derived. This is rather a rare species in North America, the only place in which it has been found; and nothing is known of its habits, though the analogy leads us to conclude that it is a ground squirrel, and not a tree one.

Hudson's-Bay Squirrel (*S. Hudsonius*). This is one of the most northerly of the American squirrels, and well known to the Esquimaux, who call it *Siksik*. It is rather less than the common squirrel of Europe. Its colours are: reddish-brown on the back and the

head, with the tail the same colour, but margined with black; the whiskers are black, and composed of very long hairs. This species remains in the colder parts of North America, and is not found so far to the south as the preceding species.

In the mountains of Georgia to the west of the Caspian, and also in the provinces of Persia lying immediately to the south of that great inland sea, there have been squirrels described which appear to belong to this section; and there have been others named as inhabiting Abyssinia, various parts of India, and the eastern islands. There are also said to be some analogous ones in the elevated parts of central America, near the Andes; but these are all so uncertain and obscure, that they cannot be rendered interesting as subjects of popular description.

Those which we have enumerated must serve as a specimen of this very generally distributed and very interesting genus of animals. Among all the mammalia, there is scarcely one that can be named which is found in so many places, and places so widely apart from each other; and though, in almost all the species, there are few animals subject to more variations of colour, either in different localities or in the same locality, there are not very many in which the generic characters are preserved more definite and easy to be understood. It adds to the puzzle which hangs over the natural history of Australia, that those animals which are met with in every other country of any considerable extent should not be met with in it. We have them on all sides of it where there is land; and this would lead us to suppose that Australia belongs to another revolution of the globe than those which have produced the other continents.

STACHYS (Linnæus). A genus of undershrubs, and annual and perennial herbs, belonging to *Labiatæ*. Two or three species are natives of Britain, where they are called hedge-nettles. One or two are greenhouse plants, and a few are admitted into the flower garden; all are easily propagated.

STACKHOUSIA. A natural order, containing only one genus, and of that only one species, viz., the *S. linarifolia*, which is an herb with stipulate leaves, the calyx ventricose and bearing both petals and stamens, the styles lateral, the ovarium lobed, the fruit dry, and the seeds erect. Of the properties of these plants there is at present nothing known. The *S. linarifolia* is a greenhouse plant, thrives in loam and heath mould, and is increased by cuttings.

STADMANNIA (Lambert). A New Holland ornamental tree, belonging to *Sapindaceæ*, and bearing octandrous flowers. It is a scarce plant in our collections.

STAG BEETLE. A large coleopterous insect, being the *Lucanus cervus*. (See LUCANIDÆ.)

STAPELIA (Linnæus). A curious genus of succulent plants, from the Cape of Good Hope. Having five stamens they belong to Linnæus's fifth class, but from the manner in which these are united the genus is arranged among the *Asclepiadeæ*. Some of the species bear very handsome flowers, but emit a most abominable scent. They are easily propagated by cuttings, laid to dry a few days before planted in dry soil.

STAPHYLEÆ (Linnæus). A genus of deciduous shrubs, belonging to *Celastrineæ*. One of the species is a native of England, and called bladder-nut, from the appearance of the seed-vessel.

STAPHYLINIDÆ (MacLeay). A family of coleopterous insects, belonging to the section *Pentamera*, and sub-section *Brachelytra* (which see), and corresponding with the tribe *Staphylinides* of Mannerheim. The restricted genus *Staphylinus*, as at present constituted (instead of comprising the whole *Brachelytra*, as in the system of Linnæus), contains only those large-sized species which have their anterior tarsi dilated, the body nearly glabrous, not hairy, the antennæ filiform, with the tip obliquely acute, and the palpi slender, with the last joint thin; typical species, *Staphylius erythropterus*, a common insect found in dung, being of the length of half to three-quarters of an inch, with red elytra, and the sides of the abdominal segments with golden pile. There are six other species, excluding the *Trichodermæ* of Stephens. (*Staphyl. murinus*, Linn. &c.)

STARLING (*Sturnus*). A genus of birds belonging to the conirostral family of Cuvier's great order *Passeres*, and being omnivorous in their feeding, resembling the crows in some particulars, but differing from them in others. The characters of the genus are these: the bill straight, conical, depressed, slightly obtuse, with an angular ridge on the culmen advancing some way upon the forehead; the nostrils near the base and lateral, anal, and half closed by a thick arched membrane; four toes on the feet, three to the front and one to the rear, the claw upon the last hung stronger than that upon any of the others; the tarsi rather stout, and of mean length; the wings long, the first quill little more than rudimental, and the second and third the longest in the wing.

Two species of starling occur in Europe, and in all latitudes and situations in which they occur their habits and manners are nearly the same. They are noisy, and, as one would say, scolding birds, at the same time that they are social birds, and generally found together in flocks more or less numerous. As is the case with some of the crow family, and with others of the harsh voiced birds, they can be taught to articulate; and on this account, as well as on that of their strong coats and their active motions, they are often kept in cages; and they have acquired in this country a sort of poetical celebrity, from Sterne's pathetic account of the captive starling, which kept constantly calling "I can't get out." They are often found on the tops of towers and steeples along with the pigeons, and they occasionally enter the pigeon-houses. They nestle in holes of lonely walls, crannies of rocks, and openings in hollow trees. At the pairing time there are many fierce and particularly noisy battles among the males; and, as is usually the case with all animals, biped or quadruped, that fight battles of gallantry, the female becomes the prize of the victor. The nest is formed externally of straw, then of rather fine vegetable fibres, and internally it is finished off with still finer ones, or with feathers or wool. This nest is a rude structure, as is usual among birds of the family. The eggs are four in number, about the same size as those of the thrush, and of a greenish blue colour. The male alternates with the female in the incubation, and both birds are assiduous in feeding the young, which do not leave the nest till they are fully feathered. The love-song of these birds is not a very agreeable one, being a sort of querulous chirping, kept up incessantly, as if they were dissatisfied. Their note of actual dissatisfaction is even more agreeable, being a shrill and prolonged whistle. But though their

natural voices are thus harsh, and without melody, they are capable of a good deal of cultivation ; for the birds are very sagacious, and by no means so impatient of confinement as the poetical account holds them out to be.

They can be taught to imitate a variety of sounds very unlike those that they utter in a state of nature. This is not peculiar to them, but belongs more or less to all birds that have harsh voices and thick and fleshy tongues. There are, for instance, no birds of which the natural voices are more disagreeable than those of the parrots ; and yet, after they have been properly taught, there are few birds more amusing. It is true that they cannot warble, and neither can the starlings, but they may be taught to whistle airs with great accuracy. To obtain a starling of the best voice, however, it is necessary that it should be taken from the nest at a very early age, for its capacity of imitation is such, that, if it is left for a time in the company of the old birds, it will acquire their harsh notes, and never after be able to leave them off. If taken in time, it can be taught both to whistle and to speak without very much difficulty, but it requires to have its lessons very often repeated. Some attention to its health, and especially to its cleanliness, is also necessary in this young state ; because, though it afterwards becomes rather a hardy bird, it is very delicate in early life. This might be inferred from the length of time that it naturally remains in the nest ; for birds that remain long there are always delicate up to the natural time of their quitting it, however hardy they may be afterwards.

In warm climates starlings are not definite as to the time at which they breed, and even in temperate climates they have usually two broods in the year, although the last one is not so numerous as the first. As is the case with many other birds of the same family, starlings are very serviceable in some situations, and as annoying in others. They feed upon mollusca, larva, and ground insects of various kinds, especially beetles ; and as these last are the great destroyers of the roots of vegetables in the ground, there are few birds, rooks excepted, which are of more service in fields and meadows than the starling. But, on the other hand, they are very annoying in the vine countries in the autumn, where they assemble in great numbers, and commit very serious depredations. As is the case with the crow tribe, the flesh of the starlings is harsh and bitter ; but it is said to improve greatly when they feed upon the grapes, though that is rather a costly way of improving the flesh of so small a bird. The bitterness is said to reside chiefly in the skin and the tongue, so that, when these are removed, the birds are palatable. Starlings are birds of smooth flight, and do not proceed through the air by upward and downward leaps, but glide away with an easy motion. Also, when they are upon the ground, they run with considerable rapidity, but do not leap, as is the case with the thrushes and some others of the nearly allied genera. There are several species of the genus, some of which species are very numerous, and they occur in both continents, but by some writers they have been confounded with other genera of birds. The species with which we are most familiar is

The Common Starling (*S. vulgaris*). This bird is between eight and nine inches in length, and weighs about three ounces. The bill is nearly an inch and a half long, bluish at the base, yellow at the tip, and having the gape very much cleft ; the nostrils have an anal projecting border of membrane ; the upper parts are black, but with reflecting glosses, which vary from green to purple, according to the light in which they are seen ; the green is most conspicuous in the coverts of the wings, the lower part of the back, and the rump ; and the feathers on the neck are long, and partially oval-shaped ; each feather on the upper part has a small triangular spot of brownish grey toward its extremity, and these spots are the "stars" from which the name of the bird is derived ; the quills and tail-feathers are blackish, with ash-coloured borders ; and the under coverts of the tail have broad borders of a whitish colour ; the irides are hazel, and the feet brownish flesh colour. The females and the young birds have the under part scattered over with small whitish spots, and they have the light coloured spots on the upper part of larger size than they are upon the mature male birds.

The common starling is not a rare bird in most parts of Europe, and it is partly migratory, partly not. As British birds, they may be considered as rather common, though they are not found in the drier and more upland parts of the country. In the breeding season they are distributed in pairs, and they build their nests in the places and the manner that were alluded to in speaking generally of the genus. In winter, again, they assemble in flocks, and associate freely with all the other birds that flock at that season of the year. At that time they collect upon the low and humid grounds in the vicinity of the marshes, and many of them leave the country. On the continent they are still more migratory, retiring to the south in vast numbers as the cold sets in, and returning again in the summer. When they flock they are generally found in great numbers upon the humid grounds, and they mingle freely with all the other birds that come upon them. They also readily imitate the cries of other birds ; and it is by no means unlikely that their power of doing this is the principal cause which, at first, led to their domestication, or rather confinement, and the teaching of them to articulate words. Many of those that pass the summer in Britain, and other northerly parts of Europe, make their retreat to more southerly climates in the winter, and those that remain flock to peculiar localities. They do not follow the example of rooks, magpies, and various other tribes, by coming upon the cultivated fields, and near to the habitations of men ; they resort to the low and fenny places, where they seek their food by running about on the ground during the day ; and, when night begins to close in, they collect for the night in the rushes, or other tall withered herbage. Before they rest for the night they perform a number of evolutions, flying round and round the place ; but, whether their object in doing so is to ascertain whether there is any enemy there, is not known, although it is very probable. The south of England is the part of the British islands where they are most abundant, and there they are often found in pigeon-houses, the inhabitants of which they meet in the fields, and accompany them home. They have sometimes been accused of eating the eggs of pigeons, but this appears to have no good foundation. At this time they are much more conspicuous than they are during the summer, when they live dispersedly in single pairs, and are so much occupied in the rearing of their broods, that they are but little seen. Their social propensities are, how-

ever, strong at all times; and, no sooner are their broods able to shift for themselves, than they begin to associate almost indiscriminately with all other birds that may happen to be in the same locality.

Their familiarity, their docility, and, above all, the facility with which they can be made to articulate, appear to have attracted the attention of mankind at a very early period; and the interest has been kept up in all countries where the passion of bird-fancying is a strong one. The Persian monarchs are said to have employed them in the somewhat singular royal sport of hawking for flies, which they catch in a mode somewhat resembling that of the swallow tribes, only not so elegant. In modern times they are not employed in this way, though many of them are kept for the sake of their voices, and of the little tricks which they learn to play. As already mentioned, they must be taken very young if they are to be of much value either for their song or their articulation; because if they are allowed to remain in the nest even half the time that they are naturally there, they acquire the chatter for which they are so conspicuous in a state of nature, and cannot get wholly rid of it by any training to which they can be subjected. Being taken so young, the rearing of them is attended with a great deal of trouble. They must be kept upon moss in a little box, and this moss must be changed every day, the most perfect cleanliness being necessary for their health. Delicate animal food is given to them, generally sheep's heart cut into little shreds (so as to resemble the young of the earth-worm, understood to be what their parents first feed them with in the nest) is what is said to suit them best. But after they are a little advanced, they acquire their omnivorous habit, and can eat both animal and vegetable matters, though they always give preference to the former. Their aptness to imitate the sound of words was not unknown to the ancients, for Pliny alludes to the starlings which were trained for the amusement of the young Cæsars, as being capable of articulating both Latin and Greek. They of course have no more knowledge of language than those birds which no art can make to articulate a single syllable; but there are few birds that can so accurately repeat a long succession of varied sounds. It is mentioned that when M. Gérardin visited his friend, M. Thirel, in Paris, he was agreeably surprised and astonished by hearing a starling articulate a dozen of consecutive sentences, with the same precision as if they had been spoken by some person in the next room; and when the bell rang for mass, the same bird called to its mistress by name, "Mademoiselle, entendez-vous la messe que l'on sonne? Prenez votre livre, et revenez vite donner à manger a votre polisson:"—Miss, don't you hear the bell ring to mass? Take your book, and return quickly to feed your little wag. The same bird whistled various airs in a clear and agreeable manner, and with the most perfect musical accuracy. In Britain the starling is but little regarded, except as an object of curiosity; and in that respect its interest is not great, as the time of the people is, generally speaking, too much occupied for their devoting much of it to the educating of birds. On the continent it is somewhat different, and in the fenny places there the birds are also sought after as articles of food. They are particularly abundant in Holland; and, as they fly crowded, and wheel and return again and again to the same spot, numbers of them may be shot with very little labour on the part of the fowler.

The starling is found in all parts of Europe, and also occasionally in Northern Africa. There appear to be some varieties if not different species, for there is one mentioned as being found in Sardinia, which is of a black colour without any spots; and even the common ones which are found in the same flock are remarkable for the different tints of their general plumage.

In the north and east of Asia there are some which are probably entitled to rank as different species. Among these may be mentioned the Daourian starling (*S. Daourica*), which is considerably smaller than the starling of Europe, being only six inches in length. The upper part of the male is black with purple reflections, and whitish margins to the quills; and the under part whitish-ash colour; there is a white stripe on each side of the head; and the bill and feet are lead colour. Another species, the green starling (*S. viridis*), is common in China. It is green on the upper part, without any spots; has the quills with white shafts and margins; a small crest of black feathers on the top of the head; and the bill and feet reddish. Another species of the eastern continent has been called the Cape starling (*S. Capensis*), though it appears to be a native of India, rather than of Southern Africa. Its general colour is blackish on the upper part, and white on the under, with the neck and throat deep black, though with reflections of purple; there is a small spot of reddish-white upon each cheek, and a band of the same colour on the back of the neck, and a small red spot between the eye and the nostril; the bill is yellow at the base and black toward the tip; and the feet are yellow with black claws.

An Australian bird (*Creadion pharoides*), is sometimes classed with the starlings as the carunculated starling (*S. carunculatus*), from two orange-coloured wattles, each almost a quarter of an inch long, which are pendent, one from each angle of the gape. The upper part of it is rusty black, and the rest of the plumage pure black; the bill is blue at the base, and black at the tip, which last is also the colour of the feet; it is about an inch longer than the common starling of Europe. There are various other varieties named as occurring in different parts of the eastern continent; but they are in all probability only climatal; and it has been remarked, that the warmer the climate in which they are found, the deeper are the colours, and the richer the reflected tints of the plumage.

The Louisiana Starling (*S. collaris*), was described by Gmelin as the great lark. It is a bird about nine or ten inches in length. It is not confined to the part of America from which it is named; for it also occurs in the United States and in Canada, but moves southward in the winter, and collects in vast numbers on the humid plains on the banks of the Lower Mississippi. It is indeed more exclusively a marsh or meadow bird than the starling of Europe, and confines itself to the open grounds near the rivers, never perching on trees, as is the case with the starling of Europe. They are much more numerous in the central states of America in autumn than they are at any other season of the year, as they then collect from the north and flock; whereas, in the breeding time, they live much more dispersedly. They are swift of foot, and nimble and ready on the wing. When observed they take flight, but speedily squat down in the cover of the bushes and tufts. They do

not associate in such numerous flocks as the starlings of Europe, though there are often many of them on the same meadow. They have all more or less of a social disposition toward each other, and also for the other birds that resort to the same places; but there is a closer attachment between the members of small parties which keep together and have their movements in concert, and they appear to be the family of the year. After they separate in pairs in the spring, the male and female show a great deal of attachment for each other, and both are very attached and attentive to the young ones. Their nests are placed in the cover of bushes, and the eggs vary from five to seven in number. There is understood to be only one brood in the year.

The colour on the upper part is much mottled and broken by various spots and markings of black, brown, red, and grey; there is a whitish stripe down the middle of the back of the neck, and a shorter and less conspicuous one upon each side, which passes over the eye; the cheeks are grey; the quills blackish, with grey borders, and marked with shades of brown across; over the eyes and on the throat, the colour is yellow; but there are black mustachios, and a patch of black upon the breast; the lower part is yellowish with dusky blackish spots, which are most numerous on the lower part of the breast toward the great black spot; the under sides of the wings are yellow; and the under part of the tail is reddish with cross bars of brown; the bill is brown above and ash-coloured below, and the feet are grey; the length is nine or ten inches.

South American Starling (*S. militaris*). In the summer, which answers in point of time to our winter, this bird is found as far to the south as the Falkland Isles and the Straits of Magellan; but at other times it ranges nearer the equator, although we believe not further to the north than the lower valley of La Plata. It is rather smaller than the starling of North America, and different in its colours; and it is also more of a vegetable feeder, coming in flocks upon the cultivated grounds and eating the grain. The upper part is brown with yellowish margins to the feathers, and the under part is crimson, mottled with black upon the flanks; the scapular feathers are red, and the quills and tail-feathers black; each side of the head is marked with a white stripe from the gape to the hinder part of the head; the tail is forked; the bill and feet are brown; the females and young are paler in the colours.

Like the starlings of North America, these are ground birds, frequenting the open places, nestling in tufts and bushes, and never taking up their abode in the holes of rocks, or perching upon trees. They have many of the characters of the starlings of the eastern continent, and yet it is doubtful whether they ought not to be formed into a separate genus or subgenera.

Various other starlings have been named and described by authors, chiefly from museum specimens, the differences of which are only those of colour. This is, in a great measure, the case with the green one, which is said to be Chinese, and there is a liver-coloured one reported to be also of China, which stands in the same predicament. Considered in themselves they are not very interesting birds; and they are so scattered about, and so roaming in their dispositions, that they are not very characteristic.

STATICE (Linnæus). A genus of perennial herbs, mostly natives of the north of Europe. The genus belongs to *Plumbagineæ*, and some of the species are called sea-lavender, and used as edgings to flower borders.

STELLARIA (Linnæus). Annual and perennial herbs, mostly natives of Europe, and belonging to *Caryophylleæ*. Several species are found in Britain, where they are called stitchwort.

STENIDÆ (MacLeay). A family of coleopterous insects, belonging to the sub-section *Brachelytra* (which see), corresponding with Mannerheim's tribe *Stenides*. The typical genus *Stenus* (Latreille) is distinguished by the large size of the eyes, the length of the sub-cylindric body, the tarsi distinctly five-jointed, and the very great length of the retractile labium. Stephens describes nearly seventy species, all of which are of small size, frequenting damp situations, as the margins of rivers, ponds, &c., especially in grassy and sandy places. They are generally of a black colour, but a few are ornamented with a red spot on each elytron. The typical species is *S. cicindeloides*, so named from the analogy which it exhibits with the *Cicindelæ*, in the great size of the eyes.

STENOCHILUS (Dr. R. Brown). A genus of evergreen shrubs, natives of New Holland. The flowers are didynamous, and the genus belongs to *Myoporinæ*.

STERCULIA (Linnæus). A genus of fine ornamental trees and shrubs, chiefly natives of South-eastern Asia; the flowers are monœcious, and the plants belong to *Byttneriaceæ*. The species are very various in appearance and character, and are easily kept and propagated in our stoves or greenhouses. The *S. platanifolia* is almost hardy; several specimens, in different parts of England, having survived two or three severe winters.

STERNA (*Tern*). A numerous and rather interesting genus of web-footed birds, which career over the marshes and waters much in the same style as the swallows do over the land, on which account they are sometimes called sea-swallows. They are birds of light weight, but clean and firmly made, with very long and pointed wings and forked tails; and the freedom and rapidity of their motions give no small interest to the waters they frequent.

Their general characters as a genus are: the bill as long as the head or longer, straight, compressed, grooved at the sides, and sharp and cutting at the tip; but there are some species in which it approaches in form to that of the gulls. The mandibles are of equal length, and the upper one is bent for some distance near the tip, against which the point of the under one acts as in the petrels, and other birds which gather their food on the wing over the sea. They in fact take up the pasture of the margin of the waters, where the gulls leave it, as these are met by the petrels which are still farther to seaward. The nostrils are near the middle of the length of the bill, and pierced through and through. The feet are short and weak, and naked of feathers to some distance above the tarsal joints. The three front toes are webbed with a notched membrane, and the hind one is free, and the claws are small and crooked. The birds can walk, and they can also swim; but neither of these is their principal motion, or that upon which they depend in the search of their food. The wings are always very long, extending beyond the tail when closed, and the first quill is the longest. The tail is

more or less forked. Indeed, were it not that they are water-birds and the swallows are land ones, they resemble these in very many particulars. Their voices even have some resemblance to those of the swallows, by sharp hissing screeches.

The style in which the terns twitch down to seize the small fishes and fry that are near the surface of the water is often very splendid; and one knows not whether most to admire, their rapidity of flight or their facility of descent, just to tip the surface of the water, and instantly again to ascend and be on the wing. How they can see with such unerring certainty, and change their motion so instantaneously from the forward rush of the wing to an absolutely perpendicular descent, as if it were a stone or piece of lead falling, is a matter which we cannot very well explain or even understand; but that they do it is certain, and as vision is the only sense that they can have to guide them, their powers in this respect must be wonderful. Taking them in the average of their species, they are not so much sea-birds as they are birds of the marshes near the sea, and the lower parts of the valleys of the great rivers that are occasionally flooded. Some of them are found upon the inland waters, or at all events upon the land-locked seas, and the rivers that flow into these. In the spring they come to the shores in considerable bands; but they generally disperse themselves in single pairs in the breeding season. In winter they are more upon the flooded grounds.

The birds are so rapid in their motions, and the habits of some of them are so little known, that it is not possible to give a general account of their manners that is sufficiently clear. In respect of their habits they might perhaps admit of division into four sections, though there are no structural differences sufficiently marked for giving these much interest in a systematic arrangement. The first of these divisions might include the species which, especially in the breeding season, find their food chiefly by fishing in the inland waters, and thus keep near the margins. A second division are more discursive over the surface of those waters, and their food is less known. A third division breed in the marshes, and live upon insects, spiders, and other little creatures which they capture when on the wing, as well as upon fish. The fourth division are more of sea birds, and deposit their eggs on the sands and flats, and especially on the small islets near the shores and in the estuaries of the rivers. Those of the last division are the characteristic ones of the British islands; for our inland waters are not ample enough, or the lower parts of our rivers sufficiently flooded, to afford scope for the others. The countries which lie toward the Black Sea and the Caspian, and the marshy banks of the rivers that fall into those seas, especially the Danube, are the great haunts of the terns on the eastern continent; but there are also many on the American marshes. The fact is, that their wings are so ready and so powerful, that a flight of a few hundred miles is with them a matter of but small effort. The haunts of the marsh ones are both difficult and disagreeable to explore, so that we are not so well acquainted with their habits as it would be desirable to be with those of birds of so much energy of character. But our notice of them must be brief, and we must in a great measure confine it to those which are generally or occasionally found in the British islands, or upon their shores,

The Gull-billed Tern (*S. Anglica*). The epithet *Anglica*, or English, is very inappropriately applied to this one, inasmuch as it is really not an English bird, and occurs in our part of the world only as a very rare straggler. The proper habitat is the east of Europe, especially the marshes of Hungary, and the countries below that on the Danube; but it ranges considerably both to the eastward and the westward; and seasonally it is found by the marshy or flooded places near the rivers that fall into the Caspian and the lake of Aral. This tern of the central marshes of the eastern continent is a much more heavy bird, and slower in its motions, than the terns with which we are more familiar on our own shores; and in its general make, as well as in the form of its bill, it has no slight resemblance to those gulls which breed in the marshes. Indeed there is one of the gulls which inhabits nearly the same locality; and probably the two perform the office of scavengers together. It is not a little curious that, though this species is by no means rare in the east of Europe, the first notice of it by naturalists should have been by the late Colonel Montagu, from a specimen found in England; and thus its introduction to natural history is English, though the bird itself is really a foreigner.

This tern is a bird of considerable size, and well winged, though, as we have said, rather a heavy flyer. The extent of the wings from tip to tip is about thirty-four inches, or half a foot more than double the length of the body. The bill is very strong and of a dark colour, and has a projecting angle at the middle of the lower mandible the same as in the gulls, and the tip is also formed in a similar manner. From the similarity in form there is every reason to infer a similarity of office, and that the tern is alternately a fisher and a scavenger as circumstances may require. In the summer plumage the head and neck are black, and the upper parts greyish white, with the shafts of the quills and tail-feathers pure white. A streak from the gape to the eye, and all the under part of the body, are also white. In winter the head and neck become nearly white; but the black is restored in the spring moult. The tail is forked, and the closed wings extend at least two inches beyond the tip of it. The nest is formed in a tuft or bush by the side of the marsh from which the bird procures its food, or on a hummock within the marsh, if there happens to be one adapted for the purpose. The nest is constructed wholly of dry vegetable fibres, and the eggs are four in number, of a greenish-olive colour, and marked with brown spots.

The Caspian Tern (*S. Caspia*) is another species of the central marshes of the eastern continent, and, as its name implies, a more easterly inhabitant than the other marsh tern. On the Caspian it is very abundant; and, though one of the large and heavy terns, it sometimes, although not very frequently, straggles into England, the place where it is most likely to visit being the east coast of Norfolk.

In its summer plumage the upper parts of this species, with the exception of the head and neck, are ash colour, and the under parts white. The head and neck are deep black, the feathers on the latter being long and silky. In winter it is supposed that the black fades as it does in the preceding species, but the habits and the breeding place of this one are little known. It is in the winter plumage that a few specimens of this bird have straggled into England. In that state the front and part of the head are white

while all the rest of the upper part is bluish ash, with the exception of the wing-coverts, which are brownish with cross bars of black and white. The quills of the wings and all the under parts of the body are, at this season, pure white; the feet are black, and the bill is vermilion red. Whether these are the winter colours which the birds uniformly assume in those places where they are numerous and native, has not been ascertained; but it is probable that they are. When full-grown, there is not understood to be much difference in the appearance of the sexes, either in the summer or the winter; but the young birds have those parts which are ash-coloured in the adults mottled with black.

The Sandwich Tern (*S. Boysii*). This is a species of the principal habitat of which there is not much known, the chief notice that we have of it being as rather a rare bird on the south-east coasts of England, though it is probable that it breeds there, not, however, in any considerable numbers. It is a bird of a foot and a half in length, and about two feet nine inches in the extent of the wings from tip to tip. The back and the coverts of the wings are grey; the principal quills have the shafts and inner webs white, and the outer webs mottled with small dots of black. The top of the head, as far down on the sides as the eyes, and backward to the nape, is black. The under parts are white, with a blush of rosy colour on the fore-neck and breast, which vanishes in the winter, at which time the head also becomes more or less mottled with white, or white altogether.

This species is usually found upon marshy places near the sea, and it is particularly abundant in Holland, and along the low shores of Germany. Its chief subsistence is small fishes, which it captures with great ease and readiness while driving about on the wing. It is not found at any distance inland, or far out at sea.

The Lesser Tern (*S. minuta*). This bird is very generally distributed over the temperate and the cold parts of the northern hemisphere; but in the eastern continent and in America, the long dreary beaches of sand or shingle are the places over which it is usually found; and it adds considerably to the interest of places that have not very much to recommend them, by the rapidity of its movements and the plaintive wailings of its voice. It is between eight and nine inches in length, and more than a foot and a half in the stretch of the wings. The upper parts of the body, the wings, and the tail, are pale grey; the quills of the wings being a darker shade of the same colour. The top of the head, the hind head, and a streak from the gape to the eye, are black, and the forehead and all the under parts of the body pure white. The young birds are, however, very differently coloured from the adults, so that they are liable to be mistaken for another species. The head is then mottled with black and grey; the back with grey and yellowish white. The tail in the young state is very little forked.

These birds remain on the beaches all the year round, though they are more scattered in line in the winter, and collect into parties, on the grounds best adapted for their breeding, in the summer. The breeding time, for it cannot be called a nesting time with them, is during the warmest time of the year. The eggs are placed on the bare ground among the pebbles of the shingle, and it is probable that the heat of the sun during the day assists in hatching them; for, even where there are a considerable number of birds careering about on the wing, it is very rare indeed that a female is started from her eggs, and thus the birds afford no clue to such as seek for them. During the night, however, it is understood that the female sits, and that she sits also during the day in case of rain. The eggs are only two, or at most three, and they are placed in a little depression of the sand or small gravel; they are pale brown, and spotted over with dusky and ash-coloured blotches.

Though this tern is far from rare on the sandy and shingly margins of the sea, and also of the great inland lakes of the eastern continent, it has nowhere been so closely observed or so faithfully described as by Wilson. It arrives, that is, collects upon the spots favourable for breeding, on the coast of the American States, about the end of April. It "coasts along the shores, and also over the pools in the salt marshes, in search of prawns, of which it is particularly fond; hovers, suspended in the air for a few moments above its prey, exactly in the same manner as some of our small hawks, and dashes headlong down into the water, generally seizing it with its bill, mounts instantly to the same height, and moves slowly along as before, eagerly examining the surface below.—About the 25th of May, or the beginning of June, the female begins to lay. The eggs are dropped on the dry and warm sand, the heat of which, during the day, is fully sufficient for the purpose of incubation. The heat is sometimes so great that one can scarcely bear the hand in it for a few minutes without inconvenience. The wonder would therefore be the greater should the bird sit on her eggs during the day, when her warmth is altogether unnecessary and perhaps injurious, than that she should cover them only during the damps of night and in wet and stormy weather."

From this Wilson draws the conclusion which almost any one would have drawn at the time when he wrote, namely, "that the actions of birds are not the effect of mere blind impulse, but of volition, regulated by reason, depending on various incidental circumstances, to which their parental cares are ever awake." Now that this tern is not guided by anything that we call an impulse, either blind or not blind, is perfectly true. A blind impulse is an attempt to proceed in ignorance in a matter where knowledge is absolutely necessary, while an impulse which is not blind, or, as we may call it, a rational impulse, is one in which the party proceeds upon a well-established ground of experience. The bird cannot proceed in either of these ways; for that which cannot acquire experimental knowledge can never be said to be ignorant, for we are ignorant of nothing which is not knowable, or to the right performance of which experience would not be a certain guide if we were in possession of that experience; but the bird has no need of experience. The young bird which never saw an egg, performs her incubation in exactly the same manner, and as perfectly free from mistake or error, as the mother of a dozen of broods; and it would be just as vain to speak about an ignorant bird blundering in its incubation, as to speak about an ignorant stone forgetting the way to fall after it were half way down the pit or the precipice. It is much to be regretted that even the very best books on the natural history of animals are vitiated by the frequent occurrence of this false philosophy, which instils the very worst of errors often with the best intentions,

Though there is no impulse on the part of the tern to this incubating only during the night and when the weather is inclement, yet there is an obvious purpose answered by it in nature, and this is the proper lesson of wisdom for us to draw from it. Where the tern breeds the pasture is rather a poor one, and food, even for a small bird, cannot be obtained without a good deal of labour. From the smallness of the prey too, and the necessity of ranging for it on the wing only, the clearest light is essential for the feeding of the bird; and those very circumstances of the locality which render it necessary that the female tern should be abroad finding her food for the greater part of the day, carry on the incubation of her eggs without her assistance at the time, when she is thus occupied.

Thus, when we take a proper view of this, we come to the very same conclusion to which we are led in every case in nature when we take it upon its own evidence, and do not call in the aid of a gratuitous sort of "inferior reason," which vitiates the whole case. All the birds of bare and sandy places, from the ostrich on the great inland desert to the tern on the shingly beach of the sea, are under the same law, though that law, as well as their own organisations and habits, are varied so beautifully according to the circumstances, that each is the best adapted for its own locality. If the bird must, according to its general habits and habitation, range the whole day in feeding, the eggs are always so placed as to be hatched by the sun during that time; but to give the bird credit for plan and purpose in this matter would not be less absurd than to give it credit for plan and purpose for having adapted the structure of its body to the place which it holds in creation. Indeed, if we admit the one we eventually admit the other, whether we avow it in so many words or not.

Wilson says that the eggs of the lesser tern in America are generally four in number, while the most careful of the British authorities say that they are never more than three. This would not be a ground for supposing a difference of species, because the eggs of various birds are more numerous in America than they are in the corresponding species of Europe. This seems to arise from America being better adapted for the bird. In the tern this is remarkably the case, because there are many more salt marshes and mud banks on the coasts of America than on those of Europe. These eggs are very similar in size, shape, and colour, to those that occur in this country, and they are always placed higher than the greatest high-water line. We must not consider, however, that the bird *studies* their safety any more than that she places them on the dry surface, *knowing* that the sun will assist in hatching them there. The birds are very clamorous, however, when their breeding-ground is invaded. Wilson says—"During my whole stay, these birds flew in crowds around me, and often within a few yards of my head, squeaking like so many young pigs, which their voice strikingly resembles. A humming bird, that had accidentally strayed to the place, appeared suddenly among this outrageous group, several of whom darted eagerly at him; but he shot like an arrow from them, directing his flight straight toward the ocean." The food of these birds is exclusively animal—insects, crustacea, small mollusca, and all the produce of the peculiar places to which they resort. They feed on the wing, catching their prey in the air, on the ground, or in the water; but they do not walk in search of it. They can range for a long time, but they are often much exhausted, and remain motionless on the ground for hours together. Besides having more numerous broods, the American species is about an inch longer than that of the eastern continent.

American Marsh Tern (*S. aranea*). This species is about the same size as the gull-billed tern of the eastern marshes, but it is a bird of different character, more rapid on the wing, and with the bill differently formed. The length of this species is fourteen inches, and the stretch of the wings not less than two feet ten inches; the bill is rather stout, much rounded on the culmen, and of a glossy black colour; the crown and nape are black, and the rest of the upper part dull bluish white, with the shafts of the quills and tail-feathers pure white; the under parts are pure white; the tail is much forked, and the closed wings extend two inches beyond it; the legs and feet are black; the eggs are three or four in number, of a greenish olive colour, spotted with brown; the young have the points of the feathers on the upper part of the head white, but the basal parts, as far as the black extends in the mature birds, is dark coloured; the feet are dusky orange, and there are some mottlings on the tips and edges of the primary quills.

Wilson found this species on the cold marshes, where the eggs were deposited on the drift grass without any formal nest. The principal food appeared to be a large black spider, which is abundant in these situations, and moves under the water as well as in the air.

The Black Tern (*S. nigra*) occurs in Britain, but it is not a very common bird. Its breeding-places are by the pools in the salt marshes, and the nest is placed in the cover of reeds and other tall aquatic herbage. It makes a nest, though a very rude one, of dry leaves and other vegetable matters. In its dimensions it exceeds the lesser tern, though not by a very great deal. In summer the upper part of the body is bluish-ash, with the exception of a small margin of white on the external feathers of the tail; and the nape, the chin, the throat, and all the under parts, are greyish-back. The male is easily distinguished at this season by a small white spot on the chin, which is wanting in the female. In winter all the colours of the under part fade to white, and the colour on the back becomes much paler in the tint. The webs of the feet are much more deeply notched between the toes than those of the other terns. The young have the upper part brown, with the borders of the feathers paler than the rest. During the breeding season these birds keep close in the cover of the marsh vegetation; but in the end of summer, when their broods are matured, they disperse along the line of the shores, the time of their stay in the marshes being about three months. They have been sometimes confounded with the common tern, but they are a distinct species.

The Roseate Tern (*S. Dougalii*). This is a larger species than the preceding, and its habits are less those of a marsh bird, for it is found only by the sea, and in the lower estuaries of the tidal rivers, especially where there are flat islets and long expanses of shingle and sand, without being flooded at high water. It is fifteen inches in length, but has the wings much shorter in proportion than most of the

others. The upper part is grey, with black or dusky on the webs of some of the quills, but with all the shafts white; the head and nape are black, and all the under parts white, with a rosy tint on the neck, the breast, and the middle of the belly. The geography of this bird is not very well known, but it is supposed to be a bird of the colder latitudes. On the shores of many parts of the Baltic, and also on those of Denmark and Norway, it is said not to be uncommon. In Britain it is rather a rare bird, and has been usually seen in company with the common tern.

The Common Tern (*S. hirundo*). This is the species which is best known, and the one which has, by way of eminence, got the name of sea-swallow. In the mature bird the upper part is pure ash-colour, the cap on the crown of the head and nape black, and all the rest white; the feet and basal part of the bill are red, and the tip of the bill black. The length is about a foot. The young have the plumage on the upper part mottled, and the chin, which is white in the old birds, of a dusky colour; the colour of the tip of the bill varies in different individuals, and the plumage changes with the season, and partially also with the latitude. There is also a considerable seasonal movement in the birds. They resort to much more northerly places in the breeding times, and more southward, again, in the winter; and, as they are found in different dresses in the two localities, they have been by some multiplied into several species. They are very widely distributed over most shores abutting on the north Atlantic; and they are found in abundance upon all parts of the British shores that are adapted to their habits. They leave the high rocks to the gulls, petrels, and other birds, which, ranging over the surface of the water, have also much more of a swimming habit than the terns. But on the low shores, where there is an accumulation of sand and shingle, and the bottom is for a considerable way alternately exposed and covered, there is sure to be abundance of them; and their rapid motions on the wing, and the shrilly cries which they utter, all tend to give them that peculiar character which imparts so much interest to the sea-birds, especially in lonely places. They deposit their eggs on the bare sand. On the British shores these are seldom more than two in number; but on the shores of America they are generally three—another proof that it is more favourable for beach and marsh birds than the eastern shores of the Atlantic. The eggs, as is frequent with sea-birds, are larger in proportion, of a dim yellow colour, and mottled with spots of brown and dusky. The common terns depend more upon the waters for their food than most others of the genus, for they live in great part upon the fry of fishes, which they are very expert at twitching out of the shallow water. During the day the eggs are left by both birds, unless in case of rain; but they are far from abandoning them. The birds are never at any great distance from the eggs; and the instant that any one approaches the place, they are in a state of great excitement, and, by their squeaking and wheeling about in the air, endeavour to draw the attention of the visiter, and keep up their motions and their voice around him, until they have got him to a considerable distance. Indeed, if one walks along for some distance where the beach is favourable for them, he may have a guard of terns the whole way; for one pair hand over the traveller to another, and he continues to get well scolded until he is fairly out of the domain of the terns.

The young, when they break the shell, are not so immediately fit for finding their own food as the young of many other sea birds. A running bird, and even a swimming one, requires little or no attention from its parents, as the one can almost immediately run about, and the other take to the water; but the development of wings upon which the bird shall be borne when it is feeding is another matter; and no bird, as it comes out of the shell, is capable of flight. Therefore, the terns have to be fed by the parent birds until their own wings are fit for flight; and, as young birds are voracious in proportion to the feathers that they have to produce, the terns have a good deal of labour in feeding the young, although the brood is so small. There is a sort of progress in this feeding. While the birds are very young, the old ones divide the food for them, and put it into their bills. After they have grown a little, they twitch it into the mouth of the young, without pausing, on the wing; and when they are nearly fledged, the old ones simply drop the food for them, and leave them to pick it up while they go in quest of more. Soon after this the young are able to rise on the wing, and find their own food, and then the labours of the old birds are at an end for the season. Thus we find that there is no deviation from the general law of nature even here. Every thing in nature, as well as in art, is a production; and the law is general, that the labour which the production demands is in proportion to the value of that production. A wing is a far more nice instrument than a walking or swimming foot; and when it is required as a principal organ in any bird, the parents of that bird must undergo a more severe and more protracted labour.

The very same principle holds in human labour; for, if there is to be additional value in any thing, there must be additional labour in the making or production of it. This is true not only of those fictitious grounds upon which things are often valued, but also upon the score of absolute intrinsic worth. There are circumstances which render the cases not quite parallel. For instance, there are different degrees of knowledge and dexterity in human workers, and these so far affect the results of their labours, that the actual time and labour which the producer expends upon it are not measures of the intrinsic value of a human production. But in nature there is no difference of knowledge and dexterity in the producer, all being alike, and everywhere perfect: and therefore natural productions are entirely free from the uncertain and indeterminate element which affects the productions of human labour. This being the case, the operation—for we cannot properly call it labour—and the production, are always in exact proportion to each other; and this is the ultimate standard of perfection to which the labour of man should be made to approximate as nearly as possible, although it is one which, in the nature of things, never can be reached. When we say that any one production of nature has a certain degree of value or perfection which another does not possess, we only state, in other words, that a greater number of opposing causes have been overcome in the production of it; and as, in nature as well as in art, the only means of overcoming is by the greater being made to act upon the less, the producing energies must be

more exerted in proportion as they overcome a greater opposition. This case of the wings of birds is quite in point, and it is a perfectly general one. It is one, too, which conveys a great deal of useful information, by teaching us that there is "no royal road" to the accomplishment of anything; but that the best and the only way to make sure of success is to make ourselves acquainted with all the difficulties and the means by which they may be overcome. There is no retreat in which we can lay so sure a foundation for knowledge of this kind as the school of nature, and there is no department of nature more instructive or more pleasing in this respect than the birds, especially those birds which have their place and office in nature clearly marked out, and are energetic and open to our observation in their working.

The terns are, in an especial manner, birds of this instructive character. Their place in nature is a very peculiar one, and their labours are exceedingly severe. They are also admirably shaped and organised for this labour. Their bodies are of the very best form for rapid motion in the air. Their strength and weight are concentrated in the wings; and as the feet have a very secondary function to perform, they are small, and the muscles attached to them are very feeble. The plumage of the terns is remarkable for the compactness of its structure and the smoothness of its surface; and it is less disordered by wind or rain, or by collision with solids, than that of most birds. Their muscular fibres, too, are remarkably tough and strong, and they are but little loaded with fat, or with superfluous matter of any kind. These circumstances render them of comparatively little value to man as food—indeed, we may say of no value, for there is little flesh upon the birds, and the little that there is, is of a very unpalatable nature.

Thus formed, they are sent forth to find their food in places where no other bird, or other vertebrated animal, could by possibility live. Even in those places which they frequent there is, however, a surplus of the production of life, and that surplus requires regulation as well as the surplus of the most fertile places. Thus, when we look upon it with anything like understanding, there is really as much perfection in the adaptation of the tern to the barren strand as in that of the ox to the meadow.

STERNBERGIA (Kitaibel). A genus of bulbs, belonging to *Amaryllideæ*, natives of the South of Europe. They do very well on warm borders in this country.

STERNOXI (Latreille). A sectional name given to the two serricorn coleopterous families *Buprestidæ* and *Elateridæ*, in consequence of their both agreeing in possessing a more or less acute and produced point at the posterior part of the prosternum, which in the latter family is employed as an instrument for enabling the insects to recover their ordinary position when laid upon their backs. In the *Buprestidæ* this point is broader, and is not employed in this manner.

STEVIA (Cavanille). A genus of Mexican perennial herbs, belonging to *Compositæ*. The species are nearly hardy, but liable to be destroyed by severe frost.

STILLINGIA (Linnæus). A genus of herbs, shrubs, and trees, natives of North America and India. The flowers are monœcious, and the plants belong to *Euphorbiaceæ*. In the greenhouse, the species if potted in light rich soil thrive well, and are easily propagated by cuttings.

STIPA (Linnæus). A genus belonging to the *Gramineæ*, commonly called feather-grass, and admitted into flower gardens as ornamental.

STOCK. A well known flower-garden favourite, the *Mathiola incana* of Dr. R. Brown. There are many cultivated varieties, as the ten-week, which is an annual, the Brompton, &c., all highly prized for the beauty and fragrance of their flowers.

STŒBE (Linnæus). A genus of undershrubs from the Cape of Good Hope, belonging to *Compositæ*. The species thrive in any light rich soil, and may be propagated by cuttings, but are plants of no great beauty.

STOMAPODA (Latreille). An order of malacostracous podophthalmous *Crustacea*, of small extent but very singular structure, which both, as regards the variations of organisation itself, and the curious analogies clearly exhibited with other and distant tribes of animals, renders this a very interesting group. The branchiæ are not affixed at the sides of the thorax, and placed in a particular cavity prepared for them, as in the crabs and lobsters, but where there exists particular organs of respiration, they are found under the form of membranous ciliæ, attached to the sub-abdominal appendages. These animals have the teguments slender and transparent, and not of that firm consistence which is found in the lobster. The carapax or shell is often divided into two parts, one bearing the eyes and antennæ, the other the appendages of the mouth and the thoracic legs; in other groups it is formed of a single piece, and exposes a certain number of the terminal thoracic segments; the abdomen is in general very much developed, and always composed of seven joints; the eyes are affixed upon movable footstalks, the internal antennæ are always terminated by two or three filaments, the organs of the mouth are formed nearly as in the *Decapods* (lobsters, &c.), but the foot-jaws have the form of large claw-like legs, those of the second pair (or first pair of leg-like organs) very often much larger than the other legs, and used in prehension; the two legs of the first pair have the same form as the foot-jaws, the others are either filiform and furnished with a lateral appendage or rudimental; each of the five basal abdominal segments is provided with a pair of false swimming-legs, like those of the *Macrura*, the sixth segment having on each side an appendage terminated by two plates, forming, with the seventh abdominal segment, an apparatus for swimming.

These crustacea are essentially marine, and die as soon as they are taken out of the water; they are generally natives of tropical seas, not extending beyond the temperate zones. Their economy is not yet ascertained, but it is evident that those which are provided with claws (*Squilla*) employ them in seizing their prey, in the same manner as the orthopterous insects forming the genus *Mantis*. These species generally frequent very deep water, but others, destitute of swimming apparatus, and the body very broad and slender, are generally found at the surface of the ocean, where they float about with very little individual motion.

There are two sections, or rather families, in this order, named *Unipeltata* and *Bipeltata*, having respectively for their types the genera *Squilla* and *Phyllosoma* (which see).

STOMOXYS (Geoffroy). A genus of dipterous insects, generally placed in the family *Conopidæ*, but more properly in that of *Muscidæ*, having the pro-

boscis porrected, elbowed near the base, and very slender, its point being advanced in repose as well as in action; the antennæ obtuse at the tips, with a terminal seta, hairy above; abdomen four-jointed, with the balancers covered by a double alulet. These are small flies which frequent the windows of our apartments in damp summer or autumn weather, greatly resembling the common house-fly, but being of a rather broader shape, and at once distinguished by the porrected proboscis, with which they inflict severe wounds, especially upon our legs, which they seem to prefer, their proboscis penetrating through our clothes without difficulty. They are also found in the fields or woods; and from the circumstance of their being most abundant in autumn, it has been a common saying amongst persons not aware of the difference of species, that the house-flies sting in the autumn. The type of the genus (of which there are several species), is the *Conops calcitrans* of Linnæus. Other species are named, *St. stimulans*, *irritans*, and *pungens*, from their irritating powers.

STRATIOMIDÆ (Leach). A family of dipterous insects, belonging to the division *Brachocera*, Macquart (see Diptera), having the antennæ apparently three-jointed; but the third joint, on examination, is found to consist, exclusive of the terminal style or bristle, of five articulations; this style or bristle is found in nearly all the species. The wings are laid upon each other in a horizontal position when at rest, with a small central cell from which several indistinct nerves radiate to the posterior margin of the wing; the scutellum is often spined, the legs simple, and the rostrum small. These are generally inactive flies, found in damp situations, but occasionally handsomely variegated in their colours. The genera are *Stratiomys*, *Odontomyia*, *Ephippium*, *Oxycera*, *Nemotelus*, *Chrysochlora*, *Sargus*, and *Pachygaster* (*Vappo*, Latreille), together with several others recently described by M. Macquart in the Suites à Buffon. The typical genus *Stratiomys* is distinguished by having the antennæ much longer than the head, the basal joint long, and the terminal joints forming a fusiform mass; the front of the head is not produced into a rostrum, the antennæ inserted on the forehead, and the scutellum spined.

Figures representing the transformations of Stratiomy's *Chamæleon* will be found in the article Insect (vol. ii., p. 840, figs. 38, 39, 40), fig. 38 representing the larva, in which the three terminal segments of the body are much elongated and very slender, and terminated by a considerable number of feathered filaments arranged in a star. The head is small, oblong, and scaly, with a number of minute curved hooks and other instruments, which serve to create a disturbance in the water in which these larvæ reside. Respiration is effected in this larva by rising to the surface of the water head downwards, its star-like apparatus at the extremity of the body being extended to the surface, and having the effect of repelling the fluid. In this manner the insect remains suspended for a certain time, an orifice situated at the base of the filaments giving passage to the entrance of the air; but when it is desirous of descending it has the power of bringing the extremity of these filaments together, enclosing at the same time a bubble of air which it carries down to the bottom for its future use, and which appears like a globule of liquid silver. This larva does not shed its skin, but the pupa state is assumed within this covering, which becomes hard and rigid, the tail often, but accidentally, being at an angle with the rest of the body. They now float on the surface of the water, the pupa occupying one extremity of the old envelope, out of which the perfect insect makes its escape by making a slit at the second segment; it then stations itself for a short time on its old case, its body hardens, and it attains a full perfection. There are six British species of this genus.

The characters and habits of the *Sargus* are given in the article upon that genus; the other genera do not present any characters of interest suited for a work like the present. The British species of this family are described by Mr. Duncan in a recent number of the Magazine of Zoology and Botany.

STRATIOTIS (Linnæus). A genus of only one species, viz., *S. aliodes*, a native of Britain, found in ditches. It belongs to the natural aquatic order *Hydrocharidaceæ*.

STRAVADIUM (Jussieu). A genus of tropical ornamental trees, named *Eugenia* by Linnæus, and *Barringtonia* by Roxburgh. They are natives of Malaya; the flowers are monadelphous, and belong to the natural order *Myrtaceæ*. Our imported plants thrive in rich loam and moor-earth, and are propagated by cuttings.

STRELITZIA (Hort. Kewensis). A fine genus of herbaceous perennials, natives of South Africa, belonging to the natural order *Musaceæ*. The *S. augusta* is a favourite stove plant, and also flowers in the greenhouse with good management. It is increased by suckers, and sometimes by seeds.

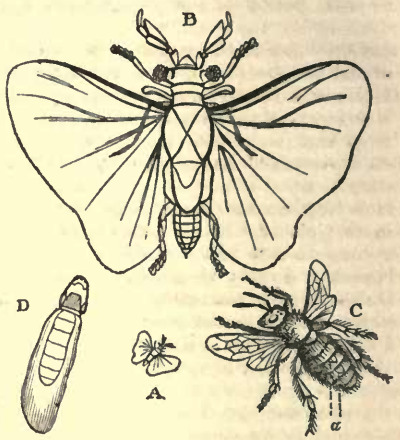
STREPSIPTERA (Kirby; Rhipiptera, Latreille; Rhipidoptera, Lamarck). An order of winged insects established by Mr. Kirby for the reception of a few insects of the most singular form and remarkable habits. The name of the order is derived from the Greek, and is in allusion to curious appendages of small size which at first were regarded as attached to the fore legs, and consequently as these legs are prothoracic, and true fore wings are mesothoracic, it was considered by Latreille that the former could not be analogous to wings, and accordingly that Mr. Kirby's name of the order was inappropriate, in lieu of which the name *Rhipiptera* was proposed in allusion to the fan-like form of the real wings, which are very large; in shape like the quadrant of a circle, and furnished with a few longitudinal nerves arranged like the ribs of a fan. Subsequent discoveries have, however, proved that the small twisted organs are in reality mesothoracic, and consequently as truly representations of the fore wings of butterflies, &c., as the elytra of beetles; in some of which latter (*Atractocerus*, *Sitarus*, &c.), these organs are nearly as much reduced in size as the pseudelytra of the *Strepsiptera*. The head of these insects is transverse with large exposed eyes placed on footstalks, divided into a small number of facets; the mouth is of a singular character, there being scarcely any appearance of aperture; there are also two slender and pointed organs inserted widely apart, but crossing each other, and a pair of large two-jointed palpi; the antennæ are very extraordinary in their forms, being generally furnished with an internal branch nearly as long as the antenna itself; the prothorax and mesothorax are very short, forming only two narrow rings, to each of which on the underside a pair of legs is attached; the mesothorax is very greatly developed and divided by several oblique sutures; the legs are

short, slender, and compressed, with the tarsi furnished with fleshy cushions, but destitute of claws; the two anterior pair of legs are close together, and the posterior pair very far behind. The abdomen is small and scarcely coriaceous; it is cylindric, eight or nine-jointed, and furnished with a recurved point.

These insects are of small size, and in the larva state they are parasitic in the bodies of various species of wild bees (*Andrenidæ*), and wasps (*Vespidæ*). The order was first detected by Rossi, an Italian entomologist, who discovered its habits, and formed a genus for the reception of the species which he discovered (*Xenos vesparum*, Rossi; *Xenos Rossii*, Kirby), but he regarded it as belonging to the order *Hymenoptera*. Mr. Kirby having discovered another species belonging to the same group, but to a distinct genus in this country, and having received another species from Professor Peck of America, investigated the subject very minutely, and detailed the characters of the order and its genera in an elaborate Memoir published in the Linnæan Transactions. The following is Mr. Kirby's account of his discovery of the English species, and as it is illustrative of the habits of the insect, we shall quote it at length. Having observed upon various species of *Andrena* "something that I took to be a kind of acarus, which appeared to be immoveably fixed just at the inosculations of the dorsal segments of the abdomen, and at length finding three or four upon a specimen of *Melitta* (*Andrena*) *nigroænea*, I determined not to lose the opportunity of taking one off to examine and describe; but what was my astonishment, when upon my attempting to disengage it with a pin, I drew forth from the body of the bee a white fleshy larva a quarter of an inch in length, the head of which I had mistaken for an acarus! After I had examined one specimen, I attempted to extract a second, and the reader may imagine how greatly my astonishment was increased, when, after I had drawn it out but a little way, I saw its skin burst, and a head as black as ink, with large staring eyes and antennæ consisting of two branches, break forth and move itself briskly from side to side. It looked like a little imp of darkness just emerged from the infernal regions. My eagerness to set free from its confinement this extraordinary animal may be easily conjectured. Indeed, I was impatient to become better acquainted with so singular a creature. When it was completely disengaged, and I had secured it from making its escape, I set myself to examine it as accurately as possible, and I found, after careful enquiry, that I had got a nondescript, whose very class [order] seemed dubious." Monograph. Apum Angl. ii., 113.

Mr. Dale, who has been very successful in the discovery of insects of this order, communicated the following observations to Mr. Curtis, by whom they were published in the British Entomology, fol. 226, together with a beautiful illustration of *Stylops Dalii* (fig. A, natural size; B, magnified; C, the andrena with the heads of two of the larvæ exposed between the segments of the abdomen; D, larva extracted and magnified), a species named after the gentleman above mentioned, and whose remarks are as follows:—

"Every specimen of *Andrena barbilabris*, I have seen this year [1828?], from the 27th April to the 4th June, have contained larvæ, pupæ, or exuviæ of *Stylops*, from one to three in each. On the 5th May, I picked out one with a pin; on the 7th another rather immature, and caught one flying in the hot sunshine over a quickset hedge in the garden; it looked milk white on the wing, with a jet black body, and totally unlike any thing else; it flew with an undulating or vacillating motion amongst the young shoots, and I could not catch it till it settled on one,



when it ran up and down, its wings in motion and making a considerable buzz or hum nearly as loud as a *Sesia;* it twisted about its rather long tail, and turned it up like a *Staphylinus*. I put it under a glass and placed it in the sun; it became quite furious in its confinement, and never ceased running about for two hours. The elytra or processes were kept in quick vibration as well as the wings; it buzzed against the sides of the glass with its head touching it, and tumbled about on its back. By putting two bees (*Andrena labialis*) under a glass in the sun, two *Stylops* were produced; the bees seemed uneasy and went up towards them, but evidently with caution as if to fight, and moving their antennæ towards them retreated. I once thought the bee attempted to seize it; but the oddest thing was to see the *Stylops* get on the body of the bee and ride about, the latter using every effort to throw his rider. A large hole is left in the tail of the bee where the *Stylops* escapes, which closes up after a time. I have found five species of *Andrenæ* infested. When off the bee the *Stylops* kept its wings still and half erect."

From the recorded observations of Jurine, it is evident that the pupa state of these insects corresponds with that of many *Diptera* in being coarctate, that is, enclosed in the skin of the larva; it also appears probable that it is not until the larva is full-grown, that it protrudes its head out of the body and between the abdominal rings of the bee; but there are still many questions relative to the natural history of these singular creatures, which still remain unascertained. Some curious speculations naturally arise from the remarkable fact observed by Mr. Pickering, of which the details are published in the last part of the Transactions of the Entomological Society, and by whom an *Andrena* was found in the winged state in its cell under ground at the end of the month of December (which had evidently only recently quitted the pupa state), and from the abdomen of which he extracted a perfect species of *Stylops* (*S. Spencii*), as well as a specimen of the larva. The following queries are suggested by Mr. Pickering as embracing

points in the economy of the *Strepsiptera*, respecting which information or confirmation is required.

1. What are the sexual distinctions in these insects?

2. In what manner and at what period of the year does the fecundation of the female take place?

3. At what period of the year are the eggs deposited?

4. Are they deposited separately in the cell of the wasp or bee, or are they laid in the eggs of those insects, or within the larva, pupa, or perfect insect?

5. How long do they remain unhatched, and do they lie in that state until the larva of the insect attacked has attained its full-growth, or assumed the pupa state?

6. How long do the larvæ of the *Strepsiptera* remain in that state? Do they cast their skins? In what manner do they feed?

7. How long do they remain in the pupa state?

8. Do these parasites render abortive the female *Hymenoptera*, in the bodies of which they are reared?

9. Do the sexes appear simultaneously?

10. Do the perfect *Strepsiptera* take any nourishment?

11. Of what use are those acute organs, termed mandibles and the two-jointed palpi?

12. What genera of bees are attacked in this country?

This order consists at present of only four genera, but it is not at all improbable, that when the minute insects of other countries have been carefully collected, others equally interesting will be discovered; indeed, North America and the island of Mauritius have already furnished species of the order.

The genus *Xenos* is distinguished by having both the branches of the antennæ inarticulate. It comprises two species, one found in Europe infesting the body of the *Polistes Gallica* (one of the social wasps), and the other *Xenos Peckii* above noticed.

In the genus *Stylops* the outer branch of the antennæ is flattened and tri-articulate. This genus comprises several British species, and appears confined to the genus *Andrena*.

The genus *Elenchus* has the antennæ similarly jointed, but very long and slender, and the eyes scarcely pedunculated. Type *Stylops tenuicornis* of Kirby. *Elenchus Templetonii Westro.* was discovered at the Mauritius by Mr. Templeton.

The genus *Halictophagus*, so named from being *supposed* to be parasitic upon the genus of bees *Halictus*, has the antennæ internally furnished with four branches. A single individual of *H. Curtisii* was taken by Mr. Dale near Lulworth Cove, Dorsetshire, by brushing long coarse grass and thistles into a net.

STREPSILAS—Turnstone. A very interesting genus of shore birds, belonging to the longirostral family of Cuvier's *Echassiers*. They have a habit different from that of any other birds which are met with on the shores, numerous and varied as the inhabitants and visitants of them are. In the arrangement of Linnæus they were classed along with various other birds in the genus *Tringa* (see TRINGA); but they have very properly been made a distinct genus by more recent naturalists.

The generic characters are: the bill of mean length, in the form of a lengthened cone, bent at the point, straight in the greater part of its length, but very slightly turned up at the point; very strong, with the crest flattened, and the point truncated; the nostrils lateral, pierced longitudinally near the base of the bill, and half closed by a membrane; the feet of mean length, naked a little way above the tarsal joints, with three toes to the front and one to the rear, the front ones united at their bases by a very short membrane, and the hind one articulated upon the tarsus higher up than the others; the wings pointed, the first quill being the longest.

The principal habit of these birds which distinguishes them from all their neighbours on the beaches, is that after which they are named, and which is a very expressive one, for they literally turn over stones, when the tide is back, for the sake of the small animals that lurk under them. But they are not confined to the turning over of stones, but turn sea-sand, and all other substances below which the small animals of the beach hide themselves, if their strength is able to perform the task. They do not bore in the sludge as is the case with the longer and more flexible-billed members of the family, neither does it appear that they range the beaches to fish up little animals that are at large upon the surface, as is done by the *Tringas* and some of the others, with which the turnstones were formerly associated in the same genus. They "stick to their vocation," and although their labour appears to be more severe than that of many of their neighbours, they are specially adapted for it, and so they perform it. They are one of the most striking instances we have of the endless resources which are displayed in the animal kingdom, accomplished too by very simple means. There is nothing strikingly remarkable in the bill of the turnstone. It is a slant bill, without being in the least heavy or loaded; it is strongly set on the rounded outline of the head; the point is very hard, and the basal point a little flexible; and it has a bend upwards, so slight that it is just barely perceptible. All these little circumstances, which one who knew nothing of the habits of the bird, would be apt to pass over as indicating little or nothing, appear, however, to produce the very best form of a bill for turning over the pebbles on the beach, and seizing whatever may be disclosed by the operation. We say that this is the best form of a bill for the labour for which it is intended, and we may say so with the utmost confidence, because it is the one which Nature has made for the purpose, and it is unique, as there is only one species of turnstone. We are therefore constrained to admit that this must be the very best form of an instrument for turning stones; that is, the one that can accomplish the work with the least exertion of muscular energy; and, therefore, if we could fully understand the mechanism and the working of this bill, we should have a solution of a problem of no small practical utility in some of the mechanical arts.

As we have said, there is only one known species of turnstone, and this one is scattered over the shores of very many parts of the world, but not in great numbers any where, and only on particular spots. The dry shingle where the turnstones have their nests, and also the oozy and sludgy places where the pebbles are partially imbedded in the mud, are avoided by the turnstone, a beach where the ground equally has some consistency, but not such as to remain very wet, with little stones scattered about, is what this bird chooses; and as it does not invade the pasture of any other bird, so there is not any that invades its pasture, even although other birds

should feed within a very short distance of it. There are few birds so widely and so thinly scattered as the turnstones, and few that preserve nearly the same identical appearance and character in all the localities in which they are found. The raven is almost the only other one which is so perfectly a cosmopolite, and the same and equally at home in every part of the world in which it is found. It is also a very ranging bird, and perhaps there is hardly a locality in which it is resident the whole year round, nor are there any where it makes its appearance as a mere straggler at a distance from the ground for which it is best adapted.

The collared Turnstone (*S. collaris*) is the only known species of this bird, though on account of the difference between the plumage of the old and the young, and also of the seasonal changes, that one has been sometimes described as two. It is a bird of about eight inches and a half or nine inches in length, with the tail rather short and a little rounded, and the points of the wings when closed reaching beyond it. In its plumage it is rather a handsome bird; the upper parts are bright maroon-red, irregularly clouded over with huge black spots; the top of the head is reddish-white, streaked with black; the forehead, cheeks, a large collar, part of the back, the middle of the breast, and the under parts are pure white; a black band passes over the front before the eyes, and divides into two parts, one of which extends to the gape and the other down the side of the neck, becoming broader as it descends, and forming a large gorget on the lower neck and breast; there is a large band of brown on the rump; the external margins of the tail are white; the feet yellowish-orange, and the bill black. The colours of the female are nearly the same in their distribution, but they are paler in the tint. The young of the first year are very differently marked, being without even a trace of black or red; the upper parts are dark brown, with margins of pale yellowish to the feathers; the head and neck are dull ash-colour, streaked with black; the sides of the head and neck grey, mottled with white; the throat and foreneck whitish; the sides of the breasts brown, with white margins to the feathers; and the rest of the under part white, with the exception of a broad band of brown on the vent-feathers; the bill is blackish, and the feet are reddish-yellow. The full plumage of maturity is not acquired till the birds are two years old; and those of a year old are also different from the young; they have the collar and breast-plate blackish, with white margins to the feathers; the cheeks whitish, dotted with black; the top of the head deep brown, with black spots; and the back mottled with black, and reddish; there is also a large white spot upon each side of the tail.

One need not wonder that a bird which varies so much in its plumage, should have its history a little confused; and the confusion is evinced by the fact that the movements of it at the different seasons, even (regarding it as a British bird) are very imperfectly understood. In places near the south it appears only in the winter; but it departs later and comes earlier than many of our migrant birds; so that it is not absent above two or three of the very hottest months of the year. That the birds which remain till the summer has begun are the same individuals that return before it closes is not very likely; but still, the lingering delay and the early visiting are so unlike what happens in most birds, that they render it probable that some of the turnstones at least may breed in the country, although in what part of it is not known. In the northern islands it is still more puzzling; for a few stragglers remain there all the summer through, and yet the nest has not been found there. They breed on the rocky islands which are so numerous on the coast of Norway; and probably as far to the north as there is a trench clear of ice to be found. They are birds of excellent wing, and powerful muscles, and thus they are capable of making a long journey in a single flight; but what their actual rate and style of migratory motion, in the distances to which they actually migrate, are, we have no means of ascertaining. They appear in little troops, but the migrations appear to be performed in pairs; and when even hundreds migrate in this manner, they are not readily observed. From their limited numbers, and the late period to which they remain, and the early one at which they again appear, it is by no means improbable that some of them breed on the wilds, near those shores upon which they are seen at so short a time both before and after the breeding season. That their nests have not been met with is no conclusive evidence against their being there; for there are parallel cases in the dotterels and some of the snipes; the former of which must breed in thousands upon some parts of our wild uplands; and yet a single one is rarely seen on the breeding ground, or during the breeding season. But their history wants a good deal of investigation before we can speak positively concerning it.

North America is a country far better adapted to the habits of the turnstone than any part of Europe; and accordingly the bird is much more common there than it is with us. It is more of a regular migrant in America than in Europe; and there are facilities for this in the situation of the country. A bird can pass between the extreme north and the tropical regions upon a line of almost unbroken beach, the greater part of which abounds in rich pastures for those birds. Thus the turnstone can proceed by very easy stages, feeding as it proceeds, and not requiring to be stationary at any time, except the breeding season. They winter in the southern parts, visit the middle states in April, and remain there two months, and then remove farther to the north where they breed, returning to the middle states about October, and leaving them for the south when the cold weather sets in. The movements of the turnstone on the American coasts are thus very easily traced; but they depend of course upon the character of the seasons there, which are not the same as the seasons in Europe. In other respects there is, however, but little difference between the birds in the two continents, in size, in colour, or in any other respect. They are subject to the same changes with age and with the seasons, and similar in all parts of their economy. The situation of the nest is not fully ascertained, as it has not been often enough seen for that purpose. The eggs are said to be placed in a very rude nest on the ground, to be in general four in number, olive in the ground, with brown spots. It is probable that they vary in colour, which is often the case with the eggs of birds that are subject to variations.

When the turnstones fly, they utter a querulous sort of twittering note. They also often run about with the wings half opened, and serving as balances to the body; but they do not run so swiftly as the

tringas, and some other birds of the family which find their food by ranging about over the surface, and not by turning over the pebbles. These birds are in motion on their feet for the greater part of their time, and do not readily take the wing. The turnstones again will often remain at the same spot for a considerable time, stirring about the small pebbles with the greatest assiduity. When they shift their ground from one stony patch to another, they generally use the wing; and thus they are more ready to take the wing in case of alarm, than most of their neighbours.

STREPTOPUS (Michaux). A genus of very pretty herbaceous perennials, natives of Europe and North America. The flowers are hexandrous, and the plants belong to *Smilaceæ*. The species affect a light sandy soil, and are increased by division of the root, or by seeds.

STROPHANTHUS (De Candolle). A genus of curious evergreen shrubs, natives of China and Sierra Leone. The flowers are pentandrous, and the genus belongs to *Apocyneæ*. These plants do well with the ordinary stove management.

STRUMARIA (Jacquin). A genus of Cape bulbous plants, belonging to *Amaryllideæ*. These bulbs require to be planted in light sandy heath mould, and watered only when growing.

STRUTHIOLA (Linnæus). A genus of slender growing shrubs, natives of the Cape of Good Hope. The flowers are tetrandrous, and the genus belongs to *Thymeleæ*. The different species do well in the greenhouse, affect light peat-earthy soil, and are propagated by cuttings.

STRYCHNEÆ. A small but remarkable natural order of tropical trees, containing three genera, viz., *Theophrasta*, *Strychnos*, and *Fragræa*. They are allied to *Apocyneæ*, and several of them are frightfully poisonous. The *S. nux vomica*, or ratsbane, is well known; it is not only fatal if introduced into the stomach, but equally so if injected into an open wound. The inflorescence of the order is terminal, solitary or aggregate, racemose or paniculate, the flowers regular, symmetrical, and united; the calyx is free, persistent, and five-cleft; the corolla below the germen, deciduous, five-cleft, and often with appendages in the throat, and contorted; the stamens are definite, five, rarely more or less, and seated on the corolla, alternating, with its segments equal to them in number, and opposite the lobes of the calyx; the filaments are mostly free in one subtype the *Apocynidæ*, and mostly connate in the *Stapelidæ*; anthers two-celled, pollen granulate, the styles two, and stigma simple. The species of the several genera in our collections, especially the *Theophrastas*, are fine showy plants, and succeed well with the ordinary stove treatment. Cuttings not divested of their leaves strike root readily in sand.

STUARTIA (Cavanille). A deciduous tree, native of Virginia, bearing handsome monadelphous flowers, and belonging to *Ternstræmiaceæ*. This plant is frequent in shrubberies, and is increased by layers in peat-earth.

STYLIDEÆ. A natural order, containing as yet only one genus, viz., *Stylidium*, a native of New Holland, of which there are several species, either herbs or half shrubby plants. "They have pink-coloured flowers, ornamented with glittering glands; their stamens are united in a column, which is terminated by a sessile stigma, and which is irritable in so high a degree, that if touched by a pin, it instantly starts from its place with great elasticity." They are propagated by seeds or cuttings, and require a moor-earthy soil. The leaves are alternate, simple, and entire, and without stipules; the inflorescence is terminal, and either solitary, spicate, or racemose; the tube of the calyx is attached to the germen, three-parted, bilobiate or regular, and persistent; the corolla is synpetalous, with the limb variously cleft; the stamens are two filaments united with the style; the anthers one or two celled; the style in one with the filaments, and the stigma, which is simple or bifid, is enclosed by the anthers.

STYLOPS (Kirby). See STREPSIPTERA.

STYLOSANTHES (Swartz). A genus of herbs and under shrubs, natives of South America, having monadelphous flowers, and belonging to *Leguminosæ*. The species require a light loamy soil, and are propagated by cuttings.

STYPHELIA (Dr. R. Brown). A genus of evergreen shrubs from New South Wales, belonging to *Epacrideæ*. They are favourite greenhouse plants, and succeed with the ordinary treatment of plants from the same quarter.

STYPTANDRA (Dr. R. Brown). A genus of herbaceous perennials, natives of New Holland, belonging to the sixth class of Linnæan botany, and to the natural order *Asphodelieæ*. These plants are nearly hardy enough to bear our winter if planted in a warm border, and allowed a little covering in hard frosts.

STYRACINEÆ. A natural order containing only two, but rather remarkable genera, viz., *Styrax* and *Halesia*. The species, of which there are seven, are elegant trees with white flowers, natives of North America. The *S. officinale* affords the useful gum imported into this country from Turkey; and in this country the *Styrax* arrives at a tree-like size, and is one of the most odoriferous of plants, especially after rain. The *Halesia* is the well-known snowdrop-tree, a hardy inmate of our shrubberies. They are increased by layers.

SUNDEW, is *Drosera rotundifolia* of Linnæus, a British plant found in bogs. The flowers are pentandrous, and the genus gives a title to a natural order, namely, *Droseraceæ*.

SUS—The hog, or rather perhaps *Suidæ*, the hog family. A genus or group of pachydermatous mammalia, differing much, in most of their characters, from all the rest of that very singular class; they have cloven feet, or only two fully developed toes, the same as the greater part of the ruminating animals, and they are the only pachydermata that are miscellaneous in their feeding, the others being exclusively vegetable, and subsisting chiefly upon strong and harsh vegetation, though most of them prefer more delicate food if they can obtain it. The hogs are also chiefly vegetable in their feeding, but they prefer succulent vegetables, especially wild fruits and roots, though, when other food fails, they can subsist upon almost any kind of garbage.

The common characters of the group, which are, of course, most descriptive of the hogs properly so called, as being the typical and by far the most important division, are as follows:—Four or six cutting teeth in the upper jaw, and always six in the under; two canines in each jaw, and twenty-four or twenty-eight cheek teeth in all; the lower incisors are pointed obliquely upward and forward, and the upper ones are conical, so that this part of the mouth is

better adapted for tearing than for cutting; the cheek teeth are different in their character, none of them are grinders, but the ones toward the front are partially trenchant, and those toward the rear are more tuberculous; the canines, which are large in the males only, continue growing during the whole life of the animal, but they can scarcely be in any way regarded as feeding instruments; they grow outwards and upwards, and in the old animals, in which they acquire much size and strength, they curve backwards at the points, and are very formidable weapons, both on account of their uneven size and form, and of the force and determination with which the animal can use them; the muzzle is lengthened into a snout, which has a slight cartilaginous enlargement at the end, is supported by a peculiar bone, capable of some motion, and very abundantly supplied with nerves, so that it is among the most essential parts of the body. The toes are four, of which the two middle ones only are sufficiently developed for being the common points of support to the body in walking, but the other two are more developed than the corresponding ones of the ruminating animals, and are furnished with small and pointed hoofs. The two principal toes have some lateral motion, and can be brought together or separated, and where they are far separated from each other the two small ones come in contact with the ground, and the plant of the foot is considerably enlarged. This structure of the foot is, as we shall see, very well adapted to the surfaces upon which the animals range when in a state of nature. The females have twelve mammæ, some pectoral and some ventral, and the litters of young are numerous. The skin is thick, but soft and pliable, capable of much extension, but not constricting so tightly as that of many other mammalia. The covering consists of stiff bristles, each of which is formed of several small filaments firmly soldered together, except at the points, where they are often separated. Below this there is sometimes a sort of coarse woolly hair; but both parts of the covering vary much with the climate, and in the domesticated ones with the kind, some being very smooth in the coat, and others almost naked. They have a tendency to accumulate under the skin a great quantity of fat, which is popularly called lard, and is something intermediate between the fat of other mammalia and the blubber of the *Cetacea*. In very hot countries this fat does not accumulate in such quantity as in colder climates, and very cold latitudes are not favourable to the animals.

They occur in both continents; but the American ones are so different from those of the eastern continent that they require to be separated as a distinct subgenus. They are of a much smaller size than the eastern ones, but less useful to man, and more limited in their distribution, being met with only in the humid woods of the central parts of South America, to the eastward of the Andes; but in some parts of these woods they are very numerous. In all places of the world they are partial to humid places, fond of wallowing in the mire, and of basking in the sun near the margins of pools and streams.

In the eastern continent they are far more widely distributed than in America; but always more abundant in the damp forests of tropical countries than in higher latitudes. In Europe they occur in a wild state, only in a few of the more wooded parts of the centre and the south; but they once appear to have been much more general. For many years there have been no wild hogs in any part of Britain, but there are many traditional accounts of their former abundance. In the forests of south-eastern Asia, and the rich parts of Africa, they are more plentiful; and they are distributed to many remote isles in the Pacific. In many places, however, it is much more difficult to distinguish between wood hogs which are natives and *aborigines*, and those that have been introduced by the people, and have been turned loose in the woods and multiplied there, than it is in the case of many other animals. Yet in the case of others there are instances in which we should be very apt to regard introduced animals not only as aboriginal natives, but as the most truly natural and characteristic of the country of any animals that are to be met with there. This is remarkably the case with the ox and the horse on the rude plains of South America. We know well from the history that there was not a vestige of any animal resembling them previous to their introduction from Europe; and yet they now literally swarm, as if that were the place of all the globe most favourable to them. It may be the case with the wild hogs of New Guinea and the Pacific Isles farther to the east; and this appears the more likely from the fact that they are not found except on islands, the shores of which at least are peopled by a race appearing to be of the same climatal variety of mankind as the Malays. Indeed the tame hogs of the east of Asia appear to be from a different variety of wild ones from that of which the remnant is still to be met with in the forests of Europe.

Hogs in a wild state are much more numerous and widely distributed than either oxen or sheep; but it is not on this account the less difficult to trace the parentage of the tame ones, or fix with any thing like certainty the locality of any, or at least all, of those that are found wild. From the fact of the hog being possessed by many races of rude men, who have neither the ox nor the sheep, it is very probable that it was the first animal that man domesticated, and probably the first that he killed in the wild forests. The hog is much more an animal of the tangled woods than any other of those which are, on account of their size, valuable as animals of the chase. From the concealed situations in which they are found, and their habits of basking in the little openings of the woods, they are more easily approached within the range of an arrow, a javelin, or even a club or other manual weapons, than animals which range in the open places, and set a watch when they feed. They are also much slower in their movements, and retreat to shorter distances, making more noise and bustle in their retreat; and thus they are more easily followed. The rate at which they breed also conspires to render them very capable of keeping up their numbers with a large surplus in those woods where fallen fruits at one time of the year, and albuminous roots at another, furnish them with an ample and constant supply of food. It is certain that, in former times, very much of the western parts of the eastern continent was covered with thick, damp, and productive woods, much more so than at the present time. Various kinds of oak, beech, chestnut, and other trees, abounding with farinaceous and oily fruits, all of them rich, and many of them readily eaten by the rude people of former times, rendered, and where the deciduous forests remain still render,

the fall in the forest a most abundant time for the wild hogs. Then in the clumps, by the margins of the pools and the banks of the tangling and intercepted streams, there were many succulent roots; and these roots must have furnished a supply both where the autumnal produce was exhausted, and during the heat of the summer. In all places where the people inhabited the woods, and there were wild hogs in them, these hogs very naturally presented themselves as an abundant and easily acquired article of food.

Canning's keenly satirical account of the origin of cruelty is thus, in all probability, something more than the mere production of poetic fancy. Man, in a state of perfect innocence, and with hands all-unstained by the blood of a single living creature, ranged the wild woods, contending with monkeys and maccaws for "fruits in their seasons," and with the wild hogs for fern and other roots, when no fruit was to be found. Whether the rivalship occasioned any jealousy of the hog, and beech mast had any influence in making man more cruel and carnivorous is not said, though it is not impossible, and would add to the truth of the application and the force of the moral. But upon one day of more than ordinary desire, man eyed with complacence the sleek rotundity of a fat hog; and the longer that he gazed, the more ardent waxed his desire of making a mess of the unsuspecting animal. Invention, for Canning did not call in the aid of the devil to bear the burden of the crime, if crime it was, set about to find means of making a meal of the hog. The bow was made and strung, the arrow was pointed; the bow was bent, the arrow set on the string—and,

> "He twangs the bow, the hissing arrow flies,
> And darkness seals the gentle porker's eyes."

Once tasting the luscious flesh of the hog, man could no longer be contented with the beech mast and the acorns, but soon began to "kill and eat" the whole of living Nature around him. Nor was he content till he had numbered the flesh of his own race among the dainties of his board. As he became more refined, the disposition to eat his fellow men became weaker; but the killing propensity has continued, and the slaughter of mankind, so that it is carried on upon a scale of sufficient grandeur, is above all others the work for which man is especially "covered with glory."

Such, in part at least, is the outline of the fable. In so far as man is concerned, we leave the propriety of the application to the judgment of the reader; but there seems every reason to believe that the hog was the first animal of any size, inhabiting the land, which formed a regular portion of the food of the human race in a state of nature.

The hogs are conveniently divided into two subgenera, those of the eastern continent. The first are the true hogs, or members of the genus *Sus;* and the second are the peccaries, or members of the genus *Dicotylus*. We shall briefly notice both of them in their order.

Sus. The true hogs have six incisive teeth in each of the jaws, the canines in the male long, and projecting out of the mouth, and the cheek-teeth twenty-four or twenty-eight, the anterior compressed, and the posteriors with tuberculated crowns. None of the cheek-teeth have the bone and the enamel alternating with each other, so as to form a grinding surface, as in the ruminantia, and in those pachydermata that are exclusively herbivorous. They have but one case of bone, with the enamel placed upon it as it is in human teeth. The jaws have no lateral or grinding motion; they merely open and shut, and the food is divided by different strokes of the jaws against each other. In consequence of this, hogs are very clumsy feeders, and scatter their food about. Their mouths are not well adapted for eating any more than they are for grinding; and thus, when their food is in large masses, they hash and mangle at it in a very rude way. If it is tough, they use the fore foot for holding on, while they seize with the teeth, and tear it asunder by an upward jerk of the head. The structure of the head, and the great depth and strength of the neck, fit them well for the performance of this kind of labour, which is, in fact, partly the same as that which they have to perform when they root up the ground in quest of the vegetable stores that are below the surface. The hind toes and their hoofs are well developed, and contribute much to bearing the animals up when they range the soft and marshy grounds in quest of the roots of plants.

It appears somewhat singular that the flesh of the hog was prohibited in the ceremonial of the Jewish law, which, borrowing from the Jews of course, as much of the koran is borrowed, has been adopted by the Mahommedans. It does not appear, however, that this part of the law was at any time very rigidly observed, especially in the later period of the history of the Jews as a nation; for we find swine and swineherds often mentioned in the historical parts of the New Testament as subjects of familiar illustration. This matter, however, being wholly of a ceremonial nature, and without any reason that we can assign, can make no part of the useful history of the animal. We shall, therefore, proceed to a very brief notice of the species. Of these there are three, besides some apparent varieties, and innumerable varieties or differences of breed among the domestic ones. Of one species we have already given a short account in the article Babyroussa, in this work, to which the reader is referred; and we have also given an account of another, which is sometimes considered as only a species of this subgenus, in the article Phascochævus, to which also we refer, and confine the present notice to the remaining ones.

The Wild Hog, or *Wild Boar* (*S. scrofa*). This is generally regarded as the parent stock of all the tame breeds in Europe, the north of Africa and Asia, except the extreme east, and that it is the same species with them hardly admits of a doubt, though there are climatal differences of the wild one, just as there are still greater differences in the domesticated, arising from the influence of climate and treatment jointly. But these very circumstances show the flexibility of the animal, and, consequently, that it can be introduced with advantage into almost any climate that mankind can inhabit; and the many and variable kinds of foods upon which it can subsist render it still more pliable in domestication, and therefore more valuable.

The wild hog is all over of a blackish-brown colour, sometimes brindled by the brown being redder in one part and blacker in another; and when these differences occur, they are generally in cross stripes, which are not strongly marked, but pass into each other. There are very long and coarse bristles upon the spine for almost its whole length, which are partially erectible when the animal is excited, and have

a formidable appearance. The eyes are very small, but expressive when the animal is tranquil, and they are fiery and glaring when it is irritated; the ears are not nearly so large as they are in many of the domesticated breeds, but they admit of a very considerable degree of motion. They come to what may be considered as their most active size in about five or six years, but they live to the age of almost thirty, and increase in size and in passive strength and daring hardihood of character during the greater part of that time. They, however, become fertile long before they reach their full size, for they are capable of breeding in their second year. The litters of these immature ones are, however, not numerous. In the wild forests of Europe the rutting time is in January or February, and commences, though more rarely, as early as November. Previous to this time, which is the season of abundance with them, as the fruits of the trees are on the ground, they assemble in small herds; but when the rutting time comes on they separate. Though they are monogamous, the males, or boars, which are exceedingly fierce at that season, often fight desperate battles of gallantry; and it is said that the largest and most powerful males fight to obtain the largest females, which, on their part, are also more favourable to the powerful and victorious than to the feeble and vanquished. In this way, the female which no one courts is left for the male which is not able to obtain another in the strife. There is, however, said to be something like a principle of honour in these battles; for, if a female shows a very strong and determined attachment to one particular male, the rest do not forcibly interfere, but allow him to lead her off quietly to the nuptial bower. Something similar to this appears in many other animals, and there appears to be a sort of natural congruity or propriety in it. We have said that the litters of the ones which have not attained their full size are not so numerous as those of the mature age; this is true, whether both parents, or only one, are immature; and in the case of one, it matters not much whether that one is the male or the female. Thus, in the case of an unequal match, there is a waste of the productive energy; and as this energy is the grand result to which all the developments of animals lead, nature takes every means for regulating it with proper economy.

When all the hostile encounters, and other parts of the pairing are settled, which have no inconsiderable resemblance to the pairings of some birds, the whole separate, each pair betaking themselves to the deep cover of a thicket, where they remain about thirty days. The period of gestation is four months, and the litter consists of from four to ten pigs, according to the age and vigour of the parents. When they are produced, the female hides them very carefully from the male, as, if he were to find them, he would eat them up. Indeed, when the season is severe, and provision is not easily obtained, the female does not scruple to eat her own offspring. This sometimes happens in the case of the domestic sow; and Shakspeare mentions, among the fitting subjects that go to the composition of a diabolic mess,

> "Sow that hath her farrow eaten,"

which he of course borrowed from the then popular notions of what subjects were fit for the purposes of witchcraft. That there should be hostility to the young on the part of the boar is rather in accordance with a somewhat common habit among animals; for in those species, whether mammalia or birds, in which the males fight battles of gallantry, they never take any share in providing for the young, always treat them harshly, and not unfrequently kill, if they do not eat them. There is even a shade of the analogy traceable among the human race; and we might, upon very sound physiological principles, assume that such might be the case; for it is to be understood that battles of gallantry among men, whatever name they may get, and whatever aspect they may put on, are in reality animal matters, not intellectual ones; and in the case of mothers, too, it very frequently happens that those who display the warmest animal affections for their children are the most prone to destroy them, both in an intellectual and an economical point of view. There is thus a lesson of practical instruction to ourselves to be drawn from the study of almost any animal to which we can refer; and this we might expect, as the animal is so much mixed up in all that we derive or do with reference to the present world.

If the young are protected, and the mother finds the necessary supply of food in the early stage (for it is in the very early stage that there is danger from her), she becomes a most attentive mother. The period of suckling is of the same length with that of gestation; but the protection of the mother is continued for a long time after this; and no parent can be more bold in the defence of an offspring, and no offspring more attached to a parent.

There is something more curious even than this in the economy of the wild hogs, something very closely resembling the founding of a sort of clan; so that those persons who are fond of tracing what they call sagacity or intelligence in animals may find it here. The litter are not only attached to the mother, but to each other; and this attachment does not cease when they are no longer dependent on the mother's protection, but after another litter has been produced; nay, it is communicated from litter to litter, till the produce of the same mother form a little colony, the members of which appear capable of recognising each other, even after they have been separated for a time from physiological causes. It is possible that most herds of social animals are originally formed on this principle, though the attachment has not been so well observed in most of the others as in these.

But this has a limit, and it is easy to see that it should; because, with the great fertility of the animals, and the small disposition that they have to range far from the same place, they would in no very great length of time become so numerous as that no pasture could maintain them, and thus the free and average operation of the principle of reproduction would in time effect the destruction of the race, the more especially when it is considered that the natural period of life in them is thirty years. But nature is never without a resource, exactly adequate to the necessity that there is for it; and though while we, in the exercise of our limited powers, in general see only one part of the case, and so see it as though it would in the end lead to destruction, yet there is always another power which comes in at its appointed time, and works for preservation. This holds in every case, although many of the greater changes appear to be connected with wide extending ruin.

In the case of the wild hogs, the correcting principle that limits the numbers of the individual herd,

and enables herd to succeed herd, just as generation succeeds generation, is both simple and easily seen. The young do not come to their full growth till the age of five or six, but they begin to breed at two. Till they attain their full growth, the attachment to the parent herd continues; but after this it ceases, and each pair, as they arrive at this stage, go off to found a new colony in a part of the forest which does not interfere with the pasture of that from which they take their departure in order to make room for other races. When the young of the year are so far advanced as that they do not greatly need the protection of the mother, the whole of the herd assemble and feed socially together, until the season again comes round, at which they disperse in pairs. When they are in the herd they are always under the leadership of a male that may be looked upon as the patriarch; though he does not exercise the same kind of sway as the patriarch of a polygamous race. After they have assembled in the herds they are apt to sally forth from the forests, and do no small damage to the cultivated fields, both by rooting up and by trampling down. There is an allusion to this in the beautiful parable of the vine in the eighteenth Psalm: "The boar out of the wood doth waste it, and the wild beast of the field doth devour it." This is finely true to nature, even in the contrast of the mischief done by the two. The wild beast of the field devours—simply eats, but the boar out of the wood wastes—tramples down and destroys.

The leader of the herd is usually at some distance from the rest, but they do not spread far; and as their vision is neither keen nor extends far, they are understood to proceed chiefly by scent; and this is the further necessary that the night is the time at which they commit their depredations. When the herd are attacked, they form in a circle with the weaker ones in the centre, and make a most formidable resistance, standing boldly out to meet the danger. If wounded by a shot, even when surrounded by the dogs, the boar will instantly turn in vengeance upon the hunter.

The hunting of the boar is a favourite field sport, but it is one which is not unattended with danger. The male when living apart affords the most dashing sport. Common sporting dogs will not do; for strength and weight, not swiftness or address, are required; and thus large mastiffs, or crosses between large mastiffs and bull dogs, are employed. When drawn from its course it does not run off, as it would find but little safety in flight. It stalks off with glaring eyes; and if the dogs run in upon it before it is a little winded, it finishes them one by one with a single application of the tusks. Old boars are not quite so formidable as those which have about gained that age at which they separate from the parent flock; and these too happen to be the ones that are most readily found. They can hold out longer, so that the dogs are more fatigued; and the tusks are sharper and straighter, and inflict more deadly wounds. The hunting of the wild boar is, however, a subject which does not directly belong to natural history. Hog-hunting in the woods is a favourite sport in India; but we believe that the wild hog there is not quite so formidable as in more temperate climates. This would lead us to suppose that the proper locality of the animal is not in the very hottest parts of the south; for, even in the islands of the South Sea, which are in point of fertility, and of course of abundance of food, superior to most other regions, the native hog is a smaller animal than the wild boar of the European forests; and it is different in shape and colour—its legs are very short, and it is black; still it does not appear to be any thing more than a climatal variety. There is one other particular connected with the varieties of hogs to which it is worth while to attend. It is this: they seem to be much more easily broken into varieties by mere change of place than most animals; but when once a variety is established in a district, it appears to be more constant.

The domestic hog is an animal of very great importance in an economical point of view; but it is one of which, on account of the almost endless variety of breeds, it is impossible to give a detailed account in a sketch. In a merely natural history point of view this is not necessary, because, in all its characters, generic and specific, it is identical with the wild one. All the varieties that have been tried breed freely with each other, and the progeny is fertile in every race. This is quite enough to prove that the species is only one; and not to show this only, but further to show that varieties without limit may be obtained by crossing and by changing from place to place. Though the same breeds vary greatly in size, none of them is so large, or nearly so powerful an animal as the wild boar; and thus if, in breeding with a view to any of the points that are held as being most valuable, the size and strength should be reduced below what may be considered as the proper standard, crossing with the wild boar will bring them back, though it is said that crosses near the pure blood produce much more vicious animals than the breeds that are removed from it.

In a highly improved state of a country, the hog is certainly not entitled to take precedence either of the ox or the sheep in point of utility, its uses not being so many or so general; but still it is a very useful animal; and there are some states of a country, or at least of particular districts, in which it is more valuable than either of the others. The milk of the hog is not, we believe, used as an article of food in any place, though there is not the least doubt of its being wholesome. It can, however, be much more advantageously applied to the purpose for which nature intended it, as the young are of some value (though not wholesome as a food certainly) at a very early age; and they grow much faster than any domestic animals of nearly equal size.

Upon an arable farm, where hogs are only a subordinate article with the farmer, the estimate is that with two females and one male, managing them so that they may be always in the highest state of fertility, the succession may be kept up, and forty fed ones sold every year, besides some of the young, at an expense of about twenty pounds, besides the waste about the farm which could not be profitably applied to the keep of any other animal. The trouble which they require is not great, and thus, at the very lowest estimate of them, there would be a profit of between 300 and 400 per cent. upon the absolute cost, which is far more than can be obtained from any other animal that can be kept on a farm. No doubt the breed must be skilfully chosen, and the treatment must be judicious; but these are essential to success in every thing that is cultivated. The average estimate is that twice the same weight of food may be obtained from hogs, taking the bad breeds with the good, that can be obtained from the same cost of food by means

of any other animals; this too on the supposition that the flesh of the hogs is all of good quality. The tendency that hogs have to fatten in the autumn and early winter even of the first year, and the superiority of young pork, are greatly in favour of this. During the time that intervenes between the calf and the bullock, and the lamb and the sheep, neither of these animals can be "forced" into fat, except at great expense; and as this is working in opposition to the natural tendency of the animals, the flesh when fatted is of inferior quality. Not so with the hog; for with it the art merely seconds nature, and consequently the quality is good.

There is another advantage: oxen and sheep must have range and free air in the period of their growth, as they are both ranging animals in a state of nature, otherwise they are diseased and absolutely unwholesome. Neither can you obtain the flesh of hogs of the very highest flavour and quality, unless they too are sometimes in the open air, but even then they require a very limited range; and good and wholesome pork may be grown and fed in a state of perfect confinement. While the hog is growing, the food, if clean and in sufficient quantity, is not very material; because in the natural state of the animals their summer food is not of the most nutritious kind. The fruits of the preceding year are all gone, and the roots which were albuminous in the winter are exhausted by the operation of sending up the stem, the leaves, and the flowers of the year; so that during that season the hogs are in a great measure reduced to the condition of herbivorous animals; and if they are in a state of confinement, clover or green tares, or any other of the succulent plants grown for stock, will keep them on till the season of plenty comes; that is, till they come in for their share of the plenty of the harvest, a share which, when they are not there to get it, is almost entirely lost.

To the cottager who has a garden, as every cottager ought to have, not merely for its direct advantage as supplying many necessaries which could not otherwise be had, but because it attaches the man to his home, and prevents him from spending his leisure hours in an improper manner—to the cottager the hog is a very valuable animal, and will always pay the rent of the cottage, if properly managed, and of the right breed. The breed is a very important matter, because the same food that will fatten one for the market will barely suffice to keep another alive.

There are many worse ways of distinguishing one country from another than by their pigs; and the same applies even to different districts of the same country. In Britain there are three of what may be called leading or typical breeds; but they are so much blended by crossings, or changed by differences of situation and treatment, that it is not easy to draw the distinction between them in every case. Two resemble, in many particulars, the wild boar of Europe, and may have been procured from that animal when it was indigenous in the island. Of these two breeds the one appears to be the result of breeding in the rude parts of the country, where there were abundance of acorns and other wild fruits, and good shelter and keep at all seasons. These are generally called the Berkshire breed; but they are distributed over many parts of the country, and broken into a great number of varieties. These are generally of a reddish colour, with black spots, and large ears hanging over their eyes. They are short-legged small-boned animals, and much disposed to fatten; but they are not well adapted for bleak situations, or for ranging over rough grounds.

The other breed, which we may consider as more immediately referable to the wild boar, has characters rather the reverse of these, or rather different from them. The body is long, and so also are the legs, and the bones are large. This is the breed of the less fertile districts, and it is usually styled the Highland or Irish breed; but it does not appear to have been more originally confined to these parts of the empire, or to either of them, although it is unquestionably the best adapted for cold and rough places, or where much systematic attention cannot be paid.

The third of the leading breeds, which may be considered as originally distinct, that is, that no one of these has been bred out of the other, by attention to circumstances on the part of the breeder, is what is usually called the Chinese breed. It is generally of a black colour; but that is not the essential distinction; for, though colour is perhaps more constant in hogs than in some other cultivated animals, it is not absolutely constant. The permanent characters of the Chinese breed are the short legs and body and the great roundness and depth of the latter, in consequence of which the belly nearly touches the ground when the animal walks. It is of little consequence whether this breed was or was not imported into this country from China; for we do not happen to know so much about the forests of that country as to be able to say that this, or indeed any other species of hog in the wild state, is to be found in them or not. We know that all its leading characters are different from those of the wild hog of Europe, and that they resemble those of the hogs that were found wild in the islands of the Pacific when those islands were first visited by Europeans, and when there was not even any traditional history of their existence among any of the nations of continental Asia. That, under these circumstances, China, or any other part of the continent, should have received a stock of hogs from those islands, is very unlikely—we may say impossible; and this appears more strongly when we bear in mind that those isles of the Pacific, instead of being fragments of a former continent, of which the greater part has been submerged, are apparently newer formations than the continent of Asia. They are, for the most part, either volcanic, or composed of coral rock, both of which require the sea for their foundation. In the meantime, however, we have to do with the hogs only, and not with the question of their descent from a wild stock in any part of the world. They agree best in character with the Oriental ones, of which we have been speaking; and therefore, the best way of getting rid of the difficulty, which we cannot solve, is to refer them to that origin. Nor is this referring wholly without its use, for it points out the situation in which the animals can be reared to the greatest advantage. They are found native in places which have what may be called a perpetual summer, and where wild fruits and farinaceous roots can always be obtained in the delightful shade of the woods, with very little motion from place to place, or other exertion on the part of the animals. They are evidently formed for such places by the comparatively small development of their organs of motion; and thus, in what may be called the pure state, they are quite unfit for rough and bare places;

and in situations where they had to roam about and merely consume the scraps, they would be most unprofitable. As compared with what we may, from present observation on the continent, consider as the type of a wild hog in Britain, this Chinese breed is in the most artificial state; and thus it must be best adapted for those places where the climate is mild and the soil rich, and where the breeding of hogs has been reduced to a regular system.

The three leading breeds of hogs which we have mentioned afford a more distinct means of assigning these animals their proper "locations," according to the nature of the places, than we have in the case of any other animals; and the almost endless variety of circumstances under which hogs may be kept to advantage, renders this a very important matter to all classes of our rural population. Oxen and sheep cannot be profitably fattened except on a large scale; but any who has room to hold it may profitably fatten a hog. We do not of course recommend that, *more Hibernicè*, it should be kept in the house, at bed and board with the human inmates. This is not a seemly way of doing the business, and yet it is one of the strongest possible proofs of the great value of the hog. An Irish labourer and his family, who "rint a quarsther" of a cellar or a garret in some squalid den in the British metropolis, often have a pig in the fraction of an apartment, which eats of the same potatoes, reposes on the same straw, and is in fact to all intents and purposes a member of the family, not merely tolerated, but loved and loving; for though hogs are sullen and stubborn animals when one attempts to lead them captive, and require to be pulled backward in order that they may be impelled forward, yet they are susceptible to kindly treatment; and a hog may not only be taught to follow its master, but there have been instances of training them to point at game like dogs, and there is not a country fair in England where the powers of "Toby the wise pig," in the mysteries of divination, are not the marvel of the rustics.

It is not, however, for the purpose of playing the pointer, or astonishing the natives with the wisdom of Tobias, that the pig is kept with so much care in the cantonment of the cellar or the garret. It tells a tale of the great and paramount value of the pig to the poor man, and a tale of Ireland—a tale of most monstrous and most heart-rending injustice on the part of somebody, but with the latter we have no concern. The tale of the pig is, that without it the poor man in Ireland could not keep the tenancy of the mud cottage reared by his own hands on the margin of the health-invading bog, that the pig finds the annual impost which the man must pay for being in that state of "glorious independence," in which no wind can blow upon him with a more bitter blast, and no contingency of events can despoil him of a single comfort.

Now, if the hog is thus, as the case of millions has proved, a sheet-anchor by which man can ride out the topmost bent of misery's tempest, how well may it serve those who can have it all to themselves? This of itself gives a popular interest to the animal, far above that which is possessed by the veriest marvel in mere natural history. Nay, there is more depth of pathos, and force of moral and social instruction, in a single hog, circumstanced as we have mentioned, than in all the formal zoological collections on the face of the earth. But the reader can pursue it for himself, while we proceed with the routine of our article.

We shall just run over the outlines of a few of the leading breeds, which have been formed out of one or more of the three principal ones. The Berkshire, which also chiefly prevails in north Wilts, and some other places, is remarkable for the compactness of its form, and the quality and quantity of its flesh. Small boned as it is, there have been individuals twelve or thirteen hundred weight. The Hampshire hog is longer in the body than the Berks, and not so compact and handsome, and it is more inclined to white in the colour—an approach, but a very slight one, to the mountain breed. It is, however, easily fattened, and valuable. The Sussex hogs resemble the other southern breeds, that appear to be related to the Berkshire. They are black and white in large patches, the white being often in one mass placed about the middle of the length. On the borders of Wales there are some large and coarse breeds, of clumsy form and not very profitable. The Cheshire are white in the ground colour, but with large patches of black or blue. They have great heads, large ears, long and stout legs, and their skin hangs loosely about them, so that, though they are moderately fat, they are never plump in appearance. The Shropshire is an analogous breed, although not quite the same as the Cheshire. They are white or sand coloured in the ground, with patches of black, less abundant and smaller than those upon the Cheshire. They are rough and shaggy-looking animals, with numerous long and strong bristles, and a good deal of rough hair among the roots. They have large bones, and are not very profitable for ordinary treatment; but when fattened on grains, at breweries or distilleries, they yield a great weight of fat but coarse pork. The two breeds last mentioned are still nearer to the mountain breed than the long-legged hogs of the south. The Suffolk breed, though different in colour, being in general without patches, is like those of the border of Wales, high on the legs and long and thin in the body.

In what we may consider as the mountain hogs, or those that have had their characters for a long time moulded to the more inclement atmospheres of our islands, there appear to be two varieties, one of the mainland of Scotland, and one of the islands; and as both of these are very variable in their localities, there are numerous shades of difference among the hogs. The native breed of the west Highlands and western isles are of small size, and of a sort of silver-grey colour. Their coats are shaggy, being abundantly supplied both with bristles, and with coarse under wool. These animals are remarkably hardy, and, for the greater part of the year, they find their own food on the hill without any cost of artificial provision, and very little trouble of any kind. They do not get fat in this situation, as compared with the southern breeds, but their flesh is of very good flavour; and when they are brought down to the low country, they are rendered very fat and excellent in a short time, and at comparatively little expense.

In many parts of Scotland the people have a strong prejudice against hogs. It cannot be called a religious prejudice; but, like other superstitious prejudices, it borrows the phraseology of religion; and it is, or at least used to be, not uncommon, in many of those places where hogs could be reared with the greatest advantage, to hear the folks object to their

than on the hind ones; the neck has an inclination upwards, and the head is carried higher than in the hogs. The outline of the back is also different; in the hog it is almost a uniform convex curve from the nape to the rump, at least in the more plump breeds, where they are fattened; but in the peccaries, it is a curve of a contrary flexure, being concave behind the shoulders, and convex toward the rump. The body of the peccary is thick and paunchy, as are the bodies of all the pachydermata, but still the outline of the back indicates more elasticity and freedom of motion in the spine than the hogs possess; it is the want of flexibility in that part which makes the hogs dodge in so remarkable a manner up and down, when they gallop, and which makes this motion so fatiguing to them in proportion to their actual strength. They not only carry forward the centre of gravity of the body, as is done by every animal, however smoothly it may walk or gallop, but they lift it up and let it down, and also shift it backwards and forwards, in the course of every step that they take. Moving the centre of gravity of an animal is the very same as moving the whole volume and weight of the animal; and in as far as the motions are up and down they are very fatiguing. Say that a fat hog of half a ton tries to gallop, and it has to lift half a ton from the ground at every leap, while it comes down with the momentum of the weight of the same, as acquired from the depth of the descent. This, by the way, is the reason why pigs, when they run over a garden, do so much mischief with their feet as compared with smooth running animals of equal weight; it is also because the porpoises make similar boundings in the water, in consequence of the stiffness of their spine, that they get the name of sea hogs.

The peccaries are not wholly exempt from this bumping motion, but they have it in a much less degree than the hogs; and thus, if they are less powerful in repelling an attack, they are better able to escape from it by flight. The teeth of the peccaries are, four incisors in the upper jaw and six in the lower, one canine in each side of each jaw, but not projecting out of the mouth as in the hogs, and six cheek teeth in each side of each jaw; the cranium of the peccaries is very short, and in this respect it resembles that of the babyroussa much more than any other of the genus *Sus*, and the lower jaw is so locked in its articulation, that it has even less lateral motion than theirs, limited as that is.

Both the species of this genus are gentle and harmless animals, living in the rich forests, and not requiring or possessing any degree of resource. They keep together in packs, which appear to have considerable attachment to each other; but, though it has been said that they combine for mutual defence against the jaguar, and even against man, and that their united efforts are sufficient to destroy either the one or the other, yet it does not appear that there is any truth in these sayings. The desire of personal safety appears to get the better of every other upon these occasions, and the pack may be destroyed one by one without any of the survivors appearing to take the slightest interest in the fate of the fallen. The Indians seem to be well aware of these circumstances, for when they meet with a herd or pack of peccaries they are sure to return to their places of abode loaded with provisions. There are two species of this genus, or subgenus, of which we shall give slight notices.

The collared Peccary (*D. collaris*).[1] This species is about two feet and a half in length from the point of the muzzle to the base of the tail, and it stands a foot and a half high at the shoulder, and a foot and eight inches at the most elevated part of the crupper. The hair with which it is covered is thick and rough, annulated with alternate black and white, which gives it the appearance of being dotted with these two colours. On the neck the white predominates, and this gives it the appearance of having a collar, from which circumstance it has obtained the common name given to it. The legs and feet are entirely black, but the whole skin of the body is of a livid whitish colour; the pupils of the eyes are round, but it should seem that their sight is but feeble, and that, as is the case with the hogs, smelling is the most powerful of their senses, and the one upon which they have the principal dependence in the finding of their food, which they do in the twilight, basking and reposing in the little glades of the woods during the heat of the day. In this species the tail is little more than a mere rudiment, and the female has only two mammæ, which circumstance alone would be sufficient to distinguish them from all the hogs of the eastern continent. The glandular pouch on the back gives out a strong smell of garlic; but the use of the pouch or the secretion in the economy of the animal, is wholly unknown. This odour is given out in the greatest abundance when the animal is irritated, as then it erects the bristles on the neck and along the line of the back, by which means the gland is more compressed than when the animal is in a tranquil state. When alarmed, it utters a sharp and piercing kind of squeak, but not quite so piteous as that which is uttered by a hog in distress; like hogs, too, they express their satisfaction by a softened species of grunting. They are inhabitants of the woods in the lower grounds on the east side of South America; but we are not aware that they have been met with to the westward of the Andes, and they never occur in lofty situations. Buffon committed a curious blunder respecting this species of peccary. The Spanish colonists in Paraguay, from whom he drew the materials of his account of the locality and habits of the animal, use the word *monte* as descriptive of a forest; and Buffon, confounding this with the French *mont*, described this peccary as a mountain animal, which is the very reverse of its proper habitat. The same eloquent, but fanciful and not very accurate describer, represented the pale-coloured collar, which obliquely surrounds the neck of this species, as a dorsal stripe extending along the ridge of the back.

These animals are found in pairs in the breeding season, and at these times they rarely, if ever, come out of the forest. The female produces, as is understood, only once in the year; and the young are generally two, and never more. They are easily tamed, and fond of being caressed, but they are also impatient of restraint, and if detained against their will, they not only erect their dorsal bristles, and utter their war cry, but attempt to bite, which they do pretty severely. Some that have been kept in menageries in Europe, have shown much docility, as compared with the hog when in the wild state. They preferred fruits and farinaceous vegetable substances to any other kind of food; but still when that was not given them, they could be very miscellaneous in their feeding. Well-known as these animals ought to be, there have been some mistakes about them; and the man-

ners and numbers of this, which is really the most rare of the two, have sometimes been given to the other, which is a larger and bolder animal, and met with in herds, whereas the collared one seems to be more retiring and seldom met with except in pairs.

The White-lipped Peccary (*D. Labiatus*) is a larger animal than the collared one, and appears to be more numerous. The hairs or bristles upon it are much larger, and as the annuli of white occupy a very small portion of the hair, as compared with that occupied by the black, the general colour approaches to black, except on the rump, where it is brownish. The bristles are very long throughout the whole line of the back, and have their upright position whether the animal is in a state of excitement or not; those on the neck, from the occiput to the shoulders, form a sort of permanent crest. The under jaw is entirely white, and there is a considerable quantity of white on the margin of the upper one. The white on the jaws continues beyond the angle of the gape and turns upward in the direction of the ear. The young of the year are reddish in the hair or bristles of the upper part; but they lose this and acquire the colour already mentioned when they come to maturity. This is apparently (for there is not a little confusion in the accounts of them) the species which is said to be formidable, not only to the smaller species of cats which are found in the forests of tropical America, but to the jaguar and even to man himself; but there does not appear to be much truth in these statements; and the jaguar is said to follow the herds of these animals something in the same way that the lion follows the antelope and the quaggas in Southern Africa, pouncing upon one after another according as he is prompted by his appetite. There is, however, so much confusion in the accounts that are given of these two species, that one scarcely knows where the truth is to be found.

The odour given out by the dorsal gland of this one, appears from the accounts to have more of a musky smell and less of the odour of garlic than that given out by the collared species; but this cannot be implicitly depended upon, as in this, as well as in almost every other respect, the two appear to have been very much confounded with each other. It is also probable that the statement that the collared peccaries are found in packs, and the white-lipped ones in pairs only, may have arisen from the observation of them at different seasons. The whole of the hog family are found in pairs in the early part of the breeding time, and all the others are found in packs, when the young are able to shift for themselves; and it is by no means likely that animals resembling each other so closely in other respects as the two species of peccary do, should differ so widely in this particular habit. There is, at least, no parallel case in any other genus, or even family of vertebrated animals. Roebucks, it is true, keep in pairs all the year round; while other deer live in herds, with the males, generally speaking, apart from the females. But then, the deer which have this habit, do not pair at any season; but are polygamous.

The males and females differ but little in their external appearance; but the young which are littered early in the season, are greyish red on the upper part, and have usually more white on the under jaw than the adults. They do not acquire the full colours of the adult state till they are a year old; and as till then they are different from both the species when mature, they have sometimes been described as a third.

Such is a brief outline of the principal members of this interesting family of animals—a family of which the species belonging to the eastern continent are peculiarly useful to man, can be kept in situations where no other useful animal can be kept, and which fill up a place in the economy of the farm, which, but for them, would be an unprofitable blank.

SUTHERLANDIA (Hort. Kewensis). A fine ornamental shrub from the Cape of Good Hope. The flowers are diadelphous, and followed by pods, of course the plant belongs to *Leguminosæ*. It ripens seeds in abundance.

SWAINSONIA (Salisbury). A genus of shewy plants, nearly related to *Sutherlandia*, natives of New South Wales, and belonging to *Leguminosæ*. They thrive if potted in any light soil, and are easily propagated.

SWAN (*Cygnus*). A genus of web-footed swimming birds, which are found on the rivers and small pools of fresh water, rather than the sea or the larger lakes, and which, when they do appear on these, are always near the shores, and never on the expanse of the broad waters. The chief reason of this is that they are vegetable feeders, and although their long necks enable them to reach the bottom at considerable depths, they never dive, and they rarely feed upon the land, or in any other mode than by floating on the surface of the water. They are among the most ornamental of all the water birds, on account of their great size, the gracefulness of their forms and motions, and the snowy whiteness of the plumage of those species with which we are most familiar. Swans have, from the remotest antiquity, attracted the attention of poets and other describers, and the ancient fable of their acquiring a musical song when they are dying, instead of the husky voice which they have when alive, is still repeated though wholly destitute of foundation. That it should be true would, indeed, be contrary to the whole analogy of nature, the voices of pain, and especially at the hour of death in animals, being, without a single exception, unpleasant to the ear. Even those song birds whose notes are the most mellifluously sweet when they are in good health, are all painful to hear when they meet with a violent death, the only time at which they utter unpleasing sounds is when that catastrophe is approaching them.

In some of the species, the swans approach the geese in many of their characters, while the typical ones differ considerably. The leading characters of the swans, considered as a genus, or as a subgenus of *Anas* are these: the bill as wide at the tip as at the basal part, and the height at the base; the nostrils are pierced about the middle of the length of the bill, and the neck is very long as compared with that of any of the other web-footed birds. Swans feed upon seeds, roots, and various parts of plants which are blanched and succulent by being under the water. They therefore have the gizzard strong and muscular, and the intestines and cæcal appendages very long. It is sometimes said that they eat various kinds of aquatic animals, but the fact of their doing so is not clearly established. They are to a considerable extent social animals; and where there is sufficient scope and they are not disturbed, they are found in troops, more or less numerous, according to circumstances. In the breeding time they are strictly monogamous; and the pairs take up their nesting-grounds at some distance from each other. They sometimes, however, fight stout battles of gallantry for the females, which battles

are said to take place chiefly upon the water; and they do not strike with the wing as they do when defending themselves, or driving away an enemy from their nest and brood when on the land, they try to drown each other by seizing the neck, and keeping the head under water. They are very hardy and long-lived animals; and their down, or under plumage, is so close and fine, that they are well adapted for remaining on the water for the greater part of their time. When it was the fashion to have things large and rare at the tables of the opulent in preference to things really good, swans made a figure in the bill of fare. They have now, however, been wholly discarded; and besides the regret that we feel that the water should be deprived of birds so very ornamental, there is really very little temptation to kill swans for the sake of their flesh. It is black, hard, and rank, even in the young ones, and the old are too tough for being masticated. The eggs are also not very palatable; and so there is every inducement to leave them in the undisturbed possession of their proper element. Their skins, their feathers, and their down are used for many purposes; but still though these are of considerable value, they are not of so much as to compensate for the loss of the birds. It is of the waters only that they can properly be regarded as ornaments; for when kept in the farmyard they are quite out of their element; and cannot be kept without absolute confinement, unless their wings are so mutilated as to deprive them of the power of flight. But though they pine in confinement, and cannot be made to remain willingly in a state of regular domestication, they can become very tame upon the water, and will readily come sailing in their best style to those who are in the habit of giving them food. There are several species; and one, the black swan of Australia which bears the climate of Britain very well, was long looked upon as a bird impossible to be found. Many of the animals of Australia would have astonished the ancients; and thus it was perhaps only natural that the bird whose existence they held to be impossible should be found in that part of the world.

The Wild Swan, whistling swan, whooper, or hooper (*Cygnus ferus*). The bill of this species is semicylindrical, and of a black colour, but with the cere on the base of the upper mandible yellow; the body is white, but with a yellowish tinge on the head and upper part of the hind neck; the irides are brown, and the naked parts of the feet black; the bronchial part of the trachea is very much enlarged and convoluted; the length of the full-grown male bird is rather more than four feet and a half; and the extent of the wings two or three inches more than five feet. The female is less than the male, but of the same colours.

It is highly probable that the notion of the swan being mute while in health, and becoming musical at the approach of death, arose from confounding this wild species with it. The voice of the wild swan cannot certainly be looked upon as very musical; but there is a mournful sonorousness about it, which gives it not a little of the expression of a song of death. It is a dull and solemn *hwoo hwoo*, having what is called an inward sound, though audible at a considerable distance. The voices of birds are all inward, that is, the proper organ of sound is at the branchial end of the windpipe; but those that trill in clear and sharp keys, evidently modify the sound very much by the action of the throat, the mouth, and the tongue. Such a bird as the wild swan has very little of this kind of modification; and thus the sound is delivered with all the harshness and depth which it receives from the convolutions of the trachea.

This is not the only confounding that there has been of these two species of swan; for Buffon and others have regarded them as being the same species, notwithstanding the marked difference that there is between them, which is not of the same kind as any change that we know to have been produced by artificial treatment. The windpipe of the white ortami swan has not the same structure as that of the whistling one; and the bill and its cere are not of the same colour. We know of no instance in which the form of the windpipe of an animal, or indeed even the mandibles and the cere of a bird, are changed by the most artificial treatment. The difference in colour, too, that of a slight yellowish tinge upon the head and nape of what is called the wild one, is the very opposite of what we should expect to be produced by artificial treatment, that is, of what is so produced in the case of other animals. A breaking of the colour is that which artificial treatment usually produces; but here the colour of what is considered as the tamed or artificially treated one is the more entire of the two; and, therefore, even setting aside the mere specific differences of the windpipe and the bill, this change of colour, the very opposite to what we invariably meet with when a tame animal is bred out of a wild, is quite against the possibility of an identity in species between these two swans; but, farther than this, the mute white swan has not been subjected to any kind of artificial treatment by which its natural characters or habits could have been much changed. It is not a domesticated bird in any one part of its habits or economy. It does not breed in confinement, it is not fed artificially, and it is put under no particular shelter by which the effect of the atmosphere upon it could be altered. It is among the domesticated animals, that is, it is upon the same grounds with them in some part of the breadth of these grounds no doubt; but it is itself subjected to no artificial treatment; and the best proof of this is, that, in no part of the world where the white swan is to be found, have its colours been in the least broken or changed. Now, in every domesticated animal, the colour that it has in a state of wild nature is the very first thing to give way; and then the perfect colour of the white swan is an unanswerable proof that it is really a bird in a state of nature; and, consequently, those who assert that it has been bred out of the whooping swan, maintain, in fact, that one species of animal may, in a state of nature, and without any interference of art, originate another and different species. Once admit this, and there is an end of all rational disquisition upon the productions of Nature. If one species can, in the ordinary course, and without any interference, originate another species, there could, by possibility, be no rational or intelligible distinction of species at all; for all the distinctions of animals would be broken down, not by external circumstances, but by the very nature of the animals themselves; and were this to be the case, the whole of Nature would be one mass of confusion, to which not one iota of philosophy could be applied.

The localities and the habits of these two species of swans are also quite distinct. The wild swan is a much more migratory bird than the other, and its habitat is found farther to the north, to which it

retreats in the breeding season, whereas the white one remains in the same locality without showing much, if any, disposition to change its abode with the seasons. Now, as the white swan, however more familiar it may be in its habits than the other, cannot in any sense of the word be considered as a tamed or domesticated bird, we must look upon them both as having distinct habits, as well as distinct characters, in a state of nature; and if there are not sufficient grounds of specific distinction, truly we know not between what two animals of the same genus such grounds of distinction are to be found.

The whistling swan is a bird very generally distributed over the northern parts of both the eastern and the western continents. In severe winters they come south in small flocks to the fresh waters near the shores both in England and in France; but it does not appear that they reach the south of Europe, excepting very rarely, and when the winter storms are more than usually general and severe. Early in the spring they quit the more southerly places; and in the longitude of the British islands, they do not remain to breed except in the far south, and then only in a very small portion of the numbers that make their appearance during the winter. We are not aware that any have ever been found breeding on the main land, excepting in that part of Caithness and Sutherland which classes toward the Polar Sea; but they were, once at least, more numerous in the Orkney and Shetland Isles, and some of the more northerly of the Hebrides. In the Faroe Isles they are, of course, still more numerous; but the great body of them must breed further to the north than these islands; for they arrive there, and also in Shetland, in numerous flocks about the month of October, but earlier or later according to the character of the season; and when the severe weather sets in, they diminish in numbers there by breaking into small parties, and moving further to the south. If the winter is comparatively open there, which it frequently is in places but little elevated above the level of the sea, they continue in considerable numbers upon the fresh-water lakes, feeding upon the submerged roots of aquatic plants, which, on account of the stems lying completely down, are very farinaceous in these high latitudes.

As soon as they begin to feel the influence of the spring, they collect their scattered parties, and retire to the regions farther to the north to spend their summer and rear their broods. Vast numbers of them are said to be met with at that season in all the polar countries—in the north of Siberia, of Lapland, in Iceland, in America, especially in the countries near Hudson's Bay, and even in Greenland; though more are mentioned as being met with in Nova Zembla or Spitzbergen. Being chiefly vegetable feeders, they of course resort no farther to the north than the roots and stems of plants are to be met with in the waters; and they avoid mountainous districts, and resort only to those in which there are lakes or rivers of considerable magnitude. On their migratory flights they ride very high in the air, and follow close to each other. The high flight is no doubt taken as a security against the attacks of the powerful falcons of the north; for which the swans, notwithstanding their great size and strength, would be no match, if the falcons were once to gain "the sky" of them. To every thing above it in the air the falcon is comparatively harmless; and the swan has little or no means of defence when it is on the wing, the stroke of the wing being what it chiefly depends on for its defence against an enemy, and this being but little available when the bird is flying. By taking the sky of the falcon, the swan is thus enabled to perform its migratory flight in considerable safety. The flight of these swans, when they are upon their migratory journeys, is much more rapid than, from the size and weight of the birds, one would be apt to suppose. As is the case with all birds of lofty flight, it does not appear to be so rapid as it really is. This is a point to which it is very essential to attend to in all cases of animals, or indeed of any thing else in motion. The portion of the retina which the visual impression of the observed object passes over is, of course the standard which we have for the measure of its velocity. In consequence of this, its motion appears to be slower than it really is in the very same proportion that its distance is increased, so that a motion at the distance of five hundred yards requires to be ten times faster, in order to have the same apparent speed as a motion at fifty yards' distance. This renders it rather a difficult matter for an ordinary sportsman, however expert he may be in hitting partridges or other ground birds on the wing, to hit swans when they are passing over him in their high migratory flight; and unless he takes aim before them, at a distance which can be determined only by experience, he is sure to miss. The weight of swans, and their size, and the abundance of their feathers, causes the wind to have very great influence on the velocity of their flight. Hence they almost invariably go with the wind in their migrations, and wait, or even halt, on their journey if the wind is adverse. Before a stiff breeze, they can make way at the rate of not less than one hundred miles in the hour, so that they are then very soon out of the observer's horizon. But against a wind of equal strength, they can make very little way; and upon a strong cross wind they drift very far to leeward.

The young swans, which are bred in Iceland and the other northerly places, are not able to take their departure the first year. They moult in August, at which time they are incapable of flight; and so the people hunt them with dogs, or fell them with clubs, their flesh being much relished in those countries where dainties are but few.

These birds have acquired a very considerable degree of fictitious interest, and therefore, besides the exaggeration of the musical power of their "sweet voices," there are various other improbable things alleged of them. For instance, it is said that when the frost begins to set in they assemble in multitudes, and keep the water in a state of agitation to prevent it from freezing, while the fact is that all the agitation that swans could produce in the water of a lake would just make it freeze the more readily. It is probable, however, that they break the thin ice, and continue breaking it at the same spot as fast as it freezes, for this is the habit of many animals in the winter.

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are said to take place chiefly upon the water; and they do not strike with the wing as they do when defending themselves, or driving away an enemy from their nest and brood when on the land, they try to drown each other by seizing the neck, and keeping the head under water. They are very hardy and long-lived animals; and their down, or under plumage, is so close and fine, that they are well adapted for remaining on the water for the greater part of their time. When it was the fashion to have things large and rare at the tables of the opulent in preference to things really good, swans made a figure in the bill of fare. They have now, however, been wholly discarded; and besides the regret that we feel that the water should be deprived of birds so very ornamental, there is really very little temptation to kill swans for the sake of their flesh. It is black, hard, and rank, even in the young ones, and the old are too tough for being masticated. The eggs are also not very palatable; and so there is every inducement to leave them in the undisturbed possession of their proper element. Their skins, their feathers, and their down are used for many purposes; but still though these are of considerable value, they are not of so much as to compensate for the loss of the birds. It is of the waters only that they can properly be regarded as ornaments; for when kept in the farmyard they are quite out of their element; and cannot be kept without absolute confinement, unless their wings are so mutilated as to deprive them of the power of flight. But though they pine in confinement, and cannot be made to remain willingly in a state of regular domestication, they can become very tame upon the water, and will readily come sailing in their best style to those who are in the habit of giving them food. There are several species; and one, the black swan of Australia which bears the climate of Britain very well, was long looked upon as a bird impossible to be found. Many of the animals of Australia would have astonished the ancients; and thus it was perhaps only natural that the bird whose existence they held to be impossible should be found in that part of the world.

The Wild Swan, whistling swan, whooper, or hooper (*Cygnus ferus*). The bill of this species is semicylindrical, and of a black colour, but with the cere on the base of the upper mandible yellow; the body is white, but with a yellowish tinge on the head and upper part of the hind neck; the irides are brown, and the naked parts of the feet black; the bronchial part of the trachea is very much enlarged and convoluted; the length of the full-grown male bird is rather more than four feet and a half; and the extent of the wings two or three inches more than five feet. The female is less than the male, but of the same colours.

It is highly probable that the notion of the swan being mute while in health, and becoming musical at the approach of death, arose from confounding this wild species with it. The voice of the wild swan cannot certainly be looked upon as very musical; but there is a mournful sonorousness about it, which gives it not a little of the expression of a song of death. It is a dull and solemn *hwoo hwoo*, having what is called an inward sound, though audible at a considerable distance. The voices of birds are all inward, that is, the proper organ of sound is at the branchial end of the windpipe; but those that trill in clear and sharp keys, evidently modify the sound very much by the action of the throat, the mouth, and the tongue. Such a bird as the wild swan has very little of this kind of modification; and thus the sound is delivered with all the harshness and depth which it receives from the convolutions of the trachea.

This is not the only confounding that there has been of these two species of swan; for Buffon and others have regarded them as being the same species, notwithstanding the marked difference that there is between them, which is not of the same kind as any change that we know to have been produced by artificial treatment. The windpipe of the white ortami swan has not the same structure as that of the whistling one; and the bill and its cere are not of the same colour. We know of no instance in which the form of the windpipe of an animal, or indeed even the mandibles and the cere of a bird, are changed by the most artificial treatment. The difference in colour, too, that of a slight yellowish tinge upon the head and nape of what is called the wild one, is the very opposite of what we should expect to be produced by artificial treatment, that is, of what is so produced in the case of other animals. A breaking of the colour is that which artificial treatment usually produces; but here the colour of what is considered as the tamed or artificially treated one is the more entire of the two; and, therefore, even setting aside the mere specific differences of the windpipe and the bill, this change of colour, the very opposite to what we invariably meet with when a tame animal is bred out of a wild, is quite against the possibility of an identity in species between these two swans; but, farther than this, the mute white swan has not been subjected to any kind of artificial treatment by which its natural characters or habits could have been much changed. It is not a domesticated bird in any one part of its habits or economy. It does not breed in confinement, it is not fed artificially, and it is put under no particular shelter by which the effect of the atmosphere upon it could be altered. It is among the domesticated animals, that is, it is upon the same grounds with them in some part of the breadth of these grounds no doubt; but it is itself subjected to no artificial treatment; and the best proof of this is, that, in no part of the world where the white swan is to be found, have its colours been in the least broken or changed. Now, in every domesticated animal, the colour that it has in a state of wild nature is the very first thing to give way; and then the perfect colour of the white swan is an unanswerable proof that it is really a bird in a state of nature; and, consequently, those who assert that it has been bred out of the whooping swan, maintain, in fact, that one species of animal may, in a state of nature, and without any interference of art, originate another and different species. Once admit this, and there is an end of all rational disquisition upon the productions of Nature. If one species can, in the ordinary course, and without any interference, originate another species, there could, by possibility, be no rational or intelligible distinction of species at all; for all the distinctions of animals would be broken down, not by external circumstances, but by the very nature of the animals themselves; and were this to be the case, the whole of Nature would be one mass of confusion, to which not one iota of philosophy could be applied.

The localities and the habits of these two species of swans are also quite distinct. The wild swan is a much more migratory bird than the other, and its habitat is found farther to the north, to which it

retreats in the breeding season, whereas the white one remains in the same locality without showing much, if any, disposition to change its abode with the seasons. Now, as the white swan, however more familiar it may be in its habits than the other, cannot in any sense of the word be considered as a tamed or domesticated bird, we must look upon them both as having distinct habits, as well as distinct characters, in a state of nature; and if there are not sufficient grounds of specific distinction, truly we know not between what two animals of the same genus such grounds of distinction are to be found.

The whistling swan is a bird very generally distributed over the northern parts of both the eastern and the western continents. In severe winters they come south in small flocks to the fresh waters near the shores both in England and in France; but it does not appear that they reach the south of Europe, excepting very rarely, and when the winter storms are more than usually general and severe. Early in the spring they quit the more southerly places; and in the longitude of the British islands, they do not remain to breed except in the far south, and then only in a very small portion of the numbers that make their appearance during the winter. We are not aware that any have ever been found breeding on the main land, excepting in that part of Caithness and Sutherland which classes toward the Polar Sea; but they were, once at least, more numerous in the Orkney and Shetland Isles, and some of the more northerly of the Hebrides. In the Faroe Isles they are, of course, still more numerous; but the great body of them must breed further to the north than these islands; for they arrive there, and also in Shetland, in numerous flocks about the month of October, but earlier or later according to the character of the season; and when the severe weather sets in, they diminish in numbers there by breaking into small parties, and moving further to the south. If the winter is comparatively open there, which it frequently is in places but little elevated above the level of the sea, they continue in considerable numbers upon the fresh-water lakes, feeding upon the submerged roots of aquatic plants, which, on account of the stems lying completely down, are very farinaceous in these high latitudes.

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elements, the quantity of matter and the velocity, and that while the effect increases only as the quantity of matter, while it does so as the square of the velocity, we can easily understand how soon rapidity of motion will make up for any inferior weight in the moving instrument. One-fourth the quantity of matter moving with four times the velocity has an effect in the proportion of sixteen to four; that is, it has an effect four times as great. It is upon this principle that a piece of candle may be shot from a gun or pistol, so as to pass clean through a deal board of considerable thickness. Even this is not all, for the small weapon delivers its effect upon a much smaller portion of that on which it impinges; and in proportion as it does this, the effect of it is also increased. Hence there may be less exaggeration than many suppose, in the allegation that the blow of the wild swan's wing can knock down a hog, or hit a bird of prey, or even a predatory quadruped, in so smart a style, as to make them avoid a second rencontre.

The female swan builds a large but rude nest, very near the margin of the water, but on a place where there is no chance of inundation, and where she can command a view of danger should it approach. From the water she has nothing to fear; and thus, if she finds a little jutting promontory of the land suitable to her purpose, she prefers that, and sits with her head to the land, unless when the state of the weather renders another position more convenient and safe. The eggs vary from four to seven in number. They are very thick and strong in the shell, of a rusty-brown colour, and marked with white blotches about the middle of their length. The incubation lasts for about six weeks. The northern people, as has been said, are fond of the flesh of the cygnets, or young of these birds; but the adults are not relished by them, though much less particular as to the quality of their food than the inhabitants of more favoured climates. They, however, make considerable use of the skins, dressing them with the down upon them, and sewing them together, in which state they form strong and warm garments; or weaving the down into a sort of framing of network, in which state it is almost equally warm, and exceedingly light and pliable. The down, the feathers, and the quills, are also of considerable value as articles of commerce.

The Mute or Tame Swan (*C. olor*) is "the swan," by way of eminence; and, though differing from the other in the particulars already alluded to, it is nearly similar in the leading points of its economy. It is rather shorter than the whistling swan, but longer in the wings, measuring about seven feet, or even a few inches more when they are fully extended. The body is rather thicker too in proportion to the length, and it is, upon the average, a heavier bird when full grown. The bill of the mute swan is of a red or salmon colour, with the margins and the basal cere, which swells into a tubercle of considerable size, black; the whole plumage of the mature bird, when on the water in a pure atmosphere, is beautifully white; and few of the living productions of nature are more beautiful than swans, especially when they are upon the small expanses of clear water, which occur in many of the rich little valleys in the south of England. Though a majestic creature in its motion upon the water, the appearance of the swan harmonises best with water which is clear and tranquil, and grasses and green meadows add greatly to the effect.

In a state of nature this species is not so migratory or so polar in the breeding season as the whistling swan. Some of them, especially in the east of Europe

and in Siberia, where the seasons run more into extremes than they do in Britain, are compelled to move southward when the weather is severe; and even in Britain they are sometimes driven from the waters of particular places by the severity of the weather; but where the waters are open they continue on the same grounds for the whole year round, and where they are placed upon ornamental waters in pleasure-grounds, or even in the close vicinity of cities, they show no very strong disposition to shift to more sequestered haunts, at any season of the year. In places that are much frequented they soon become very familiar; indeed they are far from being timid birds under any circumstances. They appear to be quite confident in that power which nature has given them; and, as they have little to fear from enemies, they are not much given to be pugnacious, at least in ordinary times of the year. When, however, they have nests, they not only defend them with great bravery, but attack, in the most resolute manner, any animal that approaches, not excepting man himself. The female is a close sitter during her incubation, which is about the same length as that of the whistling swan; and while the female sits, the male is very assiduous in watching for the safety of the family. He is ready to resist, and by the most vigorous means to repel, every intruder, not excepting his own species, who cannot come within a short distance of the nest without being attacked. Severe contests often take place between the males upon these occasions, more especially if, as is sometimes the case, there is an odd or unpaired male upon the same water. This odd one is not the assailant; for, as he is not in the guardianship of a female and nest, he does not appear to have the same excitement as those which have this

trust committed to them ; but if he is attacked, he is bold enough in his defence ; and we have heard it stated, though we will not vouch for the fact, that if he should succeed in killing or beating off the legitimate possessor of the ground, even after the incubation is considerably advanced, he takes the place and discharges the duties of watchman and protector, with the same vigilant assiduity as the one which he has vanquished.

The nest of the mute swan is very similar, both in place and structure, to that of the whistling swan, but the eggs are different ; they are of a white colour, and vary from six to eight in number. The time of incubation is about six weeks, the same as that of the other species. The cygnets are grey, and do not acquire their full plumage till the second year, and till then they usually keep in company with each other, which they also do with the old birds, until the time of pairing again comes on. The cygnets, while they are in their grey plumage, have very little of the majestic appearance of the adult swans. As articles of food, they are, however, the only ones that are held in much estimation at the present time, and there is probably more of the want of rarity than of that of nature in them. Taken from the water, in their natural condition, they are comparatively of little value ; but, when they are artificially fattened, they fetch a high price in the market. When tame, swans are kept with a view to profit as well as ornament ; their down and the quills of their wings are pulled twice in the year. This is a very cruel operation ; but then, the feathers pulled from the live bird are better than if they were taken from it when dead ; and, if the operation is performed near the time of the moult, and the birds are well fed, it is not so hurtful to them as might at first be supposed. By having this extraordinary supply of feathers to keep up, the working of their system is much more severe than when they have only to supply the natural moult, and therefore they require artificial feeding, in which oats is as good a supply as they can have. Upon small pieces of water, the banks of which are kept trim and free from aquatic herbage, swans require to be fed in the breeding time, and it is of course necessary to give them food in very severe weather, especially when they are frozen out. They are bad walkers ; and thus, when they are shut out from the water, they are but ill able to find their own food upon the land. Indeed, it appears that, if they have not free access to the water, no feeding can keep them in proper condition ; for their plumage gets dirty and ruffled, and they lose all the spirit and the majesty of appearance which they have upon the waters. When in full possession of their proper element, there are few birds so attentive to the state of their plumage as swans. They bathe and play in the water, by casting it all over them, as if it came from a shower-bath ; and then they begin to trim every feather, which they can do on almost every part of the body and wings, in consequence of the length and elasticity of the neck.

No birds are more, or indeed so much, at home on the surface of the water as swans. Their size, and the closeness, and at the same time the tightness, of their plumage, enable them to ride out during gusts and gales, in which few other birds can keep the surface ; and the pure whiteness of their colour, together with the abundance and fineness of their down, render them very independent of changes of temperature. One of their most conspicuous advantages, however, is the extent to which they can use the wings in sailing along. The hand part of the wing, that is, the portion from the wrist joint, is that which they use upon those occasions, and as the wings are large and concave, and the quills strong, they can go at a rapid rate before the wind without any exertion of the feet. If the progress is to be right before the wind, then the two wings are equally raised, and that, in proportion as speed is required, they are more expanded. The wings of the swan are, indeed, more effective sails than any that we can apply to our craft. The wings of the swan form a sail at each side, between which the current of the wind passes, and thus acts upon them with much more effect than it does upon the sails which we apply to vessels, and which, generally speaking, all draw one way. Equal sails set on the two sides of a ship, and diverging backwards, would be adapted only for going right before the wind, but they would tend much more to the preserving of a steady course than any sails set upon masts in the mesial line of the vessel ; because the current of air passing between them in that line, and of course also in the line of the specific gravity of the vessel, would keep the progress of that centre steadily to the line of the wind. Sailing upon a wind would be a much more difficult matter with this kind of double canvass ; and it is doubtful whether any contrivance of man could give it the variety necessary for gaining the maximum of effect with the minimum of wear and tear in this way ; but it is certain that, with vessels of the present construction, especially with square-rigged ones, anything but the maximum of effect is produced ; and thus they who have an interest in improving the rigging of ships—and, in a country like Britain, it is every body's interest—would do well to study intimately the mechanism and movements of the wings of the swan as it sails upon the water. It can alter the trim of the wings in a style which is truly admirable. By altering the trim of them, in respect to each other, it can not only sail on a cross wind, but absolutely "lie to the wind ;" and it can "wear" or turn without losing an inch of wing. It would be vain in us to hope for such perfection in our sailing craft, unless we could find a solution of the impossible problem of having an engine of human construction so instinct with life as that it could of itself, and without any human direction, obey the circumstances in which it were placed. This, of course, it would be vain for us to attempt ; but still, the mechanism by which an animal is enabled to do this is a subject well worthy of our consideration ; and with the principles of the mechanics of dead matter, which are the only ones that we can apply to guide us, we might make far more of the study of animal mechanism than has hitherto been made. As to motion, that is, motion originated and directed in the air, we need make no attempt, because we must always have a fulcrum to start from equal to the resistance of the medium through which the motion is to be made, and the force necessary for overcoming the exertion of that which we impel ; but when that which we move starts from the earth or the water at each application of the native impulse, and moves partly in the air, we cannot take too many lessons from those actions which nature performs under circumstances nearly the same ; and our lessons here have the advantage of being as pleasant in the acquiring

as they are useful in the application. Of this we cannot have a more delightful instance than in the swan, whether we consider it as rowing, as sailing, or as combining the two together. The waters upon which swans are seen are, in Britain at least, all in very lonely places, and the birds are most out upon the breadth of those ornamental waters at the most delightful season of the year—the green maturity of the season, which is midway between the bloom of the summer and the abundance of the autumn.

White swans cannot be regarded as in a perfectly wild state in any part of the British islands; and the obvious reason appears to be, that there is no part of those islands in a state of wild nature which is at all fitted to the habits of the white swan. It is a bird of such places where there are rivers and lakes with abundance of reeds and the taller aquatic grasses, and other plants which can furnish it with a supply of food at all seasons of the year; and when it is upon the waters of such places, it shows no disposition to migrate, as is shown by the whistling swan; we need not therefore look for it at any season in those northern pools and lakes, to which the other sometimes resorts in the severity of the winter.

But though the white swan cannot be considered as a wild bird with us, so neither is it a tame one. Man has property in it by law only, and not by any attachment that the bird has to him. There are some places of the country where the swans are not claimed by any one as a property; this we believe is the case on the river Trent, and also on some of the waters in the southern parts of the country, where swans as property are more numerous than they are in the north. On the Thames, and on most of the other rivers and lakes, the swans are in general property; and there are some pretty severe enactments against the disturbing of them, or the plundering of their nests. Notwithstanding the disposition to kill and destroy every thing, especially every thing ornamental, which seems to be inherent in the nature of certain classes of mankind, swans appear to be less annoyed than almost any other bird. When on the water they are tolerably safe from any annoyance; and in the nesting time the boys are not very fond of approaching them for the purpose of plundering. They seem to be favourites to a rank considerably lower down than most other birds, for the rest are destroyed without mercy, except when individuals are kept in confinement as a sort of property: and this is in itself a species of destruction to the bird, and has at least but little tendency to improve the disposition of the keeper. In the middle latitudes of European Russia, and of Siberia, swans are much more abundant, and more in what we may consider their natural state, than they are in any part of the British islands; but in what part of the world, or under what circumstances soever they make their appearance, they are always highly ornamental to the places where they are found.

Bewick's Swan (*C. Bewickii*). This species has a considerable resemblance to the common wild or whistling swan, and probably has been often confounded with it; but there are sufficient differences between them, both external and internal, for entitling them to be considered as distinct species. It is a smaller bird than the whistling swan, in the length of the body, the extent of the wings, and especially in the weight, which is considerably less in proportion to the dimensions; the bill is of the same colour, namely, black in the greater part of the mandibles and yellow in the cere, and the general colour of the plumage is white; instead, however, of the dull yellow on the top of the head and the nape, this bird has the front mottled with rust colour. The chief natural distinction is in the bronchial part of the trachea, which, instead of having a short convolution in this part of the sternum, as in the other, has a large duplicature within the substance, as between the plates of that bone. The habits of this species have been but imperfectly observed; they do not, however, appear to differ much from those of the other wild swans, only as the bird is much more rare in this country, and little adapted for long migrations, it is probable that it inhabits still further to the north in the breeding season, but the fact is not established.

There are various species of swans in other parts of the world, besides those which have been enumerated; but as we know but little of their habits as differing from those already described, a very short notice only will be necessary. The most remarkable is

The black Swan (*C. niger*), which is a native of Australia, but has been domesticated in some parts of this country, and appears to bear the climate very well; but it is much more of a tyrant on the waters than the white swan, and will allow no other swimming bird to live in its vicinity. The whole plumage is black, with the exception of the first six quills, which are white; the bill, and a naked space round the eye, are red; the length is about four feet and a half, and the wings rather shorter in proportion than the white swan, but they are broad and strong. The plan and structure of the nest are about the same as those of the white swan, and there does not appear to be much difference either in the food or the general habits. The male is particularly watchful of the female when sitting, and of both female and brood when they are on the water; he not only drives off all other birds, but if any animal, or even a human being, approaches, he lands and marches forth to give him battle at a distance from the family; his wings are raised ready for the stroke, his feathers are ruffled, and he puts on altogether rather a formidable appearance, only it is rendered not a little ludicrous by the awkwardness of his gait, which makes it appear that walking is really more than he can manage, without any toil of battle in supplement to it. It is probable, however, that the strong excitement that he is under is the real cause of this curious waddling motion, and that it helps to "scare the enemy" not "in" but "from" battle. In this country the young are produced about the same season as those of the white swan, and the number in a brood appear also to be much the same. They are of a blackish ashen grey, which continues the whole of the first year. As a curiosity the black swan is all very well, the more especially that it was for such a length of time implicitly looked upon as the impossible bird that was no where to be met with; but it has none of the beauty and grace of the white swan, which must continue to be the favourite as an ornamental bird.

The swans of the tropical parts of Africa and America are smaller than those of the north, and they have the colours in general more broken. We find in them, and also in some in the north parts of America, a resemblance to the geese.

The Gambian Swan (*C. Gambensis*) will be found described in the article Goose, under the name of

the "Gambian Goose," and reasons will be found stated there why those tropical birds, which have been described by many writers as swans, have been there arranged as a section of the geese. The Canada, or cravatted goose, has also been sometimes described as a swan, but it has the characters of the true goose much more completely than the one now alluded to, and will of course be found in the article alluded to. It does not, indeed, appear that there are any true swans, except the white swans of the north part of the eastern continent and the black swans of Australia; and it is not a little singular that countries so wide apart, and differing so much in all their other living productions, are the only ones that agree with each other in containing native swans.

SWARTZIA (Willdenow). Evergreen shrubs, natives of the West Indies, and belonging to *Leguminosæ*. The species are stove plants, thrive in light loam, and may be increased by cuttings rooted in sand under a bell glass.

SWEETIA (De Candolle). A genus of South American climbing shrubs, bearing diadelphous flowers, and belonging to the natural order *Leguminosæ*. There are three or four species which have been known as *Galegas, Tephrosias*, or *Glycines;* but renamed as above by De Candolle in honour of the late R. Sweet, F.L.S.

SWEET POTATO, is the *Convolvulus batatas* of Linnæus, and the *Ipomœa batatas* of Poiret. Its tubers are eatable, and much used in tropical countries.

SWEET SOP, is the *Anona squamosa* of Linnæus, a tropical fruit-tree long known, and frequently fruited in our collections.

SWERTIA (Linnæus). A genus of perennial aquatics, and annual and biennial herbs, natives of Europe, and belong to *Gentianeæ*. The *S. perennis* is called felwort in English botany.

SWIETENIA (Linnæus). A single but most valuable timber-tree, a native of the West Indies; the flowers are decandrous, and the plants belong to *Meliaceæ*. This is the celebrated mahogany-tree of commerce, of which so much use is made in the fabrication of household furniture. The plant grows well in the stove, and is propagated by cuttings. There is an East Indian species called *S. febrifuga* by Roxburgh, from its medical properties.

SWIFT—SWALLOW. See Hirundo.

SWINE. See Sus.

SYCAMORE, is the *Acer pseudo-platanus* of Linnæus, a well-known timber-tree, long naturalised in England, and much used in ornamental planting. The timber is chiefly used in turnery.

SYLVIA (Warblers, or rather Sylviadæ, the warbler family). A genus, family, or section, for it has been differently viewed by different discribers, of the order *Passeres*, the family *Dentirostres*, and the fine billed division of that family in Cuvier's arrangement. The whole of the slender-billed family, as known in his time, were arranged by Linnæus in one great genus *Motacilla*, or "Wagtail;" but as the mere motion of the tail is not a characteristic from which any useful conclusion can be drawn, it became necessary, after the structure of birds entered into the grounds of their arrangement, to make very considerable alterations, and to subdivide the Linnæan genera into many parts.

In all the family of fine-bills, the bill is slender and in the form of a little style or bodkin, with the tip sharp, and capable of entering very small crevices in the bark of trees, or pecking out caterpillars from their folds or other dwellings in or among the leaves. They hold, at least in so far as the form of the bill is concerned, an intermediate place between the finches as birds feeding in great part on seeds, and the shrikes as the most ravenous and exclusively animal feeders of the whole order *Passeres*. In those that approach the finches in character, the bill is quite straight, without any notch, and a little depressed at the base; while in those that approach the shrikes the bill is a little compressed at the base, with the upper mandible very slightly curved, and an obscure notch toward the tip. It is not very easy to find a general description which can apply to the whole of this very numerous and diversified species of birds other than that from which the family has been named by Cuvier; and in this we can discover the superiority of that great comparative anatomist and physiologist, drawn as it is from nature alone, without any theoretical basis of human contrivance, over the systems of more recent and fanciful, but incalculably shallower personages, who have not made their systems, as they ought to have done, the mirror of nature; but have made nature the mirror of their systems, or at least attempted to do it, which is much the same. They take up the succession from the *Orioles*, and the *Mœnura*, or lyre-bird of Australia; and after proceeding regularly through the different genera, to the pipits; and passing over the *Syndactylic* and *Fissirostral* birds, which from the peculiar characters of their feet, their bills, or both, cannot be made to come into the regular series, they merge in the larks, with which the pipits have so many points of resemblance that they were once considered as larks. They are thus a regular section of the great succession of birds which may be considered as having the feet with three toes before and one behind, and not in any way decidedly adapted to any one kind of action with those organs.

As there is no established English name for this extensive family of birds, and no scientific one which is expressive enough, we shall give a short catalogue of the genera in this article, referring to such as are more minutely described in other parts of this work, wherever such reference appears to be necessary. There are eight principal genera in the fine-billed family, and, as one of them admits of subdivision into two sections, there will be nine in all for our consideration, and we shall take them in the order in which they are given by Cuvier.

1.—Saxicola (*Chat*). These are the birds of the family which have most of the character of the straight-billed shrikes. An account of them will be found in the article Saxicola.

2.—Sylvia. This genus has no appropriate English name, we might perhaps call them the redbreast genus, as our little familiar favourite, the common redbreast, is the typical bird; but then all the others have not red breasts, though they agree with the redbreast in characters which are more important. The birds of this genus have the bill a little more straight at the base than the chats, indicating that they are not so exclusively insectivorous in their feeding, and some of them, at least, are stationary even in countries far to the north; whereas the chats are migratory, and depart when the season of insects is over. Their food, in the warm season, consists of insects and worms, but in the winter they subsist in great

part upon wild berries, seeds, and other vegetable matters. Indeed, at that season they are very miscellaneous in their feeding, and pick up all sorts of scraps, both animal and vegetable. They are all solitary birds, never appearing in flocks, even in the most severe weather, when almost all the smaller birds are not only social in their own species, but mingle freely with others, without the slightest signs of hostility. The members of this genus, on the other hand, are never seen even two in company, for though several may be seen near to each other, there is never the slightest indication of any concerted movement or recognition of the one by the other. Even when they pair, they are strictly *cryptogamous*, for the pair are not seen together. They nestle in holes of trees or of walls; and at that season they are not much seen even in the places where many of them nestle. When seen, they are generally skulking about among the trees; and even the song of such as breed in the woods is but very rarely heard there. But though they are thus solitary in their habits, as regards their own species, and indeed all other birds, they are by no means timid or retiring at those times when the purposes of nature do not call them to the depth of the forests. On the contrary, such of them as winter where the season is severe, are among the most familiar of birds, and not only approach houses, but do not hesitate to enter them with a boldness displayed by very few birds. Even in the breeding season, their skulking appears to have much more reference to the finding of food, than to any timidity or alarm; for though they move about and are careful enough to be out of the way of danger, yet they never become agitated, or fly off to any great distance, they merely shift about so as to get the screen of the tree, or other cover, between them and that by which they happen to be disturbed. They are also of a bold and pugnacious disposition, and when in a state of confinement they attack and vanquish birds larger than themselves. Their songs are not so varied and melodious, or given in such volume and with so much energy, as those of some others of the family; but they are in general sweet, and the resident ones, which quit the woods in the winter and resort to the vicinity of houses, sing after their arrival and again before their departure, or if the season is mild and open they sing occasionally throughout the whole of it. When they sing, however, they never come quite close to houses, or attempt to enter them, for the same severity of the weather which drives them to this familiarity, renders them perfectly silent. The species which Cuvier has included in the genus, differ a good deal in their external appearance, especially in their colour; but there does not appear to be any difference sufficient for warranting the further division of them into genera, though that has been attempted by some of them who are in more than an ordinary degree system-smitten.

Redbreast (*S. rubicola*). In the late autumn, the winter, and the early spring, this is one of the best-known of birds, and almost every one knows it, without requiring any description; but in summer its habits are much more obscure, so that doubts have been started whether it is or is not a migrant. That it does change its ground with the seasons is true; but then it is only a little way, namely, from the close vicinity of the house to the nearest copse. Some indeed may shift from the cold districts to the warm when the cold weather sets in; but there is no reason to suppose that any of them take long journeys, and especially that they pass beyond sea. They are at all times birds of short flight, and very rarely seen upon the wing unless in shifting from tree to tree, or between a tree and the ground.

Although, when they are driven to extremities by the severity of the weather, the redbreasts are the most familiar of birds, yet they have the solitary habits of the genus perhaps more strongly than any of the other species. When they are upon the breeding grounds they are very jealous of each other, and if one happens to approach too near the domicile of another, a battle is the result. Even the young of the year, when they come to the neighbourhood of houses, do not come in society; and it is said that two birds of different broods never perch on the same tree, though this is obviously a point which it is difficult, and even impossible, to ascertain with any thing like certainty.

Unless it be in seasons of uncommon severity, or in climates where the winter is very prolonged, the redbreast quits the vicinity of human abodes, and betakes itself to the woods, sometime in the month of March. It does not depart, however, until there is some action of the spring in the places to which it retires; and if the storm returns with severity, the redbreast comes back along with it. It prefers those places of the woods and copses which are humid, or near marshy grounds, because these abound much in insects and in earth worms, which are the true staple articles of its summer food. The nest is always upon or near the ground, under natural cover if possible; and when this cannot be had close enough, the bird is said to make an artificial concealment with withered leaves. This is what is alluded to in the old ballad of "The Babes of the Wood," though there the bird is represented as covering not its own nest but the bodies of the deserted children; an office which, of course, it would not perform. A hole in the ground, or in a wall, is sometimes had recourse to, when the cover of trees or bushes cannot be had near the surface of the ground. The nest is formed of dry grass and withered leaves, and finished in the inside with finer vegetable substances and feathers. The eggs, which are of a dull whitish colour, marked with waved lines and spots of ash and rust colours, vary from four to seven in number. During incubation the male sings, but by no means loudly or so as to be heard at any great distance from the nest, so that his pleasant though feeble notes are drowned by the more tuneful voices of the grove, which are at this time pealing in full orchestra. As is the case with all the fine-billed birds, the young are in the nest for a considerable time; and the parents are very assiduous in feeding them.

Their food, and indeed that of the whole genus, is not the same in the breeding season as that of the genus *Curruca*, or the true warbler. These last do not of course refuse full grown insects if they can get them; but they do not regularly hawk for such on the wing, their food consisting much more generally of caterpillars. The robin preys much more upon the full grown insects when they are beating about to find among the leaves suitable places for depositing their eggs. In this way, the good which the birds of this genus, and especially of this widely distributed species, do to the woods and copses is very great; for the capture of one parent insect ready to deposit her eggs may be reckoned equal to the cap-

ture of a thousand caterpillars, and the caterpillars which the birds pick from the leaves, and other parts of the trees, have always done some mischief before the birds can find them, generally before the sylvan warblers of the summer betake themselves to the groves, or even before they arrive in the country.

But the redbreast does not confine itself to the insects which it captures on the wing, or by hovering about the leaves till its opportunity arrives; it descends to the ground, where it captures multitudes of worms and ground larvæ, and also the mature of these,—Gaffer Long-legs for instance, and the other *tipulæ*, which are so destructive to the rootlets of herbaceous plants, and also the small jumping beetles which destroy the seed leaves of turnips and other dicotyledonous plants.

Thus, when the robin, having sung the vespers of the one year, and the matin song of the other, amusing us with the familiarity of its manners during the pause of nature between, leaves us for a season, and the performance of its own seasonal purposes, it does not quit our service; but works as diligently for the conservation of the vegetation of the grain, as it does for that of the garden and the home shrubberies during the winter. Indeed the whole of the *sylviadæ* are great conservators of vegetation, protecting it from foes which no human skill or labour can reach, and exerting themselves with an assiduity which not the most zealous and persevering of the human race could by possibility undergo. Try to pick the aphides, one by one, from a single rose-tree, or the caterpillars from a single cabbage or cauliflower, which has been planted in the wrong soil or situation, and he will have some idea of the labour which is performed by the fine-billed birds. Then it appears as if nature had endowed them with their sweetness of song, in order that men might be melted by their melody, and so spare them that they may do good. This is the fact in many more cases than we are aware of; and there are few facts in the whole range of nature that are more delightfully instructive. Those in the animal kingdom are, of course, the most striking, because animals themselves draw the general attention more than the productions of the other kingdoms of nature. Now it will not fail to strike any one who devotes but a moment's attention to the subject, that those animals which do not in any obvious way work for the good of man, always retire from places as they become peopled and cultivated; while those that are eminently useful not only stay, but increase in numbers, and follow cultivation into places in which they were not to be found so long as those places were neglected. Thus, in Britain, while eagles and ravens, and also the wild mountain game, and the long-legged fishing or scavenger birds by the waters, are all very much confined in locality and diminished in numbers to what they once were; on the other hand, the field and woodland game birds, the partridges in the fields, and the pheasants in the copses (though the latter are imported birds), have multiplied greatly; and the warblers have extended into districts in which they were formerly unknown. Now, in all instances in which such changes take place in the children of nature adapting themselves to the progress of art, we may rest assured that the animals which diminish in numbers or disappear, are not wanted in the state of culture, and would be injurious if they were to remain in numbers. Those again which remain where cultivation extends and improves, always have some useful office to perform, whether we understand the nature of that office or not. Even they may be in excess, however, beyond what is required for good, and then the surplus must do mischief; but this is a point upon which we cannot, in the nature of things, obtain perfect information; and therefore we must not come to any positive conclusion respecting it. Of the general good done by the *Sylviadæ*, there can, however, be no doubt, and there can be as little as to the particular advantages of the summer labours of the redbreast.

But its winter labours are scarcely less valuable. It comes to the gardens, orchards, and vineyards early in the season; and although it plunders the grapes to a considerable extent there is hardly any thing in common gardens and orchards to which it can do much harm. Its bill is not formed for cutting and dividing large substances; and therefore the leaves of the mountain ash and other analogous trees, none of which are of much value to man, are the chief subjects of its vegetable plunder. Vegetables, indeed, are a secondary object with it at all times, and it never has recourse to them, if it can find insects or worms, even at the expense of far more labour than the vegetables would cost. This is the great foundation of its value in the garden and near the house in the autumn, the winter, and the early spring. It is one of the most industrious of birds, the first to begin its work in the morning, and the last to give it up in the evening.

Its early arrival in the autumn is of particular value. It comes long before the air is freed of winged insects for the season; and it watches them with assiduity, and catches them with certainty, when they resort to those places where they deposit their eggs. It is understood that the young birds are the first to appear near houses in the autumn, and that they break into song, in consequence of the food which they then eat, and the temperature of the season jointly bringing upon them a sort of forced act of that energy which is to come into full vigour and exercise in the spring. Be that as it may, their song in the autumn is exceedingly pleasant; because amid the decline of the year it sings of hope and prophesies that the spring will again return.

The natural cause which brings it so constantly and so closely to the dwellings of mankind, is the number of perfect insects which are kept alive by the artificial heat of such places. These are chiefly, if not wholly, females; for the males of insects are something like the anthers of flowers, they perish as soon as the function for which they are appointed is performed. But the females have a longer duration: they have the eggs to deposit; and, if no casualty overtakes them, they do not perish until that is performed. In countries where the seasons are very marked, the cold often comes upon them before the eggs are laid; and it appears that they are under some special protection of nature while charged with this important trust. When the cold overtakes them they become dormant, until they are aroused to activity by the return of warmth. Some of them, as for instance the bees and wasps which form annual colonies, remain in this dormant state all the winter; but there are many others which habitually deposit their eggs and perish, of which a considerable number become dormant in a temporary way, but are ready for being called into activity by any natural or even artificial increase of temperature. The redbreasts are not only on the

alert to capture those insects when they appear on the wing or in motion, but search for them in the chinks of walls, the clefts of trees, and all other hiding places in which they are likely to be found. The insects which are so captured by the birds, are all matured females ready for depositing their eggs, and as we have said—and it is an under statement—the destruction of one mature insect in this state is equivalent to the destruction of a thousand larvæ, the advantage which the redbreasts give at this season, are almost beyond the power of calculation.

Besides its direct usefulness, which is thus very great, there is something very pleasing in the familiarity of the redbreast. If it is fed with crumbs of bread, or little bits of meat in the window sill, it will not only return while the storm lasts, but it will, as is said, come back year after year to the very same place. In the cottages of the upland places in the north, where there is no regular chimney, and where in consequence it is often necessary to keep the door open in order so to confine the acrid smoke of turf and wood to the upper part of the house as that the people may be able to breathe, the robin will, after a few pauses and lingerings in the porch and at the threshold, come hopping on the floor, and even show the same familiarity as if it were one of the family. This is a little curious ; for the bird which is thus familiar with man and his dwelling, and which will perch on the shoulder of a person sitting still, or on the back of a dog lying by the fire, has less familiarity with birds in general, and with those of its own species in particular, than almost any other that can be named. Innumerable anecdotes of it have been printed, and there is probably no person who has been familiar with the country, or even with the straggling outskirts of towns, who could not, if so inclined, add to the list. The progress of its familiarity is well told in Thomson's "Winter"; but the tale must be too familiar to every body for needing to be repeated. We shall only allude to one instance, in which the bird appears to have taken up its regular abode in the house for the winter, and yet returned to free nature in the spring. In November 1788, a redbreast, shivering with cold, tapped at the window of M. Gérardin. The window was opened, and the bird perched with the utmost confidence on the back of an elbow chair near the fire. When it had recovered from the effects of the cold, its first occupation was to attempt catching the few house flies which had been awakened from their dormancy by the warmth of the apartment. It was fed upon crumbs of bread and small shreds of boiled beef; and so well did it like its lodging and board, that it not only remained during the winter, but sung its hymns of gratitude as cheerfully every morning as if it had been perched upon a twig in the spring. It was particularly familiar with M. Gérardin ; and although it did not actually assist him in his studies, it amused him while engaged in them. It perched upon his desk, and sometimes on his left hand while he was writing ; in short, it was more familiar and at home than the majority of birds which are reared from the nest with the greatest care. In all this, however, there was not the slightest degree of attachment, but merely a very powerful instinctive attention in the bird to its own personal comfort—which is one of the most necessary, and therefore one of the most powerful, instincts in all animals; for when the season came round, and the impulse of nature called it to the woods, it flew away and returned no more.

If circumstances render it necessary for the redbreast to build its nest and rear its brood near the habitation of man, it shows the same attention to its own occupation, and the same indifference to what they may be doing in its close vicinity. They may work, and hammer, and make as much noise as they please, without in the least disturbing the bird, if they do not invade the place of its nest. Indeed, it hops about near them, and scrutinizes with curious eye, as if it devoted a part of the leisure of its own active life, in superintending and seeing that they perform their task with equal assiduity.

This familiarity and curiosity often costs it its life ; for they make it very apt to run into the snares of the bird catcher. In Britain this is rarely taken advantage of, because though redbreasts are very common they are not very numerous at any particular spot ; and the only small birds that will repay by their flesh the trouble of catching them in Britain, are those that flock numerously on the fields in the winter ; and even they are attended to in particular places only. But it is different on many parts of the continent with little birds generally, and with the redbreast in particular. In many parts of France, and in particular in the valley of the Moselle, redbreasts are very numerous in the autumn, being attracted in great numbers to the vineyards. The catching of them is there a considerable trade. They are mostly carried to Paris, where they are held in very high estimation by epicures ; but they must be carried very quickly, as they lose, in four and twenty hours, the flavour for which they are so much esteemed when recent.

The Blue-throated Warbler (*S. suecica*) has been already described at some length, in this work, under the name BLUE-BREAST, and with the synonymes of "Fantail" and *Pandicilla*. We have little to add to the description given in that article. The bird is far more numerous in the north of Europe than the redbreast, and it is found in much higher latitudes, and at greater elevations upon the mountains. It is much more of a marsh bird than the redbreast, and not quite so much of a woodland one. Its nest is very often in the cover of the dwarf birch, or the heath, and generally among the wild willows which creep along by the sides of the mountain-pools, rather than in the woods properly so called ; and in winter, though some of the birds descend to the low country, the greater part migrate to the south. It has not the familiar habits of the redbreast. In those situations where it has only low and creeping bushes as a cover to the nest, with no trees in the neighbourhood, it does not, at all times at least, sing from the perch, but rises to a small height in the air, and sings hovering on the wing. Its natural song is sweet, and contains a very considerable number of modulations ; and, from one or another of the birds, it is heard all the night long—we speak of Lapland, where the night has no darkness. It is then that its song is most pure, for it is a great mimic, and when the other birds around it are in voice it imitates them all in succession. The Laplanders are very loud in praise of its musical powers, probably because song-birds are but few there ; and they may prefer it, as they do, to the nightingale, upon the same principle that the Highlandman gave preference to the hooded crow, one of the most husky-voiced birds in existence, over the parrot :—"She speaks better Gaelic in the Heelands than ta creen dtoo that will no be there." It is rare in middle Europe, and still more so in the

south; not appearing even in Germany, except in the winter, or in Britain, except as an exceedingly rare straggler on the eastern coast. Insects are its chief food in the summer, and wild berries in the winter.

The Redstart, Red-tailed, or Brown-tailed Warbler (S. phœnicurus). This bird is better known, and therefore more interesting, in the middle and more southerly latitudes than the former. It has been made the *name bird* of one of the modern genera, by raising the specific name *phœnicurus* to generic honours. Now, even as specific, this name is not very happy on various accounts. In the first place, the colour on the bird is not red but reddish-brown; in the second place, this brown is not so red on the tail as it is on the lower part of the back and rump, and on the fore part of the belly; and in the third place, the tail-feathers are not wholly reddish-brown on the upper side, the side from which the colour of the tail ought to be described, if it is to be described from colour at all. But, besides these objections, there is a more weighty one, namely, many other birds have the tail much redder than this one; and thus, though it is the most red-tailed of Cuvier's *Sylvia*, and therefore correctly enough styled the *phœnicurus* among them, the pointing of it out generically as the red-tailed bird is ludicrously absurd, just as calling the blue-throated warbler *Pandicilla* is "flat burglary as ever was committed" on the tail of the peacock, worse than "accusing the lady Hero wrongfully."

The red-warbler or red-robin (for one or other of these seems to be its most appropriate English name) is a bird of rather less than half an ounce in weight, and five inches and a half in length. The bill and feet are black; the irides hazel; the front white; the top of the head, back of the neck, and upper part of the back, bluish-grey; the cheeks and throat black, the black extending on the sides of the neck and the upper part of the breast; the rest of the body red-brown, which is deeper on the lateral feathers of the tail, and the two middle feathers of the tail and the quills blackish-brown.

As a British bird, this species is only a summer migrant, a common one in the south of England, and along the eastern part of the valley of the Severn; but more rare in the north-east, and very rare in Scotland, occurring only in the counties on the Solway Frith, and the valley of the Clyde, and some parts of the Lothians, not frequently in these. Like many of the summer migrants, it is not found in the south-west of England, where indeed we could not expect to find those birds which migrate by short flights, which appears to be the case with all the fine-billed migrants of whatever genus. Syme says, he has "frequently met with it in the neighbourhood of Edinburgh. Though a very shy bird, it often approaches and builds near the habitations of man, and constructs its nest in places that we should scarcely expect so timid a bird to select for that purpose. At Craigcrook Castle, near Edinburgh, we found its nest in a hole of a wall, close by an old gateway, through which people daily pass to the castle; it was placed within reach of the hand from the ground. These birds often haunt gardens, orchards, and shrubberies; but they also frequent solitary situations among rocks, crags, and woods, where they build in the crevices of dangerous ravines and precipices. Though wild and timorous birds, they are often found in cities, but always selecting the most difficult and most inaccessible places for the important work of incubation. If the eggs are touched by the hand, unless the hen has sat for some time, she will forsake the nest and build again."

We have quoted this passage, which has been quoted by others, not certainly as recommending the soundness of the doctrines which it contains, and still less with any intention of criticising the style, though certainly it is very open to criticism. We are aware that Mr. Syme's observations were well made and faithfully reported, because he looked upon nature with the eye of a very clever painter, capable of discriminating the most minute details. But he has totally misunderstood the character of the bird, and therefore his conclusions are the very opposite to those that naturally follow from his premises. The nestling in the gateway and in the cities are no characters of a "timid" bird, whatever they may be of a bird of hidling habits, and solitary as regards other birds, whether of its own species or of any other. This is farther corroborated by the ease with which the bird can be tamed, and the readiness with which it recognises those that feed it. Its disposition, as well as all the essential points of its organisation, are the same as those of the redbreast; and the chief difference is in latitude, and in the season of the haunts. In those parts of Britain to which the red-warbler comes in any considerable numbers, it changes guard with the redbreast, occupying in summer nearly the same places which the redbreast occupies in the winter, and performing services not very dissimilar. This, by the way, shews us the great superiority of Cuvier's arrangement of animals according to their general structure, over even the mere species classifications of those who first make the system and then try to make the animals fit it; for if ever there were two birds with distinctions sufficiently specific, and generic characters identically the same, the redbreast and red-warbler are they.

This bird does not, in general, inhabit so near the water, or so much in the copse, and feeds much less upon worms, or any other prey that it can hop after on the surface of the ground. But the red-warbler hops much more up and down, for short distances in the air, than the red-breast does, and it is for the purpose of enabling it to do this that it has the more powerful action of the tail, and has the tail larger and stronger in proportion.

Buffon called the red-warbler "the wall-nightingale," and the name has been retained by many of the French describers, who, like our own, have often fully as much penchant for the *magnifique* as for the accurate. The song of this bird is a sweetly plaintive little song certainly, but it has not a touch of the brilliancy and heart-thrilling song of the nightingale. Besides, it is a morning song in its finest effect, and not begun till that of the nightingale ceases. It is a bird of holes and corners, but it is a very pretty bird; and it is a bird of romantic places. It comes to us in the middle or the latter part of spring, and takes its departure about the autumnal equinox. The eggs are numerous, amounting to six or eight; and, as is the case with the rest of the genus, the young continue long in the nest, and require a great deal of feeding. All the birds, indeed, which come to sing to us in the summer, come also to work; and they reprove those human beings who neglect the more important duties of their situations for empty for-

mality and idle song, a habit to which the vain and half-educated are but too prone. The following passage, from "Sweet," is of value, but we omit his inferences:—"In confinement it soon becomes very tame and familiar, and will be much attached to the person that feeds it; if brought up from the nest, it may be made to sing any tune that is whistled or sung to it. One that I was in possession of some years back, learnt the Copenhagen waltz, that it had often heard sung, only it would sometimes stop in the middle, and say *chippee*, a name by which it was generally called, and which it would repeat every time that I entered the room by night or by day. In winter it would generally begin singing in the evening, as soon as the candle was lighted, and it would sing as late as eleven o'clock at night. In spring, when it first arrives in this country, it mounts to the top of the loftiest trees, where it will sit and sing for hours, beginning in the morning at day-break."

The Blue Robin (*S. sialis*), an American species will be found described as the Blue Bird, to which article the reader is referred.

The Black Redstart, or *Blue Robin* (*S. tithys*), is nearly of the same dimensions as the common redstart, but different in colour and in geographical distribution. The upper parts are of a bluish ash-colour; the cheeks, the space between the bill and the eye, and the throat and breast, are black; the belly and flanks are deep ash; the middle of the under part, between the black and the ash, is white; the under tail-coverts, and the rump and upper coverts of the tail, are bright red; and the two middle tail-feathers are brown, with red margins; the greater coverts of the wings have white borders; the first quill is short, and the fourth and fifth are the longest in the wing. The female has the upper part dull ash-colour; the under coverts of the tail reddish yellow; and the rump and upper tail-coverts dull red. The young of the year have a good deal of resemblance to the female, only the ash-colour on the under part is not so bright. This species has occurred in Britain as a straggler, but it is exceedingly rare, and, in fact, one of those birds which it would be in vain to look for in any part of the country. Even on the continent it is a rare bird, at least in those countries where the habits and characters of birds have been much attended to. It is more common in the south of Spain, we believe, than in any other part of Europe, and we may presume that its habits are not very different from those of the redstart; but we have no information to be depended upon respecting this subject.

In the bluebreast, the common redbreast, the redstart, and the black redstart, we have a succession of four species of birds occupying, as their principal habitats, four zones in latitude, beginning at the extreme north of Europe, and terminating at the extreme south, but alternating less or more with each other in all the middle latitudes. On the continent those blendings are much greater than they are in England, or all the birds are of comparatively short flight. We have the one which is at each extremity of the series only as a very rare straggler; the most northerly of the intermediate ones as a common resident, but shifting within the country with the seasons; and the most southerly of them only as a summer visitant in the more southerly parts of the country. There are not many birds which keep up so gradual and regular a series over such an extent of latitude, and at the same time have their generic character so clear and definite.

There are various foreign birds which have a considerable resemblance to these, but little is known of the majority of them further than as museum specimens, so that they have little or no interest for the general reader.

3. Curruca—warblers properly so called. These are the true sylvan songsters, and the birds of sweetest notes that are known. An account of them will be found in the article Curruca, in various other articles referred to from that one, and in the article Nightingale, so that more need not be said of them here.

4. Anthus—Pipits. An account of the leading species of these will also be found in the article Anthers.

5. Regulus—Crested Wrens. These are very small, but exceedingly energetic birds, differing in the form of the bill, and in some other characters, from the more conspicuous and typical birds of the family, but still they agree with the majority in their leading habits. The bill, instead of being cylindrical to near the lip, as in the others, is conical, converging to a very fine point, and when it is seen from above, the outlines of the sides are concave, a form which gives it considerable stiffness, notwithstanding its very small size. These birds are accurately known only as European birds; indeed, their dimensions are so small, and their usual habitations so far out of the way of common observation, that they are but seldom seen. We shall confine our notice to these two species.

Golden-crested Wren (*R. auricapillus*). This is the smallest, not only of the British, but of all European birds. The average weight is only about eighty grains troy, so that it would take seventy-two of the birds to weigh a pound. The length in the feathers is about three inches and a half, and the stretch of the wings about five inches; but, when the feathers are taken off, the length of the body does not exceed an inch. It is a very handsome little bird. The upper parts are green, clouded with ash-colour on the hind part of the head and neck; the forehead, the chin, and a space round the eyes, are whitish; the under parts are brownish-white, paler on the middle of the belly, and with a slight tinge of yellow there; the quills are dusky, with greenish margins, and the secondaries have a black hue on the base, above which there is a white one on the coverts; the tail is a little forked at the extremity, and composed of dusky feathers with greenish yellow edges. The most remarkable character of the plumage, however, is the crest on the head. It is longitudinal along the top of the head, and composed of two double rows of feathers, a little distant on their bases, but inclining toward each other at the tips; the external ones on each side are deep velvet black, and the internal, which are longer, and rise over the others, are bright golden yellow, so that the crest, seen sideways, appears like a golden coronet on a black chapeau. The contrast of the two colours is particularly fine. The female has the crest much less prominent, and the young are entirely without it till after the first moult, which takes place in the autumn.

The crested wrens afford a very forcible illustration of the absurdity of associating energy and power of endurance with mere quantity of matter, as we are but too apt to do. Those who fall into this mistake

would be very apt to imagine that this delicately-formed little creature must be the feeblest of all the birds of Europe, and confined to sunny climates and flowery banks. But the very reverse of this is the case. The raven himself, generally as he is distributed, and able as he is to bear the storm, is not more hardy than the golden-crested wren, and the labour which he has to perform is far less severe and incessant. He finds large prey, and, having gorged himself, he dozes, and he at all times uses the wing as little as ever he can, except as a parachute to soften his coming to the ground when he hops. This little bird, on the other hand, is almost incessantly on the wing, beating about among the buds and leaves, hanging by the feet in all sorts of positions, and capturing minute insects and larvæ with wonderful adroitness, but always with the wings ready to act and float it speedily through the air to any new part that he may wish to occupy. In summer it is exclusively a forest bird in most places; but, as it inhabits to the full extent to which the forests reach in the high latitudes of the north, it is sometimes found in lonely bushes. It occurs in the wooded districts of the whole range of Europe, and also of Asia, being met with in the latter quarter from the woods nearest to the Arctic Sea to the woods of India, though it is not to be met with in the central deserts, or anywhere in places of an arid character. It is also found in America, though there, according to Wilson, it is rather larger in size than it is in Europe; and, indeed, the one which he describes as being a common migrant in the United States is, in all probability, the other species, the fiery-crested one; but there is little difference between them, except in the colour of the middle feathers of the crest, the shade of colour on the back, and the size.

These birds are very numerous as well as very generally distributed; and in places where they migrate they appear in great numbers on the middle grounds of their range during the autumnal months. With us in Britain they are found in most wooded places, and they do not appear to have much of any kind of migration even within the country, except a migration such as that which the redbreast has; namely, to the neighbourhood of houses in very severe weather, and to the wood and the copse at other times. It does not, however, come to the close vicinity of houses so early or so regularly as the redbreast, neither does it continue so long there, or enter the house in search of food, though it is any thing but a bird of shy disposition. It is a bird of much more resource than the redbreast, adapted for seeking its food at the tips of those slender twigs which would not bear the weight of any other bird. Its conical and keenly-pointed bill, too, is admirably adapted for digging into the crevices of the young bark, or the hybernacular scales of the young leaves, and bringing out any larvæ or insects that may be lurking there. The pine family are very liable to have the terminal buds attacked by insects, whose punctures let out the substance of the tree, which, instead of swelling the buds and producing shoots, falls in an unseemly powder upon it; the tree, though it does not die immediately, and may stand half living, half dead, grows no more. This most commonly happens in trees which have been only a few years planted where the soil is too thin and dry; and, if they have been once attacked, there is no alternative but to grub them up, for they never recover. The writer of this article has seen a plantation of Scotch fir which, having suffered an attack of this kind, remained more than twenty years without increasing a single inch in height; and indeed the progress seemed to be that the life of the tree went out branch after branch, the lateral branches continuing to make shoots of normal length, just as one may see in a peach-tree attacked by the aphis, until they were extinguished one by one.

The points of the twigs of these trees can scarcely be reached by any other birds; and thus the crested wrens, small as they are, are of no little use in the pine forests; and we find that these forests are their chief places of resort, though they are not confined to them, and quit the more northerly ones in the winter. They are also partial to oaks; and as the oak is never found in those very cold and upland places where the pines are in general most abundant, the birds remain in them during the winter, which is the proper season for observing them, as in summer they are concealed by the leaves. The male is in song only in the spring, and the song, though not disagreeable, is feeble, so that it is not heard at any distance, and can be barely heard at the foot of a lofty tree when the bird is near the top. The nest is elaborately constructed with moss or lichens, formed and matted together with hair or wool, and lined with small feathers. It is very warm and compact, but without any dome, the entrance being at the top. The eggs are rather numerous, being from six to ten or eleven, of a white ground with a tinge of pink, scarcely marked with any clouds or spots, but becoming gradually darker toward the thick end. They are so small that it takes about fifty of them to weigh an ounce. The parent is very attentive in feeding the young birds, and continues her maternal care under circumstances which evince an exceedingly strong attachment. A remarkable instance of this is mentioned by Colonel Montagu from his own accurate observation. The pair had built their nest on a fir-tree in his grounds; and, though the male sung regularly during the incubation, he ceased as soon as the young were hatched. This is the case with almost all birds in which the male takes any concern in the rearing of the young; but the notion that song birds teach each other was not then exploded, and so the Colonel took the nest and young when six days old, and placed them in the window of his study, with a view to ascertain the fact, and to observe the mode of schooling, if such there should happen to be. The male never uttered any sound during the course of the experiment, except his chirping call-note when the female came in sight; but the economy of the birds was well observed. When the nest was placed outside of the window, the birds came readily and fed the young ones; after this, it was placed inside the window, and again toward the opposite part of the room, the window being left open. In both situations, the female came fearlessly to the nest and fed her little ones; and the male accompanied her to the outside, and waited there till she came out; at first he appeared with food in his bill as well as the female; but after a time he brought none, but merely attended his partner. One part of this is so characteristic, that to abridge it would be injustice both to the observer and the birds. "The female would feed them at the table at which I sat, and even when I held the nest in my hand if I remained motionless. But on moving my hand one day, while she was on

the edge of the nest, which I held in my hand, she made a precipitate retreat, mistook the open part of the window, knocked herself against the glass, and lay breathless on the floor for some time. However, recovering a little, she made her escape, and in about an hour after I was agreeably surprised by her return, and she would afterwards frequently feed the young while I held the nest in my hand." Her assiduity in feeding the young was perfectly astonishing, and gives us a very striking idea of the immense labour that some birds must undergo. "The visits of the female were generally repeated in the course of a minute and a half, or two minutes, or, upon an average, thirty-six times in an hour; and this continued full sixteen hours in a day, which, if equally divided among the eight young ones, each would receive seventy-two feeds in a day, the whole amounting to 576." Each feed was about a quarter of a grain, so that each of the young had about eighteen grains in the day, or not much less than a fourth of the weight of an old bird to each of the young every day. This female was as attentive to cleanliness as to the supply of food, and bore her severe labour with the utmost cheerfulness. The labour was of course much more severe than if the nest had remained in a state of free nature, for in that state the male would have borne a part, probably nearly the half, though from the fact of his not venturing into the room it is evident that his attachment to the young was weaker.

When the winter sets in severely in the countries which are covered with woods, both to the north and to the south of the Baltic, these little birds take advantage of the wind, and migrate southward in great numbers. They are, however, much more at the mercy of the wind than birds of larger size, even supposing the specific gravity, or weight, bulk for bulk, to be the same in both. This is a point which is worth knowing, though it is one which is generally overlooked; supposing the forms of two birds to be similar, and their specific gravities the same, then the weights are as the solidities or cubes of the same dimension, while their resistances are as the squares. For instance, suppose two birds the same except in bulk, and the one twice as long as the other; then its weight as resisting the action of the wind will be eight times that of the small bird, while the effect of the wind upon it will be only four times that on the small bird. Thus the bird which has double the dimensions has double the advantage; and generally the power that birds of equal specific gravity have to bear up against the wind is according to their dimensions, supposing that they are similar in form, and without any reference to the power and structure of their wings.

Small birds are generally, however, much more disadvantageously adapted to the wind than this. Thus making allowance for the greater length of tail, the golden crested wren is about one-twelfth the length of the golden eagle, and thus the purchase of the wind on the eagle is 144 times as much; but the resistance of the eagle is 1728 times as great as that of the wren; and therefore the eagle, without regard to the structure of her wings, has twelve times as much power in the pursuit as the wren. This is as against the wind; for with the wind the advantage is exactly reversed, and will help the wren forward with twelve times the energy that it helps the eagle. Flying on a side wind, the wren will make more lee way than the eagle at all angles to the wind; and if the wind is nearly dead against them and blows a gale, they are driven before it like chaff. Selby mentions a case of the wreck of an immense number of golden-crested wrens by a strong gale in the autumn of 1822. The wind was first at north-east, which must have caused them to make lee way westward; and then shifting to south-east, it took them a-head and drove them on the coasts of Northumberland and Durham, along the whole line of which they extended. It is by no means unlikely that a fresh colony of the birds may come to Britain from the northern parts of the continent of Europe every severe winter; but whether they usually return back again to the north, or stay in whole or in part to increase our home stock, has not been, and probably cannot be, ascertained with any certainty.

The fiery-crested Wren (R. ignicapillus) is by no means so common as the other; and it is very lately added to the list of British birds, and was so added by the ornithological talons of a cat. The whole tabby race have been long known to possess a great natural genius for ornithophagi, so much so, that if the cat can find birds enough in the shrubbery, the mice may lord it in the larder as they please; but just as the march of intellect, and the effects of education, converted the natural cannibalism of man into the noble science of war, in which the hero does not kill his fellow man for his own eating, but for the glory of a royal master, or the exaltation of a grateful country, even so a most famous tabby in the possession of an intelligent and amiable naturalist at Swaffham, was schooled to capture birds, not for her own eating, but that their stuffed skins might become ornamental in the museum of her master. It is true that she was allowed to eat up the common fill as the wages of her labour, just as the warrior eats up, in another sense, the common fill of that country for whose glory he slaughters away at so valiant a rate; but before this was done it was *Le roi le veut* in the one case as in the other. Well, in the course of her scientific labours, this cat brought home a fiery-crested wren just at the season when those birds breed. The trees were sought, the nest was found, other naturalists beat other bushes whether with or without the aid of felino sagacity and claws; and the result was that the fiery-crested wren is by no means a very rare bird in the southern parts of England.

In its habits, this bird appears to differ little from the golden-crest; but it is larger in size, and not so familiar in its manners, neither has it been found in such cold places as the other. On the continent, it is much more numerous than in Britain and also much more migrant, although it does not occur in such numbers on its autumnal flight as the other. Small as the other is, for, as we have said, there are six dozen birds to the pound, it is highly relished by the ornithophagi in some parts of central Germany, and the capturing it by means of calls, which it readily obeys, is a regular trade in the season.

The top of the crest in this one is bright and glowing fire-red, with three black streaks divided by two white ones on the base at each side, whereas the golden crest has only one black streak. This is only a trifling character, but it seems to be quite constant in the species. The bill is also thicker at the base, and larger and stouter in its whole length.

It is very probable that this bird had been often seen before the singular discovery of it by the cat, but that it had been confounded with the other and much

more common one. It is also probable that the crested wren of North America is a different species, although it resembles the fiery crest more than it does the other eastern species. It is about four inches long, and six and a half in the stretch of the wings, and one half heavier than our gold crest, being about one hundred and twenty grains, while ours is eighty. The upper part is yellowish olive, with grey on the hind neck, a white line passes across the forehead and over the eyes, above this there is a line of black extending the whole length of the top of the head, above this again the yellow, and, where the yellow feathers of the two sides meet, there is a line of bright fire red, so that the bird is both golden and fiery in the crest. The two lobes which form the crest, open and shut at the pleasure of the bird, and have a very pretty effect when it is whisking about among the leaves and twigs. From the gape to the eye is dotted with black, there is a white spot under the eye, then a black line extending as far as the ear covert, and a white one below it. The breast, the flanks, and the vent feathers are cream colour; the wings dusky, with yellow margins to the quills, white tips to the greater coverts, and a black line immediately under them. The tail is long, forked, of a dusky colour with yellowish orange margins to the lateral feathers. The legs are brown, the feet and claws yellow and the bill black.

In the middle states of the American union it is a regular bird of passage, arriving from the south about the first of April, and continuing through that month and part of May, by the close of which the whole have disappeared. They return again in October in much greater numbers, and are particularly active and useful in clearing the copses and orchards from insects. At that season they are in excellent condition. They continue in the central states till the winter sets in, and then they move southward to the cedar swamps and other wooded places near the sea and the rivers of the southern states.

Their migrations in America are so regular, and their numbers so considerable, that they are a good subject in which to observe the general habit of migration, especially in its different characters upon the middle passage at the two seasons. On their spring passage, the birds are excited by the physiological impulse, and they keep moving onwards, and pass over the ground in succession, so that they do not appear so numerous at any one place as they do in the autumn, at which time their chief object is food, and where they find that in abundance they remain till it is exhausted, or till the severity of the weather shuts them out from it or otherwise obliges them to retire. Autumn is also the season of plenty; but that alone is not the reason why birds and other animals are in best condition at that time; for much also depends upon the fact that the whole energy of their nature is concentrated upon the operation of feeding.—In the middle states of America this wren never sings, its voice being only a very feeble chirp; but it is a songster, though a very subdued one, in the more northerly places in which it breeds. *Wilsonii*, or *Auriflamma*, ought perhaps to be the name of this one, to distinguish it from the crested wrens of Europe.

The Ruby-crested Wren (*R. calendula*) is another American species, very similar to the former in size and in habits, but not just exactly the same. The upper parts are nearly the same colour as in the preceding species, only more inclining to yellow, and with no grey on the hind neck. The dark colour on the wings and tail is purplish brown instead of dusky, and the under parts are yellowish white. The coloured part of the crest is a spot of bright ruby red; which is alternately hidden and exposed by the feathers at the sides. The feet are of the same colour as in the former species, only the yellow is a little brighter. They come rather earlier in the spring into the middle states, and they are rather later in the autumn; and probably they breed farther to the north. They are exceedingly active in the trees, and clear them of vast numbers of insects, though in the spring they stand accused of eating the essential parts of the blossoms of early fruit trees. In this, however, there is probably the same mistake which is often made respecting the tits and some others of the more active and useful birds of our own country. Wilson says they "are particularly numerous in the month of October, and the beginning of November, in orchards among the decaying leaves of the apple trees that, at that season, are infested with great numbers of black-winged insects, among which they (the wrens) make great havoc. I have often regretted the painful necessity one is under of taking away the lives of such inoffensive, useful little creatures, merely to obtain a more perfect knowledge of the species; for they appear so busy, so active and unsuspecting, as to continue searching about the same twig, even after their companions have been shot down beside them. They are more remarkably so in autumn, which may be owing to the great number of young and inexperienced birds which are then among them; and frequently, at this season, I have stood under the tree motionless to observe them, while they glanced among the bare branches, sometimes within a foot or two of my head. They are extremely adroit at catching their prey; have only at times a feeble chirp; visit the tops of the tallest trees as well as the lowest bushes; and continue generally for a considerable time among the branches of the same tree, darting about from place to place; appearing, when on the top of a high maple, no bigger than humble bees."

The above quotation contains by far the best account of the autumnal action of these birds that has ever been published; and it is not confined to the ruby-crowned species, but applies equally to all the rest. Wilson is not quite correct in supposing that the fearlessness of the birds in autumn is owing to the *inexperience* of the young, for old and young are equally fearless, and equally unaffected by what we call experience. In the autumn the whole energy of the bird is, as we have said, concentrated upon its feeding; whereas in the spring it is actuated by another impulse, along with which there is awakened that vigilance which comes to its full development at the time when the birds leave their nests and young. What we are accustomed to call the results of experience in birds, are all produced by the circumstances in which they are placed at the time, some of which are local as arising from the place, and others seasonal as arising from themselves.

There is a fine instance of natural adaptation to be traced here. Autumn is the time when the bud-protecting birds are most on the alert; and have no impulse to draw their attention from their labour; and autumn is the time at which that labour is most valuable. It depends in a great measure upon the character of the weather in the spring, whether the

insect egg which is lodged in the bud shall become a wasting canker-worm or not; but if the egg is there there is never any security against the grub. Now the larvæ or grubs which destroy the buds, especially the flower-buds of fruit trees, are all produced from eggs which are deposited in the autumn; and each of the millions of insects which these little birds capture, is the means of preventing the deposition of a vast number of eggs. If, therefore, there is any one time at which the birds which range the twigs and buds claim our especial protection, that time is the autumn; for he who wantonly shoots one little bird in the orchard during that season, is almost certain to pay for his sport; not only by a bushel of next year's apples, but by serious injury to the trees.

With us, these autumnal labours are not performed so much by the crested wrens, as by the tits (see the article Tit); but our crested wrens are of great service to the copses and woods, especially to the pines and other trees that have their leaves on in the winter. The leaves of such trees are seldom so much eaten by insects as those of deciduous trees; but the buds of the pines especially are very subject to ravages; for the shoot of the pine is produced as wood before there is any development of the leaves or spines upon it; and until these have made some progress it is tender, sweet, juicy, and no bad vegetable for human use, to say nothing of insects. Some of the destroyers of these young shoots are flies, and some beetles; but the larvæ of both are exceedingly destructive, and would be quite ruinous were it not for such birds as the crested wrens, whose energy and light weight enable them freely to examine the minutest twig, and whose voracity fits them for consuming so many myriads of destroyers. It is true that the crested wrens are not exactly the birds which destroy the eggs and larvæ of the *Scolytidæ* and other mining beetles (see the article Scolytus), which fell whole forests and groves with the same certainty as the axe, for the bark birds, creepers, woodpeckers, and others, have the especial regulation of these; but the labours of the wrens are of most essential service in their own particular department.

It is highly probable that there are in the extensive forests of many parts of the temperate and the cold regions, or migratory between the two, other species of crested wrens besides those that we have enumerated; but as the known species differ but little in appearance, and hardly any thing in manner, the enumeration of more, even if they were known, would make little or no addition to our stock of really useful knowledge. Even in those which we have mentioned there is not much diversity of information; but we have endeavoured to point out the account of the habits among all the four; and, minute as the birds are, there are not many that offer a more pleasing study or lead the student into more delightful places.

6.—Troglodytes (Wren). The characters and manners, as well as the form of the crestless wrens, are so far like those of the crested ones, that there does not appear to be much chance of error in applying the same common name to them; but they, at the same time, differ so much that they cannot with propriety be considered as species of the same genus. In some respects the crestless wrens resemble the robins more than they do any others of the family; but they still differ considerably from them. The bill is much more slender, awl-shaped, and a little bent in its whole length: the body is even more short and compact than that of the redbreast. The habits are nearly the same, only the wren is a more hiding bird, which has occasioned the name *Troglodytes*, or a dweller in holes. There are many birds that have been called wrens, which are not true wrens in either their characters or their habits; and so we shall confine our notice to one or two species which properly belong to the genus. They are birds of the cold and temperate parts of the nothern hemisphere.

Common Wren (*T. vulgaris*). This species has been called *Europæus*, but not very properly, for it is equally abundant in the north of Asia, and also, though perhaps with some difference of appearance, (which is usual among similar birds in the two continents,) in the more northerly parts of America. In the middle states it is called the "winter" wren, to distinguish it from another species which comes from the south in spring, as this one does from the north in autumn, and is on that account called the "summer" wren. On the eastern continent it is also known most familiarly as a winter bird, but it is not so migratory as it is in America, and in Britain it, perhaps, seldom migrates farther than between the house and the nearest grove. As a household bird in the cold season, its history is closely connected with that of the redbreast, and popular story has placed the two in the relation of man and wife, "Kitty Wren" being the spouse of red-breasted "Robin." Of course, the paucity of the supposed wives did not occur to the rustics; but if their theory had been true, the robins would have deserved the epithet *Cælebs* far more than the chaffinch, for there are usually fifty robins seen for one wren, and thus the former, did they depend on the latter, would be as badly wived as the folks of Australia.

In its lineal dimensions, the common wren does not differ much from the crested ones, the length being about four inches, and the stretch of the wings about six. The body is also short, and the tail long, though, perhaps, not quite so long as in the crested ones, and it is not forked; it is in general borne sloping upward at a considerable angle with the axis of the body. The weight is, however, fully three times that of the gold-crest, being about two hundred and fifty grains to eighty. It is, indeed, one of the heaviest, and also the stoutest, for its inches, of all the feathered race.

Of course, the bird is fitted for very different action from that of the light and airy crested wrens; for while they are beating about for their food among the buds and sprays, it is generally ranging among, or below, the underwood. It lodges in holes of the earth, of walls, of trees, or in heaps of stones, or under fallen timber; and even during the day it may be seen to leap about by the assistance of its wings rather than to fly. Like the robins, the wrens never formally associate with each other; for in the places where they are most abundant, each individual seems to act entirely for itself. In cold weather, however, several of them may sometimes be found in the same hole; but there is no likelihood of their entering these by mutual consent, and their courage may be so taken down by the cold, that their pugnacity, which is pretty strong and forward at other times, may make them prefer heat to hostility.

The wren is a dusky-looking little bird, and when it moves about in a pile of sticks, or under the leafless brushwood, it might, at first sight, be mistaken

for a mouse. Its bill is about half an inch long, a little bent, of a dull brownish colour, and so slender that it can with difficulty be seen even at a little distance, if not projected against something much lighter in the colour; the irides are hazel, and the eyes, though not large, are full and expressive; the whole of the upper part is reddish brown, clouded with obscure cross bars of dusky, and the under parts are of the same brown, but lighter in the shade; the quills and tail-feathers are dusky brown, and there are very few markings on any part, except an obscure pale streak over the eye, and a few white spots on the under coverts of the tail; the feet are of the same brown as the general tint of the body; and perhaps there are few instances of a more perfect adaptation of the colour of birds of the same family to the places which they inhabit than the fine but delicate tints of the crested wrens on the top of the tree, and the sober livery of this one, which breeds with the mice among the brushwood at the bottom. Insects and earthworms, especially the latter, form at least the principal food of the common wren; and, small as its bill is, we have seen it in a garden pull from the ground an earthworm as long as itself, and nearly as thick as a goose-quill, and fly to the foot of an apple-tree, and, by the process of swallowing alone, bolt it in a very short time. It has been said, though we suspect with no great truth, that the robin cleans its worms. We never saw one so nice in its eating, and certainly the wren takes them as they are.

As a winter bird, the wren has none of the peculiar fascinations of the robin. It comes near to the house, but not in; and it does not appear to be so thankful for crumbs of bread as robin. Altogether it is a much more obscure bird than the other, and seldom appears in open places, or perched at any great elevation on trees. It neither comes so early nor so regularly as the other, and it departs sooner in the spring. The warm and shaded places about which it lurks appear to have a better supply of food during a greater part of the year than the haunts of the robin. It does not do a great deal of garden work on the trees themselves, as the other does; but we must not, for this reason, suppose that it is wholly without its use. Notwithstanding its partiality for hiding-places, there appears to be a good deal of curiosity about this wren; and, indeed, it seems to be a pretty general law among animals, that those which find their food by prying about in obscure or confined places, are very apt to examine everything new with a great deal of attention. Many other birds, which you surprise by walking into the garden or the shrubbery, betake themselves to their perches or hiding-places the instant that they observe you; but not so the wren, for it leaps out of the bush to reconnoitre you; and if you stand perfectly still, it will remain "at gaze" for several minutes; but if you follow it, it moves to two or three places, still eyeing you with a sort of wondering curiosity, till at last it leaps away you know not where. If you keep your first position steadily for some time, the chance is, that it will treat you in a different manner, for it will leap to some perch, not a very elevated one, and salute you with its song, which, though far from a varied or powerful one, is much more shrill and sweet than you would be prepared to expect from a creature so mouse-like in its colour and habits. Cats lie much in wait for wrens where they are abundant, but they do not appear to be so successful in catching them as in catching many other birds; for the cat is found with many robins for one wren even in places distant from towns and near woods, where the two birds are about equally numerous. This is another proof of the very keen eye of this little bird; and we have again and again seen grimalkin get within her distance, and take her spring, but the wren bounded a little aside, and, leaping on a twig, looked down upon her with perfect unconcern. The fact is, that birds of moderate range in the free air are much more frequently destroyed by cats than birds of holes and corners, as they do not appear to have their eyes so much about them, and are more awake to sounds than to sights. It is chiefly in the very severe weather that wrens come to the close vicinity of houses, and at these times they sing, although every other bird is mute, save the querulous and complaining chirp, which has no expression of pleasure to the bird, or pleasurableness to the hearer. In the northern parts of the country, when the snow lies confirmed for many weeks to the depth of several feet over the common pasture of the wren, and the bird must resort to the vicinity of the farm-house, or the bank of the yet unfrozen fountain or stream, it is delightful to see how the little thing joys in the warmth of the sun, leaps upon some projecting point, and pours forth its little song as jocundly as any lark that ever proclaimed the spring from the top of the morning sky.

The nest of the wren is always in a warm and sheltered place, though differently sheltered according to the nature of the ground. Where there are young pines, with branches near the ground, and heath under these, the place is especially favourite, as the pine shuts out the rain almost as completely as a roof. Whether it is the general habit of the bird, we will not pretend to say, because we have intimately studied its economy only in places of a peculiar character; but we never met with a wren's nest under a young pine except on the north or the north-east side. We have not certainly had any personal means of verifying the fact, that the nest is begun at the top and built downwards, neither did we ever see one placed at any considerable height above the ground, though they were all, in a way, a sort of dome nests, with a lateral opening, and so concealed in the underwood as not to be readily found. We have usually found a few small sticks, but these formed only the timbers of the fabric, the substantial part of the external nest being moss or lichen, according as the one or the other was most readily found. The interior was copiously lined with feathers, and never with wool, which indeed it could not be, as there were then no sheep in that part of the country. In districts of a different description, the nest, of course, varies both in situation and materials; for birds, like men, must be contented with such places and materials as they can command; and it is well for both that their Almighty Creator has endowed them with this flexibility to circumstances. Wrens are prolific birds. We never saw more than from six to eight eggs in a nest; but the authorities say that they are sometimes as many as eighteen, and even more, and we see no reason for doubting the authorities—though it were very desirable that no such thing as an authority in natural history existed. The eggs are very small, of a white colour, with the faintest possible pinky tinge over the greater part of their surface, and a neatly mottled band of rust-coloured dots near the larger end.

From Wilson's account, and we can have none more accurate, it should seem that the winter wren of America is a smaller bird than the common wren of Europe, though the colours, and all the other particulars, are so nearly the same as to leave but little doubt as to the identity of the species. It is, however, much more of a migrant, and does not breed in the central states; but that is nothing, as all birds are more migrant in America than Europe. The account of its winter habits, which we shall give in Wilson's own words, would answer equally well for our wren. "During his residence here, he frequents the projecting banks of creeks, old roots, decayed logs, small bushes, and rushes near watery places; he even approaches the farm house, rambles about the wood hill, creeping among the interstices like a mouse. With tail erect, which is his constant habit, mounted on some projecting point or pinnacle, he sings with great animation. Even in the yards, gardens, and outhouses of the city, he appears familiar and quite at home." According to the same authority, the dimensions are smaller than those of the European wren, but the colours are exactly the same.

House Wren, or summer Wren (*T. ædon*). This is the American species which alternates with the former, coming when it returns in the spring, and retiring when it comes in the autumn. It arrives in Pennsylvania in April, and rarely tarries so late as October. It is larger than the winter wren, and different in colour. The length is four inches and a half, and the extent of the wings five and three quarters. The upper part is deep brown, clearer in the tint than that on the other species; but clouded in the same way with transverse markings of dusky black, except upon the head and neck. The cheeks, throat and breast, and also the legs and feet, are clay colour; the under part is spotted with black, brown and white, though these colours do not appear unless the feathers are ruffled. The bill is slightly bent and black, having some resemblance to the bills of the creepers. Both sexes are nearly alike in their plumage.

In Pennsylvania, and the other central states of America, this is a very familiar bird, and one which finds favour in the eyes of the people, from the vast number of insects which it destroys. It builds in hollow trees, or under the projecting eaves of houses, but the people often erect boxes on the tops of poles for its accommodation. These are in or near the garden, in order that the birds may more successfully carry on the war against the caterpillars. "If," says the grand historian of the birds of the United States, "all these conveniences are wanting, he will even put up with an old hat nailed to the weather boards, with a small hole for entrance; and, if even this be denied him, he will find some hole, corner, or crevice about the house, barn, or stable, rather than abandon the dwellings of man. In the month of June, a man hung his coat under a shed, near the barn; two or three days elapsed before he had occasion to put it on again; thrusting his arm up the sleeve, he found it completely filled with rubbish, as he expressed it, and on extricating the whole mass, found it to be the nest of a wren completely finished, and lined with a large quantity of feathers. In his retreat, he was followed by the little forlorn proprietors, who scolded him with great vehemence, for thus ruining the whole economy of their domestic affairs. The twigs with which the outward parts of the nest are constructed are stout and crooked, that they may better hook into one another, and the hole or entrance is so much shut up to prevent the intrusion of snakes or cats, that it appears almost impossible that the body of the bird could be admitted. Within this, is a layer of fine dead stalks of grass, and lastly feathers."

An anecdote of Wilson's with regard to this species is so interesting and so well told, that we cannot resist the temptation of quoting it. "This little bird has a strong antipathy to cats; for, having frequent occasion to glean among the currant bushes, and other shrubbery in the gardens, these lurking enemies of the feathered race often prove fatal to him. A box fixed upon the window of the room where I slept, was taken possession of by a pair of wrens. Already the nest was built, and two eggs laid, when one day, the window being open, as well as the room door, the female wren, venturing too far into the room to reconnoitre, was sprung upon by Grimalkin, who had planted herself there for the purpose; and, before relief could be given, was destroyed. Curious to see how the survivor would demean himself, I watched him carefully for several days. At first he sung with great vivacity for an hour or so, but, becoming uneasy, went off for half an hour; on his return, he chanted again as before, went to the top of the house, stable, and weeping willow, that she might hear him; but seeing no appearance of her, he returned once more, visited the nest, ventured cautiously into the window, gazed about with suspicious looks, his voice sinking to a low melancholy note, as he stretched his little neck about in every direction. Returning to the box, he seemed for some minutes at a loss what to do, and soon after went off, as I thought, altogether, for I saw no more of him that day. Towards the afternoon of the second day, he again made his appearance, accompanied by a new female, who seemed exceedingly timorous and shy, and who, after great hesitation, entered the box; at this moment the little widower or bridegroom seemed as if he would warble out his very life with ecstasy of joy. After remaining about half a minute in, they both flew off; but returned in a few minutes, and instantly began to carry out the eggs, feathers, and some of the sticks, supplying the place of the two latter with materials of the same sort; and ultimately succeeded in raising a brood of seven young, all of which escaped in safety."

The above, of the perfect truth of which there cannot be the least question, is one of the most curious in the whole history of animals of whatever class they may be; and if one was to build a theory of the reasoning powers of animals, perhaps there is no better foundation on which it could be erected; but we have neither room nor inclination for such theories; and therefore, we shall leave the reader to draw from the account, of the correctness of which there can be no doubt, whatever conclusion may be the most agreeable to himself; meanwhile we proceed with our notice of the bird, as with that of all other irrational animals.

We cannot resist quoting a little more of the account of this highly interesting bird, in the description of which Wilson is peculiarly happy. "The immense number of insects which this sociable little bird removes from the garden and fruit trees ought to endear him to every cultivator, even if he had nothing else to recommend him; but his notes, loud, sprightly, tremulous, and repeated every few seconds with great animation, are extremely agreeable. In the heat of summer, families often dine under the piazza, adjoining green canopies of mantling grape-vines, gourds,

&c., while over-head the trilling vivacity of the wren, mingled with the warbling mimicry of the cat-bird, and the distant softened sounds of other songsters, form a soul-soothing and almost heavenly music, breathing peace, innocence, and rural repose. The European who judges of the song of this species by that of his own wren will do injustice to the former, as in strength of tone and execution it is far superior, as well as the bird is in size, figure, and elegance of markings, to the European one. Its manners are also different; its sociability greater. It is no underground inhabitant; its nest is differently constructed, the number of its eggs fewer; it is also migratory, and has the tail and bill much longer. Its food is insects and caterpillars; and, while supplying the wants of its young, it destroys, on a moderate calculation, many hundreds a day, and greatly circumscribes the ravages of these vermin. It is a bold and insolent bird against those of the titmouse or woodpecker kind that venture to build within its jurisdiction, attacking them without hesitation, though twice its size, and generally forcing them to decamp. Even the blue-bird, who claims an equal and a sort of hereditary right to the box in the garden, when attacked by this little impertinent, soon relinquishes the contest, the mild placidness of his disposition not being a match for the fiery impetuosity of his little antagonist. With those of his own species who settle and build near him, he has frequent squabbles; and when the respective females are sitting, each strains his whole powers of song to excel the other. When the young are hatched, the hurry and press of business leave no time for disputing, so true it is that idleness is the mother of mischief. These birds are not confined to the country; they are to be heard on the tops of houses in the most central parts of our cities, singing with great energy. Scarce a house or cottage in the country is without a pair of them, and sometimes two."

Many other birds than those which have been enumerated in this sketch are called wrens, some of which are warblers, some creepers, and some belong to other genera. It is very natural, and perhaps unavoidable, to have this general application of the name of a bird with which every one is familiar, to other birds that are less known, but which resemble the well-known one more or less in appearance, in habits, or in both. From its familiarity in the winter, as well as from the peculiarity of its appearance and its manners, every body, whose ornithological knowledge extends beyond the house-sparrow and the goose, knows the common wren, and thus it becomes a very good key to the mere distinguishing of those birds which are called after it. But when we come to more accurate knowledge, which depends upon the whole structure and habits of the birds, those popular extensions of the same name are by no means so convenient.

There still remains a small section of sylvan birds, belonging obviously to the family now under notice, which some have classed with the wrens, and some with the warblers properly so called (*Curruca*). But they do not properly belong to either. In the English descriptions they have pretty generally been denominated "willow wrens," or "willow warblers;" and therefore, without pretending that it is accurate, we shall call them by the general name of

8. Salicaria—Willow birds. It must not be supposed that these birds are never to be found but among willows, any more than that willows are never to be found without these birds; for such rigidity of expression as this could not be applied in any department of natural history. All that is meant is that, in the places which these birds visit in their migrations, especially their summer one, they chiefly resort to situations which are peculiarly favourable to the growth of willows, whether there happen to be willows upon them or not. They have been called marsh-warblers; but that name is not altogether accurate, as they do not resort to the marshes properly so called, but to those places of the banks of pools and streams which have a cover of very tall and close vegetation in the summer, whether that vegetation consists of willows, reeds, sedges, tall aquatic grasses, or any other plants, provided those plants grow tall enough for affording the requisite shelter, and there is damp enough for affording the peculiar supply of food which these birds require. Their characters, as a distinct genus or subgenus, are not very strikingly marked, but still there is a likeness among all the known species, and a dissimilarity to all the other genera or subgenera of the family. They have the body more slender and tapering at the shoulders than the other warblers; the upper part of the head is flattened; the wings are short and rounded; and the tail is long and wedge-shaped at the end. Their whole form and expression clearly indicate to any one who has been in the habit of paying even a very slight attention to the haunts and the forms of birds as adapted to each other, that these are formed for boring their way among very close obstacles, getting on the wing in very confined places, and rising and falling in their flight with much more facility than they make forward progress on the wing. While they are in England they roam very little, and are rarely seen upon the wing, except hovering over the osier holt, or the bed of reeds or sedges, or taking very short flights from one part of it to another. As the foreign birds, which should be included in this subgenus, are not well defined, we shall confine this notice to those which are met with in Britain. They are birds of which it is not easy to study so as properly to understand their manners; for their haunts are neither easy nor pleasant even in our latitudes, and in warm climates they are highly dangerous both on account of the miasmata they give out and the reptiles and other awkward inhabitants which they contain. They are not all equally birds of the rank aquatic vegetation; and some of them have little or no claim to be called warblers, for their voices are any thing but musical. There are three known species of them, all of which are regular summer visitants, not rare by the streams and pools in the south of England, diminishing in numbers as we proceed northward, and there is no well-authenticated account of their appearance in Scotland.

The Sedge Warbler (*S. phragmitis*). This is the sedge wren of popular language, but it is unlike any of the wrens properly so called, both in appearance and in manners. It is about the same weight as the common wren, but it is more than an inch longer, and of a far more slender and delicate shape. It is about five inches and a half in length, seven inches in the stretch of the wings; the head is narrow as well as depressed on the crown, and the bill pointed, of a dusky colour on the upper part, and white on the under; the colours are sober, according well with the retiring habit of the bird; the upper parts are

soft yellowish-brown, pure on the middle part from the back of the head to the upper tail-coverts, but slightly marked with rust colour on the scapular-feathers and the coverts of the wings; the quills and tail-feathers are of the same colour as the rest of the upper part, but little deeper in the tint, and each feather obscurely margined with dusky; the ground colour of the cheeks, and a small portion of the sides of the upper neck, are dark brown; the chin and throat are yellowish-white, deepening into a sort of brownish-yellow on the breast, and gradually fading to the same tint as the throat upon the belly: all these colours are so subdued, and fade so gradually into each other, that the birds cannot well be described by them; there is one marking, however, by which it may at once be distinguished from all the other little birds that are found in the same places; from the gape, or rather from the base of the upper mandible, a white streak extends in the direction of the eye, but before it reaches that organ it divides into two, so that that organ is enclosed in the fork; this marking being upon a dark brown ground is very conspicuous, and it is constant in the species, so that it is a ready means of distinction.

This bird arrives in England about the middle of April, but as it comes silently to take possession of its breeding grounds, it is but little noticed. When the song begins, it is rather a feeble one, but not without music. It is heard to most effect in the early morning, and again toward evening; but it also sings occasionally from its cover during the day. It sings in concealment from the visible perch, which, however, is never very high, and also in its short flights. The place of the nest varies with the locality, being within a bush among the stems of reeds, or upon a dry stool in a willow holt, according to circumstances. Vegetable fibres and moss are the chief materials, and the lining of the nest is finer fibres, with occasionally an admixture of a few hairs. The eggs are five or six in number, of a pale brownish colour mottled with darker. The food consists of winged insects captured among the rank vegetation; and probably also of larvæ, small mollusca, and worms; indeed, all the little birds which are animal feeders are pretty miscellaneous, and do not refuse any kind of small life that may come in their way. From the accounts, it would seem that this species is more generally distributed over the country than the one about to be mentioned; but there is a degree of uncertainty about all these little birds of the tall vegetation by the waters, as one bird is apt to be heard and another seen. The reed-warbler, or even the reed-sparrow, may be the bird of which a glance is barely got before it glides into its cover; and then if the observer throws a stone in order to get another peep at his bird, that is sure to set the sedge-warbler a singing if it happen to be in the cover.

The Reed-Warbler (*S. arundinacea*), is nearly the same in size as the last-mentioned species, and not very different in colour. Still, however, the two can be discriminated without much difficulty. The bill of this one is yellowish on the under side, broader at the base than that of the former species, and there are two or three stiff hairs at the angle of the gape, which would lead one to conclude that it feeds more exclusively upon insects in the winged or perfect state, though the mode in which it captures them has not been well ascertained. The plumage of the whole upper part is plain ash-brown, with the quills and tail-feathers edged with the same, but dusky brown in the greater part of the breadth; the under parts are yellowish-white, paler on the middle, and passing through a slight brownish tinge on the flanks into the olive on the back; the streak from the gape to the eye is very obscure, and there is no brown on the cheek to set off either it or the little pale-coloured cloud on the eyebrow. This is a soft bird in its colouring, but one of the least gay that are to be met with.

It comes about the same time as the sedge warbler, but it does not come in such numbers, nor is it so widely distributed over the country. It is chiefly found near the coasts, and on the lower estuaries of the great rivers, rather than on the banks of the more upland streams, however rank they may be with vegetation. It is more aquatic than the sedge bird; and though they are often found in the near vicinity of each other, they are not found upon precisely the same spots. The sedge and the reed, after which they have been called, point out tolerably well the difference of location in the birds. The sedge and the reed are very close neighbours; but the sedge is only close by the water, while the reed is in it. The two birds have a similar distinction in their habitats. There is generally, if not always, an earthy surface under where the sedge-warbler has its nest, and that nest is in general placed upon a solid support; but the reed-warbler in general nestles over the water, though only where that water is thickly covered with reeds. Whether those reeds are upon a flat shallow of the river or on a pool, they are resorted to; and hence the bird is often found on neglected mill-ponds, and other small patches of water. Where there are extensive brick-works, the makers often keep reed-pools upon some of the places from which the brick earth has been taken, as these reeds are valuable to them as covering for the bricks in the course of the manufacture. There are several such reed-pools in the neighbourhood of London, and wherever they are they are sure to be frequented by reed-warblers in the summer. When the reeds are so close as that several of them can be employed to support the nest, it is usually placed upon them, composed first of coarser and then of finer vegetable matters, but never with hair or feathers, as the bird does not frequent places where these are likely to be obtained. The eggs are a little larger than those of the sedge-warbler, of a greenish white colour in the ground, and marked with dusky brown. So far as has been observed, the nest is never placed on the ground, though it is sometimes among the lower branches of a thick tree or bush near the water, or occasionally, but rarely, in a tuft of tall and shady herbaceous vegetation.

It is understood to come rather later and depart earlier than the sedge warbler; but this is not clearly ascertained, as it is silent when it first comes, and also before it departs. This bird has much more powerful action of the feet than the former species, and, when necessary, it can cling very dexterously to the stem of a reed, though it usually perches upon the leaves, or upon stems which are in a sloping position. Its song is sweet, but so subdued that it seems as if it were whispered, and it is heard only at very short distances.

The Grasshopper Warbler (*S. locustella*) has been sometimes described as a third species of these aquatic birds; but though it is often in situations near the

water, it is properly a land bird, or rather a bush bird on rich places. It is about the same length as the two species which have been mentioned; but it is more stoutly made, and rather heavier. The colours are also a little more distinctly marked. The general tint of the upper part is brownish olive, with the middle of each feather on the back darker, producing a pretty effect. The streak over the eye, the chin, the throat, and the belly, are yellowish white; the brest, flanks, and tibiæ, brownish; the two last obscurely streaked with darker. The quills and tail-feathers are dusky, with their external webs olive. The tail is much wedge-shaped, the lateral feathers being an inch shorter than the middle ones; and each individual feather is rounded or pointed at the tip. The wings are very short and much rounded. The legs are brown, and the claws horn colour; that on the hind toe being short and crooked, quite unlike the hind claw of the lark, though the bird has sometimes been called a lark.

It is a summer visitant, resorting to brakes, building its nest in close cover, and altogether living in much concealment. The nest is but a rude structure, and composed wholly of vegetable matter; the eggs are four or five in number, of a bluish white colour, and without any spots. The only note which it has been ascertained to utter, is the hissing one, something like the sound of the grasshopper; and it is highly probable that the one voice may in some instances have been taken for the other. The place of the utterer of these hissing sounds is not very easily ascertained, as they strike the ear like echoes, and one is apt to suppose that they come from the very opposite direction. This is a tender as well as a hidling bird, and is not found in upland places; indeed, it is rare as well as local.

For the remaining genus of the family *Motacilla*, which Linnæus made the generic name of all the species, we must refer the reader to the article WAGTAIL.

SYMPHORIA (Pursh). A genus of hardy deciduous shrubs from North America, belonging to *Caprifoliaceæ*. Linnæus considered this a *Lonicera* (honeysuckle), but it was subsequently made a separate genus by Pursh.

SYMPHYTUM (Linnæus). A genus of European herbs, having shewy pentandrous flowers, and belonging to *Borragineæ*. Two of the species are natives of England, where they are called comfrey. One of the Caucasian species, the *S. asperrimum* of the Hortus Kewensis, has been lately recommended to British farmers as a green forage plant, and has been cultivated on a small scale in various places with considerable success.

SYMPLOCARPUS (Nuttal). A North American aquatic, belonging to the *Aroideæ*. The plant was formerly called *Dracontium* by Linnæus, and *Pothos* by the author of the Botanical Magazine. It is in our collections planted in a marshy situation, and is increased by division.

SYMPLOCINEÆ. A natural order containing only one genus, viz., *Symplocos*, which gives the title, and is the type. Of this there are four species bearing polyadelphous flowers, and are shrubs with serrated leaves, turning yellow in drying. The flowers are small, white, and rather fragrant. The *S. tinctoria* is used as a yellow dye, under the name of sweet-leaf in America.

SYNALLAXIS (*no proper English name*). A genus of rather handsome little birds, belonging to Cuvier's tenuirostral family of *Passeres*, and bearing no inconsiderable resemblance to the nuthatches of Europe. They are all tree birds, and are known to Europe and naturalists chiefly as Brazilian; but it is probable that they occur in the rich woods of other parts of tropical America. The characters are: the bill not very long, slender, pointed, very much compressed, naked at the base, the mandibles slightly curved inwards at their margins; the upper one a little curved at the tip, the under one straight. The nostrils broad and lateral oblong, covered in part with a small vaulted membrane and ornamented with feathers. The feet of mean length, with three toes to the front and one to the rear; the two lateral front toes of equal length, and united at their bases to the middle one, which is of the same length as the hind toe. The wings are very short and rounded; the first quill very short, the second and third gradually longer, and the fourth the longest in the wing. The tail very long and wedge-shaped, the feathers of it broad in great part of their length, but tapering to points. They correspond in America to certain little birds, which are found in the tropical forests of other parts of the world, but not enough is known of them for the establishing of a proper classification.

S. albescens has the upper part olive ash; the top of the head and the hind neck bright red; the front eye-brows and cheeks olive grey; the lesser wing coverts russet; and the tail feathers olive. The chin and belly white; the throat clouded with black; and the breast and flanks reddish grey. The bill black, with the exception of the middle of the lower mandible which is white. The length about five inches and three quarters.

S. rutilans, has the upper part of the body olive grey, clouded with deep grey; the forehead, brows, cheeks, sides of the neck, breast, and wing-coverts, bright red. The tail-feathers blackish, with glosses of chestnut red; the quills, and also a spot on the throat, black; the rest of the under part greenish grey, clouded with deep red; the bill greyish in the chief part of its length; but black at the tip; the feet black; the length about six inches.

S. tessellata. The top of the head bright red; the back mottled with regular darkish spots; the coverts of the wings brown, with spots of a different shade; the tail feathers brown and much wedge-shaped; the region of the eye whitish, finely mottled with minute brown spots; the cheeks bluish or greenish white, with small mustachios of black; the chin yellow; a large spot of black on the throat; the breast, fore part of the belly, and flanks, bright fawn-colour; the rest of the under part whitish; the bill grey at the base, black at the tip; the feet brown; the length seven inches.

S. setaria. Upper parts bright maroon red; forehead ash grey; top of the head clear grey; nape and upper part of the neck, brown, finely streaked with white; a patch of white on the bastard wing; quills blackish brown, bordered with maroon red; tail-feathers the same, much wedge-shaped, and with brighter borders; chin, throat, and breast, greyish white, dotted with black, and the rest of the under parts clear fawn; bill ash-colour, and white at the base; feet black; length seven inches.

S. cinerescens. Olive; brown above; the quills brown, bordered with maroon; the tail-feathers russet, the chin white, finely lined with lilac; a large black

spot on the breast; the cheeks, and also all the under parts, slate grey; the bill ash; the feet brown, the length six inches,

S. Ruficauda. The upper part brown, slightly clouded with red; the quills and tail feathers red; the chin yellow; the throat, breast, and belly, white; the under parts, backwards, grey; the bill and feet black; the length five inches.

S. Ruficapillus. Upper part brown; top of the head red; eye streak yellow; forehead and cheeks greyish ash; quills brown, margined with red; tail much wedged, and of a clear maroon colour; breast grey; flanks olive; belly whitish; bill black; feet brown; length five inches.

Little is known of them save the colours and sizes. They appear to stand in nearly the same relations to the tropical forests as the warblers do to the temperate ones, and we have mentioned them chiefly for the contrast of the plumage.

SYNDACTYLI, a family of birds which have the outer and middle toes of nearly the same length, and soldered together. They consist of bee-eaters, king-fishers, hornbills, and a few other genera. See Bird,

SYNGNATHUS (Pipe-fish), or perhaps Syngnathidæ, the pipe-fish family, singularly formed fishes, belonging to the order *Lophobranchii*, or those that have the gills in tufts. The name *Syngnathus* means that the jaws are united, and the fishes have the mouth drawn out into a sort of tube or pipe. The characters are: the mouth drawn out into a sort of tube, formed of prolongations of the *ethmoïde*, the vomer, the tympanal, the preopercular, and the subopercular bones, and not of the genus properly so called; and this lengthened tube, which gives a very singular form to the head of the fish, has a mouth of the ordinary structure at its termination; but the opening of it is nearly vertical. The breathing aperture is at the nape. In their fins they vary much, the greater portion have no ventrals, some want only the ventrals, others have no fins but the dorsal and caudal, and others again have only the dorsal. Their bodies are in general very slender and much elongated, some of them have a considerable similarity to snakes, and others to worms; and some are popularly called sea-needles. Some of them have the tails prehensile, or capable of laying hold of sea-weed or other substances by curling the tail round them, and we believe it can curl round with equal readiness in every direction. In an economical point of view they are of no value; but they have an interest with the mere lovers of nature, in being among the most singular looking of all the productions of the sea, while the very singular mode of their production which differs not only from that of all other fishes, but of every known animal, gives them a still higher degree of interest in the estimation of physiologists.

Essentially they are fishes even in this the most peculiar part of their economy,—that is to say, they are females and males, the first of which prepares roe and the second milt, just as in other fishes. Here, however, the parallel ends, and we come to the singular peculiarity. The females are oviparous, bringing their eggs or roe to maturity, and then discharging them as is done by all the oviparous fishes. But the eggs so discharged by the female are not committed to the sea, they are handed over to the male in order to be hatched. The male has an abdominal or subcaudal pouch for receiving the eggs, and they not only remain in this pouch till the young are formed and escape from the capsules of the eggs, but the said young afterwards take shelter in the pouch of the male, as a place of security from danger. The pouch is differently formed and situated in the different species, but that is a matter of detail for the particular notices of them, and the general principle is common to them all.

They thus have some resemblance to the marsupial mammalia of Australia; only, in the case of the fishes, the marsupium is on the male, while in the marsupial mammalia it is on the female. In what may be considered as the most typical members of the family, if in so singular a family any one can be considered as typical, the pouch is composed of two longitudinal lobes or leaves, which shut against each other on the lower part of the fish, and when it has this form it is chiefly if not always subcaudal; but it is sometimes made up of a number of sections, and these are generally in advance of the vent. By what kind of progress the eggs are transferred from the female to the pouch of the male, we have no means of ascertaining; and indeed we are nearly in the same ignorance as to the mode in which the females of the marsupial mammalia transfer their young to the abdominal pouch upon themselves.

The family consists of three genera, *Syngnathus*, properly so called, *Hippocampus*, and *Solenostomus*. Various species of the first of these genera are found in the British seas, chiefly but not exclusively on the south coast; and there is at least one British species of the second; but the third genus is, we believe, wholly confined to the Indian and other warm seas.

Syngnathus, properly so called,—pipe-fish. There are two sections of this genus distinguished from each other by the number of the fins, and also by the form of the hatching appendage on the under side of the male. Mr. Yarrell, to whom the students of British fishes, whether scientific or amateur, are under so many obligations, has established as British two species of the one section, and three of the other. In doing this he has blended his own most accurate, valuable, and discriminating observations and dissections, with those of other competent naturalists.

1. Pipe fishes with many fins. The characters of this section, some of which, however, it possesses in common with the other one, are as follows: Body very long and slender, covered with a series of hard plates, arranged longitudinally in parallel lines. The head long, with both jaws produced in the manner that has been already stated, and united so as to form a tube, at the end of which the mouth is placed. There are pectoral, dorsal, anal, and caudal fins, but no ventrals. The fins are small, the tail very long and tapering, so as to be slender at the base of the caudal, which is shaped like a little fan. The males have a long pouch on the under part behind the vent, which is closed by two folding leaves or lobes running in a longitudinal manner, and in this pouch the eggs are hatched after they have been discharged by the female.

The use of the singular tubular extension of the mouth in these fishes has not been ascertained, neither is it understood why they have the gills so very differently formed from those of all other fishes. These gills consist of a number of little tufts, and they are defended externally by a large and firm operculum or gill cover, which does not open like that of ordinary fishes, but merely by a hole at the posterior part of

its upper edge. There seems thus to be in their breathing apparatus something between the character of the free gills of bony fishes, and the fixed gills of the *chondropterygii*. Even in the covering of their bodies, there is this intermediate sort of character. Most of the chondropterygii have the body covered with bony plates, or granulated with very hard tubercles; and the pipe fishes have their long and slender bodies defended by a great number of hard plates, which are variously figured or sculptured upon the surface. All the species, whether of this section or the other, and indeed all the *Lophobranchii*, or fishes with tufted gills, are inhabitants of the salt water only; and, though many of them have great swimming powers, they are seldom found at any very great distance from the land. In general, whether nearer the land or farther in the offing, they are found near sea-sand bottoms; and hence we may perhaps conclude that they feed upon the small crustacea and mollusca that have their residence in or near such sand, and on the very young fry of such fishes as deposit their eggs in the sand as a place of safety.

Some of the species, those of the present section especially, appear to follow the habit of many fishes, in approaching nearer the shores at some seasons and receding farther from them at others. When fishes do this it is usually connected with their spawning,—the seaward course is taken in order to recruit the strength and improve the growth of the individual fish; and the shallow water where they can have the influence of the direct light and heat of the sun, and also the radiation and reflection from the bottom, is undertaken in order to mature the spawn; while those which deposit their spawn, and they are by far the most numerous of fishes, find near the shore the proper places for it. In the depths of the sea there is of course little stimulus to anything at the bottom; and thus, if the spawn of fishes were placed there, it might lie inert for years or for ages. The *Syngorathi* carry their spawn about with them till it is hatched, and thus they can always have it in that temperature which is the very best for bringing it to maturity. On the British shores some, at least, of the pipe-fishes are said to go twice in the year to the deep water, but whether they spawn twice in the year has not been fully ascertained.

The Great Pipe-fish (*S. acus*), is perhaps the most frequently found on the British coasts, sometimes among the sea-weed just by the low-water line, and at other times in the water at considerable depths. They are seldom more than a foot and a half in length, and they come so far to maturity as to be capable of breeding when they are less than half a foot in length. These circumstances render it rather a difficult matter to say what is the proper size of them; and, indeed, the power of growth in most fishes is so indefinite, that any positive statement of their size is calculated only to mislead. All that can be said with certainty about this one is, that, though it is called the great pipe-fish, it is always a small fish as compared with the greater number of the other fishes. The male and female are very readily distinguished from each other by the presence of the abdominal valves or pouch on the former and its absence in the latter; there is generally also roe in the female, in some state of forwardness, the more so the nearer the shore we believe, and the male sometimes has roe in the abdominal pouch and sometimes not. It does not appear that the whole which are deposited in that receptacle are brought forward at the same time; for, when the fishes have been examined, it has been found that the young in some of the ova were only beginning to be formed, while in others they were complete, and that some of the empty pellicles of the ova remained adhering to the valves of the pouch. When and how the eggs are transferred to the pouch of the male, and whether gradually or the whole production of the female at once, we are not informed, neither are we acquainted with the economy of the two after the transfer. If we were to reason from the analogy of other fishes, which however is not a conclusive mode of reasoning, notwithstanding that the milt and roe are primarily formed in the pipe fishes, just in the same manner as in the others,—if we were to reason thus, we should be inclined to say that the males must remain near the shores in order to hatch the eggs in the pouch, for some time after the females have retired to the deep water, for the purpose of recruiting their strength and preparing a new succession of eggs; this is what the general law of nature would lead us to conclude, and it is to be wished that the habits of the fish had been observed with reference to this law. As the eggs are transferred from the one to the other, we might expect that the two sexes should alternate with each other in their stay upon the coast,—that they should do this in the single pair and in the average of the whole for the season, although during that season we may expect both to be coming and going for a very considerable period of time. It is perhaps this which occasions the double resort to the deep water which is mentioned by the authorities, and which probably consists chiefly of the females at the one time, and of the males at the other. It is only of late, however, that the attention of physiological naturalists has been drawn to the subject, and therefore many observations have yet to be made before the details of their singular economy are clearly established. The statement of the leading facts in "Yarrell's British Fishes," cannot fail in being highly useful as lights to guide them who are upon the ground, and have the inclination as well as the opportunity for clearing up this and many other points in the economy of the characteristic natives of that sea which is so especially interesting to every Briton. The following account of the late Mr. Walcott's observations, as quoted by Mr. Yarrell, is very satisfactory as far as it goes, and it may also enable us to state the principal points upon which farther information is necessary, in order to complete the history of the fish in a satisfactory manner. "The male differs from the female in the belly from the vent to the tail fin being much broader, and in having for about two-thirds of its length two soft flaps, which fold together, and form a false belly or pouch. They breed in the summer; the females casting their roe into the false belly of the male. This I have asserted from having examined many, and having constantly found, early in the summer, roe in those without a false belly, but never in those with; and on opening them later in the summer, there has been no roe in those which I have termed the female, but only in the false belly of the male." Following up the train of these observations, Mr. Yarrell found, about the hottest time of the year, eggs in a state of maturity, eggs from which the young had escaped, and hollow impressions from which the capsules or cases of the eggs had parted. The different depths of water in

which both are found, before and after the transfer of the eggs, if any such difference there be, the manner in which the eggs are transferred and fecundated, and the time that they remain in the pouch before the young are fully developed, are the most essential parts which remain to be ascertained by future observations.

Risso, in his valuable work on the fishes of the Mediterranean—a sea in which those fishes are more abundant than they are upon our shores, mentions that the adult pipe-fishes show an affection for their young which is very rare among the finny tribes, they being in general just as apt to eat the fry of their own species as that of any other. But even this point has not been ascertained with that precision which is desirable in fishes of a character so very peculiar. We can understand why the male should be attached to the young of those fishes, and they to him, but then we can see no more reason for a reciprocal attachment between the female and the young, than there is in the cases of fish that spawn in the usual manner. The moment that the roe is transferred to the male all connexion between it and the female appears to be at an end; and it would be a new and rather anomalous fact in physiology to find a female attached to young for which she did and could do nothing. This would be an affection without an object; and though we find that the human race very frequently blunder into the exercise of such affections, we are not aware of the existence of one in the rest of nature. The affection of the male, or rather of the young for the male, is well established, and we can see its purpose. "I have been assured by the fishermen," says Mr. Yarrell, "that if the young were shaken out of the pouch into the water over the side of the boat, they did not swim away, but, when the parent fish was held in the water in a favourable position, the young would again enter the pouch." The female has no such protection to give them; and thus it would be important to ascertain whether the female has any attachment for the young or is perfectly indifferent to them.

The determining of this is a matter of no inconsiderable importance in a physiological point of view. The best portion of that labour which wholly devolves on the female in all other animals that bring their young to maturity, either by internal gestation, or by hatching, is, in the case of the pipe fishes, transferred to the male; and what we wish to know is, "Is the maternal affection transferred along with it?" This is a cross case—the very reverse of what usually occurs; and, therefore, if we could get complete information upon it, it would be an *experimentum crucis*, giving to our theories of the paternal and filial affections of animals much of the force of demonstration. To those who do not reflect upon the length to which a single well-established principle will often carry us, this may seem only a trivial matter; but it would afford an easy and ready key to many apparent anomalies that we meet with when we study the actions of animals, and even those of mankind, for the purpose of tracing them to their causes, the most important purpose for which we can study them.

The motions of this fish in the water are somewhat singular. Mr. Couch mentions, that "this species may be seen slowly moving about in a singular manner, horizontally or perpendicularly, with the head upwards or downwards, and in every attitude of contortion in search of food, which seems to be chiefly water insects." How the food finds it way to the stomach is rather a puzzling matter, at least upon any of the ordinary principles of deglutition. The gape of the mouth can do little in this way, for it is very small, the pipe of the produced jaws appearing as if it could be half opened by a lid on the end, this lid being the lower jaw, which does not come so low as to be horizontal when the gape is distended, and the upper jaw inclines backwards. The mouth is not in any sense of the word a biting mouth, and it is capable of enclosing only a very small substance, without any apparent means of conveying it along the pipe. Mr. Yarrell says, "These *Syngnathi* are supposed to be able, by dilating their throat at pleasure, to draw their food up their cylindrical beak-like mouth, as water is drawn up the pipe of a syringe." This supposition is not satisfactory; and that for this obvious reason, that any one who looks at the tubular part of the mouth of a pipe-fish, and who has at the same time a knowledge of the principles of hydraulic action, would at once pronounce that this, if fit for acting as a syringe at all, is about as clumsy a one as could well be imagined. But Nature's machines are all the very best adapted to their purposes that can be made—that can be imagined, for nothing at all approaching to them can be made; and therefore there must be some other use than this of the singularly-formed mouths of those fishes, for which the said mouths are much better adapted than any other form of that organ which we can imagine. What this may be is a matter of observation, and not of any reasoning from analogy; for the fishes are so very peculiar that we cannot find an analogy that will rightly apply to them.

With the genus *Pegasus*, in which the mouth is differently formed, these fishes are distinct from all the rest as an order, and thus the elements of all our knowledge of them must be drawn immediately from observation of themselves.

We have mentioned that, as they begin to produce while yet very small, the size of these fishes cannot be admitted into the general description of them; but, as the proportions are nearly the same for all sizes, we shall thus quote Mr. Yarrell's very clear and accurate statement of these as being perfectly descriptive of the species. "From the point of the tubular mouth to the posterior edge of the indurated portion of the operculum, the length is, when compared with the whole length of the fish, as one to eight; if measured to the edge of the shoulder it is as one to seven and a half, and this proportion exists in individuals of various ages and lengths, from six inches to eighteen; from the mouth to a projecting point at the anterior edge of the eye, and thence to the pectoral fin, the distances are equal; the jaws united. tubular, slightly compressed; in depth but one-third that of the head at its deepest part, which is in a vertical line with the centre of the operculum; the mouth small, placed at the extremity of the tube, opening obliquely upwards; the lower jaw the longest; eyes rather large, bony orbits prominent; operculum covered with radiating striæ; the head between the eyes flattened; behind the eyes rising into a keel-like crest, which reaches to the neck; from the pectoral fin to the anal aperture the body is deepest and heptangular, with three ridges along each side, and one along the abdomen, which ends at the vent; throughout the short length of the dorsal fin

the body is hexangular, the ridge on the abdomen being discontinued; thence to the end of the tail sloping, slender, and quadrangular, with a series of forty-four plates; the pectoral fins are small; the dorsal fin commences at two-fifths the length of the fish, and in a vertical line rather before the anal aperture; the largest rays are not equal in height to the depth of the body; the anal fin very small; the tail rounded and fan-shaped; there are forty rays in the dorsal fin; twelve in each of the pectorals, four in the anal, and ten in the caudal. The prevailing colour is pale brown, transversely barred with darker. It appears from the statements of the various authorities, that the numbers of rays in the fins are not quite constant. The colour also differs. It is always rather lighter on the under side of the fish than on the upper, and in some specimens it is whitish.

Deep nosed Pipe-fish (*Tylphe*). This species belongs to the same section as the one already described; and its economy seems to be very nearly the same. It has pectoral, dorsal, anal, and caudal fins, and the male has the same kind of abdominal pouch for receiving the eggs when they are discharged by the female. As a British fish it is found on the same grounds as the other, and is not rare on many parts of the south coast, though we believe it is not found in so many localities as the other. It is usually found in the sea-weed, or in the water near it, where the depth does not much exceed two fathoms.

It is easily distinguished from the former species both by its form and its colour. The pipe and mouth are much deeper in proportion, being nearly the same as the head, the outlines of which pass into those of the pipe without any angles or curves. It is also larger in proportion to the whole length of the fish; and it is considerably enlarged just at the end. Mr. Yarrell, who is by far our best authority respecting it as a British fish, says, "The whole length of the largest specimen which I have seen, is thirteen inches; from the point of the closed jaws to the posteror end of the indurated portion of the operculum the distance, compared with the whole length of the fish, as one to six; the head larger than in *S. acus*, and without the elevated ridge on the top of it; the distance from the point of the upper jaw to the projecting tubercle in front of the eye, and thence to the end of the pectoral fin, are equal; the united jaws are very much compressed, and nearly as deep as the head, only slightly inclining to a slope in front of the eyes; the body hexangular, the middle lateral angle on each side becoming the upper angles of this quadrangular tail at the end of the dorsal fin. The fin commences further back than in *S. acus*, the middle of the dorsal fin being nearly the middle of the whole length of the fish; the series of indurated plates between the shoulder and the vent includes eighteen, thence to the end of the tail about thirty-seven, but both series are liable to a little variation in the numbers of the plates; the abdomen is almost rounded; the anal fin minute; the caudal fin pointed; the two central rays the longest, the others graduated. Fin-rays—Dorsal thirty-nine, pectoral fifteen, anal three, and caudal ten. The prevailing colour is olive green mottled with yellow brown and yellowish white.

Some other species having caudal fins have at times been described as British; but the probability is that they have been either one or the other of these. The early period of life at which these fishes are capable of breeding, renders them liable to many mistakes as to the species of these fishes. Indeed their whole character is so full of anomalies, that nothing can with safety be stated respecting them, unless it is borne out by the facts as established by the most careful observers.

2. *Syngnathi*, with a dorsal fin only. The species *Acus* which we first noticed, has sometimes been called the "Sea Adder," but these of the section which we are now to notice, have much more of a snake-like shape, in consequence of the absence of all the body fins answering to the extremities of ordinary vertebrated animals, and also the caudal fin. They of course swim by means of the flexures of the body, as the dorsal fin is not a propelling organ, but merely a steadying one, by means of which the effect of the portion of the body behind it is increased. The males in none of the species of this section have subcaudal pouches for the reception of the eggs, but still they hatch them on the same principle as the others, though not exactly in the same way. They are placed upon the abdomen of the male before the vent, each being lodged in a separate depression which is in the form of a segment of a hollow sphere; and to this the egg is glued by its own gelatinous capsule until the young fish is matured. The eggs of these of the former section, are also each lodged in a depression, or made to adhere to it, and not left loose in the pouch with only the protection of the two leaves that close it. This is also the case in the marsupial mammalia; for when the young are transferred to that abode in a rude and formless state, each adheres to its teat independently of the pouch, and the pouch is only an additional protection. In the marsupial animals, we believe there is a relation between the developement of the parent and that of the young when discharged from the internal uterus, these being always nearer its maturity in those species that have the pouch the least developed. We are not aware whether the two sections of the pipe-fish follow the same law, and whether the eggs remain a shorter time attached to the male than in those with the pouch, but it is probable; we are certain that the young of the pouchless ones can find no place of security in the body of their parent, after once they come out of the egg. The difference of time, if any, in the hatching of the eggs of the two sections, is a point well worthy of being ascertained, as a sort of connecting link in one of the most obscure portions of physiology. The eggs of these fishes are not the only ones that are hatched in depressions on the body of the parent animals; for the eggs of the Surinam toad are hatched in the same manner, only it is on the back of the female, the intermediate parts of which swell up and form lodgments for the eggs as long as it is necessary for them to be there. To what extent the integuments of the abdomen of the males of these pipe fishes swell up so as to afford a protecting lodgment for their eggs, has not been observed, or, if observed, not stated.

One cannot help being struck with the beautiful provision of nature in the place and mode in which the eggs of the two sections of pipe-fishes are hatched; as well as with the different forms of the tails as making part of this provision. The tail of a fish from the dorsal fin backwards, is the portion of it which has the most severe action in swimming; and if there is no caudal fin, more motion of the tail would be necessary to give the same impulse to the body than where

there is one. The first section of the pipe-fishes have caudal fins, and the second have none, therefore the second must exercise the tail more vigorously in swimming than the first. Therefore again, the eggs are far more safe on the under side of the tail in the section which have a caudal fin than in the section which have not. But still, even with the fin, the tail has too much motion for the perfect safety of the eggs, without the protection of the pouch; and they are furnished with that protection accordingly. The body anterior to the vent, which contains all the organs of the vital, nourishing, and reproductive systems of the fish, does not partake in the rapid action of the tail as an organ of motion; and therefore the eggs placed upon it are secure enough in the depressions of the body without the addition of a pouch.

Thus far we can understand the meaning of the different organisation of the two sections of these very curious fishes; but here the chain of our investigation breaks off; for we want all the information that, could we obtain it, would enable us to connect these fishes with the rest of the system of nature, so as fully to understand the part which they act in the general economy of the whole. In nature, all animals are useful, not for what they produce as for what they consume; and when we find one framed and organised upon a plan widely different from the majority of the others, we may, in general, be assured that the one so formed has an office to perform as curious, and as much out of the ordinary way, as it is itself. But the whole of these fishes is peculiar. They are peculiar in their very skeletons; for they are not bony fishes properly so called, neither are they cartilaginous. They in some measure partake of the characters of both, and the result is a character which does not agree exactly with either. Their fins, when they have them, resemble the fins of the true fishes; and the coverings of their bodies are more analogous to those of the cartilaginous ones. Their gills are intermediate both in structure and in action; and so, notwithstanding its peculiarities, is the mode of their re-production. The singular form of the body, and the still more singular formation of the mouth, point out a very peculiar kind of food and manner of getting at it; but it is exactly at this point that our information breaks down; and we call upon the admirers of nature in its working state to tell us, "What is the particular use of the pipe-fishes?" At present, there are no data from which to deduce any thing like a satisfactory answer to that question; and therefore we have no alternative but to wait till more knowledge shall be acquired, and, while we do so, make the most of the works of which we are in possession, which carry us very little farther than the mere discrimination of a few of the species,—to which species, in this second section, we shall now very briefly advert, confining ourselves to such as have been met with on the shores of the British islands; as it is by attending to them that we have the best chance of increasing the volume of our information.

Æquorial Pipe-fish (*S. æquoreus*). The specific name given to this species would lead to the conclusion that it is is more a fish of the plane or open sea than the others; and in corroboration of this we may remark that, as a British fish, it is much more rare on any one part of the coast than either of the species already noticed, but that it has been found occasionally at more points. Either, or both, of the fin-tailed species may be obtained, with a very great degree of certainty, by fishing for them in certain parts of the channel; but there is no place where the capture of a specimen of the present species could be calculated upon with any thing like certainty. It was mentioned as occurring in Scotland by Sir Robert Sibbald, whose *Scotia Illustrata* appeared in 1684; but though Sir Robert is correct in the main, there are certainly doubts as to some of the animals which he enumerates. The silurus is one of them, and it may be that this pipe-fish is another, the more so that none of the specimens which have been found in recent times have been of nearly the dimensions which he assigns; namely, two feet in length. The best account that we have of it is from Colonel Montagu, who obtained his specimens on the south coast; we shall therefore quote what he says of it: "Length twenty inches and a half, viz., ten to the vent, and ten and a half to the end of the tail." "The length of the head,' adds Mr. Yarrell, "is to the whole length of the fish as one to twelve; the most similar form to that of *S. acus;* its length to the eye three quarters of an inch; from thence to the end of the gill, nine; including the eye, one inch (which gives the head a little, but a very little, more length than Mr. Yarrell's proportion, which is sufficiently near the truth for ordinary purposes). The form of the body is rather compressed and angular, with an acute dorsal and abdominal ridge, which, together with three slight ridges on each side, give it an octangular appearance; it is of equal size from the gills to the vent, which part (that between the gills and the vent) contains about thirty plates; from the vent to the extremity of the tail it is at first quadrangular, and toward the end round and taper, containing about thirty plates: immediately behind the vent the body of this specimen suddenly decreases to one-third less in diameter; but this may be a sexual distinction.

"The dorsal fin consists of forty rays, commencing in a vertical line considerably in front of the vent, and terminating behind it, so that three-fourths of the fin is before the ventral aperture. The end of the tail is extremely small and compressed, the rays of which are not visible to the naked eye. The colour is yellowish, with transverse pale lines and dark margins, one in each joint, and another down the middle of each plate, giving it the appearance of possessing double the number of joints that it really has; these markings, however, cease at the vent."

Various testimonies unite in proving that this is a more pelagic fish than either of them which we have noticed as belonging to the first section. Mr. Couch, notwithstanding all his wits, and all his industry in "wiling fishes from the flood," has hitherto been unable to obtain more than two specimens of this one; but the channel fishermen report, that about thirty or forty miles from the land, and in a depth of not less than fifty fathoms, it is very commonly seen in fine weather, swimming near the surface. It is also, according to the accounts, much more abundant near the channel islands than toward the shores of the mainland of England. It does not, indeed, appear to come so regularly to the shallow water for physiological purposes as the fin-tailed species; but we are still in want of many of the elements which are necessary for obtaining a satisfactory history of it. There is one circumstance in the form of this fish which is worthy of attention, the more so that it is common to some others, though not to the whole of the division. The part of the body from the gills to

the vent, which is of nearly equal diameter for its whole length, is capable of very little flexure; and the sudden diminution in thickness of the tail after this enables that organ to move from its base with much more freedom and less disturbance of the anterior part of the body, than if the taper were more gradual. This allows a sort of repose to that portion of the animal which contains the vital organs, and also which bears the eggs, whether in the interior of the female, or on the exterior of the male, while the tail is at perfect freedom to impel the body through the water. Thus, comparatively finless as it is, this species appears to be better adapted for free swimming in the under-sea, than those members of the family which are the most amply provided with fins, and which, on a cursory view, we should be apt to regard as the best swimmers.

Snake Pipe-fish (*S. ophidion*). This is the most snake-like in its form of the whole race. The tubular portion is long and slender, the head very small, the body also small, but of uniform thickness to the vent; the tail is very long and slender, and tapers to a very fine point, or rather it tapers till it becomes exceedingly slender, and then the tip of it is slightly enlarged and compressed. Slenderness is indeed the remarkable character of this fish; for in a specimen a foot long no part is thicker than an ordinary goose-quill. The tail behind the dorsal fins is considerably longer than the body and head; and as about a fourth of the fin is in rear of the vent, that portion also must be considered as belonging to the tail. The body appears to be much less angular than in most of the other species, by the longitudinal rays being nearly obliterated, and the junctions of the plates on the sides of the body are also very indistinct. So far as the vestiges of the ridges can be traced, the body is octangular in the section, with one ridge on the back, another on the belly, and three upon each side. The colour is a pretty uniform olive green, without any cross bars or mottlings. The irides of the eyes, which are rather prominent, are red, and the pupils black.

There is no vestige of a pouch on either the female or the male, but the latter has depressions on the abdomen for receiving the eggs, which do not appear to be matured till the early part of the autumn. This appears to be a discursive species as well as the preceding; and though specimens have been taken near the land, it has been in the free water, and where that water had a current. It has been mentioned as occurring both in the northern and the southern seas of Britain, although most frequently in the latter; but every where it is comparatively a rare species. Twelve or thirteen inches is the greatest length of any that have been described; and it is curious how so light and slender a thing can endure so well as it appears to do the violence of our seas in their most turbulent state. The probability is, that these, like all the more slender fishes, retire to a depth below the vibration of the waves in all cases of storms, for they are seen swimming over the surface only when the weather is fine and the sea tranquil.

Worm-shaped Pipe-fish (*S. lumbriciformis*). This is the smallest of all the British *Syngnathi*; and though it agrees with the rest of the section in all its more general and essential characters, its appearance and manners are somewhat different. It is seldom more than between five and six inches in length, and smaller in the thickest part of the body than an ordinary earth worm. The tubular part of the mouth is shorter than in the others, and curves upward at the extremity. The head is rather large, and the thickest part of the body is near the head, from which it tapers uniformly to the point of the tail. The head, from the point of the snout to the posterior edge of the operculum, is one-twelfth of the whole length; the head and body to the vent make only a third of the length, leaving two-thirds to the tail; three-fourths of the dorsal fin are on the tail, and only the first fourth on the body. There are about nineteen plates on the side in front of the vent, and as many as fifty on the tail. These plates are but little conspicuous; and the longitudinal lines are almost wholly obliterated, so that the section of the body is nearly circular; the surface is also smooth; the colour is dark olive green. This species is a shore fish, and not a pelagic one. Its habits are lurking, and it is usually found under stones. It is met with on various parts of the coast, and even in the northern islands: and in some places of the south it is reckoned very common.

Hippocampus—Sea-horse. The fishes of this genus are even more singular than the *Syngnathi*, both in their appearance and their habits. They have the body much compressed and very considerably deeper than the tail, to the thickness of which the posterior part of the body is reduced by a very rapid curve, which, for a reason afterwards to be explained, is much more conspicuous in the female than in the male. The depth of the body is also much contracted toward the head, which, with the enlarged operculum and the elevated angular plates on the head behind the eyes, gives the fish the appearance of having a true neck as in mammalia and birds. This part is also much more flexible than in any other fish, so that the head can be moved upon the body, and thus become, by means of its angular and spinous projections, an instrument of prehension, by the help of which the fish can climb. This flexible portion is not a neck, however, but a part of the body, for the pectoral fins are in advance of it, and when they are exerted they have something the appearance of ears. The tubular part of the mouth is very slightly bent upwards, and the gape oblique and very small. The eyes are prominent, and the widest part of the head is across them, the crest behind being compressed, so that when seen in front it has the appearance of an ornamental crest set on the head rather than belonging to it. There are two spiny elevations immediately over the eyes, and the pectoral fins look like ears placed immediately behind. The general profile of the head is of a triangular shape, and in the female the crest toward the hind head rises higher than in the male. The body and tail are angular, with prominent longitudinal ridges, which are crossed by other ridges at the junctions of the plates, extending round the body, and forming little projecting knobs where they cross the longitudinal ones. Both sexes have dorsal fins as well as pectorals, the dorsal being wholly or nearly in advance of the vent; the female only has a small anal fin, and neither have any ventral or caudal. Indeed the tail is more completely finless in them than in the *Syngnathi* which have no caudal; for these have the dorsal in part upon the base of the tail. The tail is prehensile, and can twine firmly round the stems of seaweed, or other small substances, its hold being rendered more firm by the

ridges and tubercles with which it is beset to the very tip. What with the prehensile tail, what with the flexibility of the anterior part of the body, and the angular projections on the cheeks, these animals are not badly adapted for climbing. They can hold on with the tail, and advance the body to its whole length, hold on with the head, and again bring up the tail, so that they can clamber about among the seaweed something in the style of the small climbing *Sauria*. It appears also that they can make use of the unbending of the body and tail to give them a rapid impetus through the water, in the same way that an impetus is obtained by lobsters and various other leaping crustacea

When they are dead, the body does not become relaxed and straight as it is in most fishes. The middle, where the dorsal fin is situated, bends slightly inward as seen in profile; and the flexible part of the body bends in a curve toward the belly, till the axis of the head is enclosed at considerably less than a right angle to the axis of the body. The tail also coils up into a spiral, toward the lower side of the fish; and the bending both of this and of the anterior part are in the mesial plane of the body. This, with the angular projections on the body which give it the appearance of being made up of a series of flat plates, soldered together at the ridges both longitudinal and crosswise, make it look very unlike any ordinary fish, and thus it is in request by collectors of natural curiosities.

When in this bent or curled state it has, whether viewed in profile or in front, some faint resemblance, in the head and neck, to the same parts of a horse, which is the cause of the name given to it. In the profile the male has most of this resemblance, as the posterior part of the head is not so deep in the section as in the female. In both the curved part of the body, as far as the commencement of the dorsal fin, has a good deal both of the outline and the peculiar curve of the neck of a horse; and the front view has perhaps more of this fanciful likeness; but here the resemblance ends, and the portion to the rear of the dorsal has much more resemblance to the tail of a saurian reptile.

The mode of reproduction has not been actually observed; but from the structure of the animals, both internal and external, there is no doubt of its being in principle the same as in the *Syngnathi*. The females are at once distinguished from the males by the more prominent outline of the belly, its more rapid contraction posteriorly, and the presence of a very small anal fin near the angle at which the under line of the body meets that of the tail. The specimens having this form have been ascertained to be females, by the fact of their containing ovaries and roe. The males have the under line much less prominent, and at the part corresponding to that where it begins its sudden curvature toward the base of the tail in the female, there is in the male a sort of pouch consisting of two side lobes, not with ridged plates like the rest of the body, but smooth and flexible; and there can be no doubt that these form a pouch in which the eggs are hatched, in a manner similar to that in the first section of the *Syngnathi*. This pouch is so situated that its contents are well protected from injury from the motions of the fish; they lie in the deep angle formed at the posterior part of the body, and still there is enough of the tail left free beyond the pouch for all the purpose of swimming and prehension.

There are various species of *Hippocampus*, some found in the seas of Europe, and others in the seas of the south and east. Some of those of the warmer seas have the tubular part of the mouth much larger than those of the European seas; and some of them have filaments at the muzzle and on other parts of their bodies, which increase the singularity of their appearance. A large species which is found in the Australian seas has various parts of the body furnished with appendages in the shape of bows, the use of which is not known; indeed we know but little of the economy and habits even of the one which is occasionally found upon our own shores. That one is,

The Short-nosed Sea-horse (*H. brevirostris*). This is not very often met with on any of the British shores; but the more southerly the place, there is the greater chance of finding it, though the chance is so small that one need hardly risk the getting of it as an adventure to be undertaken on purpose. It appears to occur most frequently on the shores of the Channel isles; next to that on the Channel coast of the main land, and more rarely in the Bristol Channel and on some parts of the coasts of Norfolk and Suffolk; but we are not aware of its occurrence in the northern parts of the island.

It is a very small fish, none of the specimens obtained in this country exceeding five inches in the total length; and, when they are curled up in the state in which they are commonly exhibited as museum specimens, they are not above half that length. The tubular portion of the mouth is much smaller in both its dimensions than the remaining part of the head. The eyes are very prominent, with the irides of a straw yellow; and the spinous tubercles over them have much the appearance of little horns; the pectoral fins are immediately in the rear of the gill-cover, rather small, and containing about eight rays in each; but they are capable of being erected and spread out, so as to be conspicuous for their size; the section of the body is seven-sided, one of the sides being on the back, and continuous from the nape to the tail; thus, there are three ridges shown upon each side, and one upon the belly; this and the one next to it on each side merge at the posterior part of the abdomen; and the tail is quadrangular or flat, or bare below, and on the sides with four ridges; this is different from those *Syngnathi* which carry the eggs before the vent, for in them the ridges next the back merge in the continuation upon the tail; on the body the cross ridges, or transverse segments of the plates, are eleven in number, with the tubercles at the intersections rather prominent; and the number of segments on the tail is about thirty; the dorsal fin, which is rather higher in the female than in the male, contains about sixteen rays; and the anal fin of the female, which is very small, not more than four; the general colour is pale brownish-ash; but there are traces of blue upon some parts of the body; and in the living fish there is a beautiful play of prismatic colours, which fades when the fish is sickly, and goes off entirely after it is dead.

If its food were known, which it is not, this would be one of the most amusing of vase fishes, as its manners are so different from those of any other of the species. The golden carp, which is our principal vase fish, is pretty enough; but it has nothing to recommend it save its colour and the ease with which it can be kept in a state of confinement in fresh water. The sea horse, or indeed any of the family to which

it belongs, is never found but in the sea; and thus it could not, in all probability, be kept, unless in situations where it could have regular changes of sea water. But where this could be had,—and it is probable that, if taken from places where the fish is found, it would in all likelihood contain the requisite supply of food,—there is no doubt that this fish could be made an amusing addition to the living collection, as well as a source of mere wonder at its form in the dead one. Specimens found upon different parts of the British coasts have been kept alive long enough to show that they are any thing but tender of life. Indeed we might come to the same conclusion *à priori*, by attending to the structure of the breathing apparatus, which gives the air so little access to them, that the fish must, according to the general analogy of all fishes, live for a long time out of the water, as compared with fishes to whose gills the air has ready access. We do not know the quantity of respiration which those fishes with tufted gills require, as compared with such as have them free and pectorated; but there is every reason to believe that it is less; and thus the water in which the fishes were kept would require to be less frequently changed. Mr. Lukis, of Guernsey, who supplied Mr. Yarrell with specimens of these fishes, of which figures are given in Mr. Y.'s work, and also with every valuable information, gives the following account of their manners in a state of confinement:—"At the time of writing, June 9, 1835," says Mr. Yarrell, "Mr. Lukis had two female specimens of *Hippocampus brevirostris*, then healthy and active, which had been hung in a glass vessel, and their actions were equally novel and amusing. 'An appearance of search for a resting place induced me,' says Mr. Lukis, 'to consult their wishes by placing sea-weed and straws in the vessel; the desired effect was produced, and has afforded me much to reflect upon in their habits. They now exhibit many of their peculiarities, and few subjects of the deep have displayed, *in prison*, more sport or more intelligence. When swimming about, they maintain a vertical position; but the tail is ready to grasp whatever meets it in the water, quickly entwines in any direction round the weeds, and, when fixed, the animal intently watches the surrounding objects, and darts at its prey with great dexterity. When both approach each other, they often twist their tails together, and struggle to separate, or attach themselves to the weeds; this is done by the under part of their cheeks or chin, which is also used for raising the body when a new spot is wanted for the tail to entwine afresh. The eyes move independently of each other, as in the chameleon; this, with the brilliant changeable irridescence about the head, and its blue bands, forcibly remind the observer of that animal."

This passage, short as it is, throws more light upon the character and habits of this very singular fish, than all the disquisitions of the systematic naturalists put together, and makes one heartily wish that there was a Mr. Lukis on every part of our shores. It establishes beyond a doubt that the chief residences of these fishes is among the sea-weed; and that they cling by their prehensile tails waiting for the very minute substances on which they feed, till they are brought within their reach by the motion of the water. They are thus enabled to hold on in places where no fish could hold on by the mere action of its fins upon the water; and we can see how well the flexibility of the anterior part of the body and the double action of the prominent eyes, each taking in its own field of action, independently of the other, enable it to capture the smallest food in sufficient quantity for its support. What purposes the filaments and leaf-like appendages upon the species which are found in the tropical and southern seas may answer in their economy, we are unable to say. We cannot suppose that, like the barbules which are found upon many common fishes, they can in any way answer as baits or lures to attract the prey, for the fish itself is so small and its gape so narrow, that it cannot be supposed to feed upon any thing that could be lured by a visible bait. There is, however, no known limits to the smallness of the tenants of the deep, as they do not require any apparatus for bearing them up, as is the case with air animals; and thus the total volume of living creatures in the sea which are individually too small for our vision, may amount to more than that of all the visible ones, abundant as they are. It is only in this way that we can account for the subsistence of the countless myriads barely within the range of our vision, with which all parts of the ocean teem.

Solenostomus (Tube-mouth.) This name has been given by some authors to one or other of the pipe-mouthed fishes (*Bouches en flute* of Cuvier), which are spinous finned fishes with pectorated gills, and spawning in the same manner as other fishes, whereas the one now alluded to (and there is only one known species) agrees exactly in its physiology with the rest of the present family. This one species has been confounded with the said pipe-mouthed fishes (*fistularia*), which are the long-bodied division of the *Bouches en flute*, while the name of this one has been given to the sea snipe of the Mediterranean, which is one of the oval-headed or Contrisii. In most of its characters, it agrees with *Hippocampus;* but instead of the pouch there are two large ventral fins in the rear of the pectorals, which form a sort of apron for retaining the eggs; there are also two dorsals, one just behind the head, and a smaller one near the origin of the tail, and there is a long and pointed caudal fin. It is found in the Indian seas, and is the *Fistularia paradoxa* of Pallas.

SYRPHIDÆ (Leach). A very extensive family of dipterous insects, belonging to the section *Athericera* of Latreille, having the proboscis long, membranous, or fleshy, elbowed at the base, terminated by two large lips, enclosing in a dorsal canal the organs of suction, which are four in number, the superior large and channelled beneath, in order to receive the three other slender organs, which are the representatives of the maxillæ and tongue; the palpi are two in number, and attached at the base of the maxillæ: the head is hemispherical, and occupied, to a large extent, by the eyes, especially in the males; its forehead or frontal part is often produced into a sort of muzzle or nose; the slender bristle of the antennæ is attached at the upper part of the third joint of these organs; the abdomen is often long and depressed. Many of these insects resemble humble-bees (see the article Entomology, vol. ii., p. 430, for comparative figures of the bee and one of the *Syrphidæ*); others resemble wasps. They are often of large size, and their colours variegated, some being metallic in their tints, varied with golden or white bands. They delight to rest upon flowers, the honied sweets of which they extract for their food. There is considerable diversity of form amongst the different species of which the family is composed; in

some the body is short and thick, in others long and depressed, and in a few the abdomen is very slender at the base, and clubbed at the end; the legs in some are very slender, whilst in others the hinder femura are thickened and toothed, and the tibiæ curved. The flight of these insects is also varied according to the species. Many of these insects delight to select some quiet warm spot in the open part of a wood or garden, where they may be seen hovering for a great length of time without shifting an inch from the spot, although their wings are in such rapid motion that they can scarcely be perceived. No sooner, however, are they alarmed or disturbed by the approach of some other fly, than they dart off with the quickness of lightning, returning again, however, in a very short time to the very same spot. In like manner they will select a leaf or a stone, from which they will make long flights, returning again to the identical situation.

There is considerable diversity in the economy of these flies. Although the observations hitherto made upon their habits have been but few in number, it has been ascertained that their eggs are deposited in the earth, in manure, in rotten wood, in the bulbs of cilliaceous plants, in the nests of humble-bees and wasps, on the leaves and stems of plants, in putrescent matters, and in water. The larvæ have the head fleshy and of a variable form; when full grown they do not throw off the outer skin, which becomes a covering for the pupa.

The number of species comprised in this family is very considerable; the genera are, *Ceria, Callicera, Chymophila, Aphrites, Ceratophyla, Chrysotoxum, Psarus, Mixtemyia, Volucella, Temnocera, Sericomyia, Criorhina, Mallota, Eristalis, Didea, Platynochæta, Helophilus, Priomera, Palpades, Merodon, Tropidia, Senogaster, Xylota, Brachypalpus, Syritta, Eumerus, Rhingia, Graptomyza, Brachyopa, Pelecocera, Milesia, Syrphus, Doros, Sphærophoria, Ocyptamus, Cheilosia, Chrysogaster, Orthoneura,* and *Paragus*. The most interesting of these genera are described in their places in alphabetical order.

The genus *Syrphus* is distinguished by having the abdomen narrowed from the base to the extremity; the frontal projection of the head is short, the wings are apart when at rest, and the posterior margin of the exterior cell of the wing is nearly straight, or but little sinuated. The larvæ of this genus feed upon plant-lice, and it is very interesting to observe the carefulness with which the female *Syrphus* flies around the twigs of various garden shrubs, inspecting each minutely, for the purpose of discovering whether there are any of the *Aphides* upon the plant. In case any are discovered, the insect, still remaining on the wing, turns herself round and deposits an egg in the midst of them, attaching it to the twig or leaf; from this egg an unsightly grub, without legs, is hatched, which is no sooner born than it commences its voracious attacks upon the insects in the midst of which it finds itself; destitute of eyes, it gropes about with the extremity of the body, until it feels one of its luckless victims, which it immediately seizes upon, by means of the acute points with which its mouth is armed, and raises it aloft in the air, holding it in that situation until it has completely extracted all the fluid from its body, and then casts it away; it then proceeds in the same manner, having little occasion to move from the spot, and consequently being destitute of legs. When it has attained its full size it fastens itself by the hinder part of the body to the twig; it then contracts its body, which by degrees assumes an oval form without casting the outer skin, which serves as an envelop for the inclosed pupa. The perfect insect makes its appearance in a very short time, having lost all the voracious propensities of its former state. We have found it very serviceable to introduce the larvæ of these insects amongst the *Aphides* which have infested a choice plant, and which they have cleared in a very short time. There are about thirty British species of this genus.

TABANIDÆ (Leach). A family of dipterous insects belonging to the division *Brachocera*, and forming the subdivision *Hexachæta* (see DIPTERA). These are large two-winged flies, well known for their tormenting powers in attacking horses and cows, by sucking their blood by means of their powerful proboscis, composed, as the subdivisional name indicates, of six lancet-like organs, inclosed in the ordinary fleshy rostrum, which is terminated by two large fleshy lips. The eyes are large, especially in the males, and the antennæ have the third joint large and crescent-shaped, terminated by several smaller articulations. A figure of the head of one of the species of the genus *Tabanus*, with all the parts of the mouth disengaged from the rostrum, is given in the article DIPTERA, and the details of the mouth in the same genus are given in detached figures in the article INSECT (vol. ii. p. 850, fig. 88). These insects have often been described under the name of gadflies. The body is seldom very hirsute; the head is of the width of the thorax, nearly hemispherical, and covered, except a narrow space, especially in the males, by two large eyes, which, in some of the species, exhibit the most brilliant hues when alive, the colours being arranged in bands. The wings are extended horizontally on each side of the body when at rest; the winglets are large, and nearly conceal the halteres; the abdomen is triangular and depressed; and the tarsi are terminated by three pulvilli.

From the comparatively large size of these insects, they are capable of inflicting very great pain both upon men and beasts of the fields. Their flight is noiseless, although some make a buzzing sound when on the wing; and often, whilst walking in the fields and woods, we have been made to start by the sudden pain produced by one of these insects which had settled upon the naked hand. Their pertinacity is also so great that they cannot be driven away. The horse lashes with his tail and throws about his head, but all in vain; the *Tabanus* retains its seat, and at length, when satiated, the fly desists; and then the sides of its victim may be seen trickling down with blood from the wounds made by the insect. It is supposed that the redoubtable *Zimb* of Arabia, or *Tsaltsalya* of Bruce, is a species of this group of flies. The *Tabanus maroccanus* of Fabricius attacks the camel, which, according to M. Desfontaines, is sometimes entirely covered with these troublesome creatures. It is a curious fact that the females alone are endowed with these blood-thirsty qualities, the males frequenting flowers.

The larvæ of *Tabanus bovinus* reside in the ground. They are long, cylindrical, narrowed towards the head, which is small, and armed with two hooks. The segments of the body, twelve in number, have elevated transverse ridges. The pupæ are naked, nearly cylindrical, with two tubercles in front, the

margins of the segments serrated, and six points at the posterior extremity. By the assistance of the serrated points of the segments of the abdomen, the pupa makes its way immediately before its final metamorphosis to the surface of the ground, where it protrudes the fore part of the body into the air. According to Fabricius, the larvæ of *Chrysops* also reside under ground, and those of *Hæmatopota* in dung.

The genera are: Pangonia, Dicrania, Rhinomyza, *Tabanus*, Diabasis, Acanthoceras, *Hæmatopota*, Hexatoma, *Chrysops*, Silvius, Raphiorhynchus, and Acanthomera, the three printed in italics being inhabitants of this country. The genus *Pangonia* is especially distinguished by the great length of the proboscis, which, in some species from Georgia, in America, and Nepaul, are more than twice the entire length of the body. *Tabanus* is distinguished by its short thick proboscis, and by the emarginate structure of the third joint of the antennæ. The species are very numerous, and are found in almost all parts of the world. The type of this genus is the *Tabanus bovinus*, Linnæus, a large handsome species, an inch long, with the body brown above, grey beneath, eyes green, tibiæ yellowish, and with transverse lines and triangular spots of pale yellow on the abdomen. The wings are transparent, with reddish-brown nerves.

TABERNÆMONTANA (Linnæus). A genus of tropical trees and shrubs, mostly ornamental; the flowers are sweet-scented and pentandrous, and the genus ranks among the *Apocyneæ*. The species are favourite stove-plants, are grown in light loam and heath mould, and are increased by cuttings rooted in sand.

TACHINA (Meigen). A very extensive genus of dipterous insects belonging to the family *Muscidæ*, having very much the appearance of common flies, with the body narrow, or of moderate width; the face a little oblique; the antennæ reaching to the epistoma; the second joint elongated, and as long, or nearly as long, as the third; eyes naked; abdomen cylindrico-conical, ordinarily destitute of bristles in the middle of the segments. This very numerous genus comprises various species of *Muscidæ*, the larvæ of which are parasitic in the bodies of caterpillars, in the same manner as the *Ichneumonidæ*. The genus, in fact, may be regarded as the type of a still more extensive group which M. Macquart has named *Tachinariæ*, and Robineau-Desvoidy *Entomobiæ*, all of which exhibit the same parasitic habits. The food of these insects, which they obtain from flowers, has far less influence upon their habitats than the cares for their progeny. They deposit their eggs upon the outside of different insects, especially caterpillars; and the larvæ, as soon as hatched, burrow into the body, and there find a supply of food, taking care not to touch the vital parts. Lepidopterous larvæ are especially liable to the attacks of these insects, and our breeding cages are sometimes filled with a swarm of these flies, instead of some scarce moth or butterfly which we had hoped to rear. The type of the genus is the *Musca larvarum* of Linnæus.

TACHINIDES (Mannerheim). See Brachelytra and Tachyporidæ.

TACHYPORIDÆ (MacLeay). A family, or rather a subfamily, of coleopterous insects belonging to the division *Brachelytra*, and corresponding to the two tribes *Tachinides* and *Aleocharides* of Mannerheim. The chief character of this family consists in the small size of the head, which is immersed in the thoracic cavity as deep as the eyes, without any distinct neck; the thorax is broader behind than in front; the body is of a moderate length, or is somewhat elliptical; the mandibles without teeth; the elytra often cover a considerable portion of the abdomen. They chiefly reside in fungi or dung. They are very active in their motions, and are occasionally prettily varied in their colours.

The chief genera are, *Lomechusa*, *Tachinus*, and *Tachyporus*. In *Tachinus* the tibiæ are spinose, the antennæ gradually thickened, and the palpi filiform. The *G. tachyporus* differs from the latter chiefly by having the palpi terminated by a small conical joint. The species are numerous and of small size.

TAGETES (Linnæus). A genus of South American annual herbs, belonging to the natural order *Compositæ*. Some of the species have been long cultivated as tender annuals; that is, raised in a hotbed in the spring, and transplanted into the open borders in May and June. The French and African marigolds are two of the most common.

TALIERA (Martius). The *T. Bengalensis* is a magnificent palm, native of India, where it was found by Roxburgh, and by him called *Corypha taliera*. In our collections they require to be kept, potted in light soil, in the warmest part of our stoves.

TAMARINDUS (Linnæus). A genus of large and handsome trees, natives of both East and West Indies. The flowers are monadelphous, and the genus belongs to *Leguminosæ*. These trees are celebrated for the excellence of their fruit, being medicinal as well as dietetic. The woods and jungles of the Coromandel coast are thickly studded with these magnificent trees, yielding almost at all times their delicious fruit. The pods hang long on the tree after the pulp is ripe. In our stoves the plants are kept in a diminutive state, and may be increased by cuttings.

TAMARISCINEÆ. A natural order comprising only one genus, namely, *Tamarix*, of which there are six species. The species are chiefly shrubs or perennial suffruticose plants, with rod-like branches, small, entire, alternate, scale-like leaves, usually glaucous, diaphanous at the apex, and without stipules. The inflorescence is in racemes or spikes, and the flowers regular and united. The calyx is four or five cleft, persistent, and imbricate in æstivation. Petals attached to the base of the calyx, and equal in number to its divisions, and also imbricate in æstivation. Stamens equal in number to the petals, or twice as many filaments, free or monadelphous; anthers two-celled and burst longitudinally. Germen superior, free. Style short, and stigmas three. The species are natives of Europe, Asia, and Africa. Some of the kinds have an astringent tonic bark, and yield, when burnt, a large proportion of sulphate of soda. It is stated that it is a species of *T. gallica*, which produces that peculiarly saccharine and gummy matter known as the manna of Sinai. The species thrive in any soil, and are propagated by cuttings put in the ground either in autumn or early in spring.

TAMEÆ. A natural order containing only one genus; viz., the *Tamus communis* (black briony), and two species. They are climbing herbaceous plants, having very large tubers, whence the roots and stems are produced. The leaves are cordate, flowers axillary, in racemes small and white, succeeded by red berries, and common in British hedges. Qualities dangerous

TANACETUM (Linnæus). A genus of hardy herbaceous perennials and evergreen shrubs; two of the former are British, and cultivated as pot or medical herbs, under the name of *Tansy*. The genus belongs to *Compositæ*, and is common everywhere.

TANAGER (*Tanagra*). A numerous genus, or rather group or family, of birds, belonging to the *dentirostral* division of Cuvier's *Passeres*, and placed in the system between the fly-catchers and the thrushes, with each of which they have some characters in common, though there is still enough that is peculiar to entitle them to be ranked as a distinct group, and so much diversity as to require separation into a good many subordinate genera. The progressive history of the group is by no means clear; so that, upon consulting the succession of authors that have alluded to them, it is not easy to say what is a tanager and what is not.

The general characters of the group are: the bill conical, triangular at the base, slightly arched in the culmen, and with a notch toward the tip; the wings short, and the birds taking only short flights. In their habits they more nearly resemble our finches than any other family of our birds. They feed upon seeds and berries, and also upon insects. The greater number of them are remarkable for the brilliance of their colours. In this also they agree with our finches, which, though sober in their attire as compared with the tanagers, are yet among the gayest of our little birds.

The more particular characters which may be regarded as applying most perfectly to the typical species are these: the bill with a ridge on the culmen, which makes its section nearly triangular at the base; the culmen a little arched; the upper mandible slightly notched, and very sharp at the tip; the lower mandible straight, but a little enlarged and convex in the lower outline toward the middle part; and the tomia of both mandibles rendered very efficient for breaking and bruising, by being bent inwards so as to form a margin; the bill is thus a very powerful and efficient one for its size, and it has much more of a granivorous than of an insectivorous character, though the notch shows that it does, to some extent, partake of the latter. The nostrils are lateral near the base of the bill, pierced in very slight nasal grooves, and partially covered by the reflected feathers of the front. The feet are of mean length, with four toes, three to the front, and one to the rear; the middle front toe as long as the tarsus, and united to the external one at its base; the inner one is entirely free. The wings of mean length, and rounded; the first quill shorter than the second; and the third the longest in the wing. As has been hinted, the flight is short, and the birds are not given to extensive migration, though many of them alter their habitation with the seasons. In this also they have some resemblance to our finches; for, when they are in the woods and thickets during the breeding time, they are mostly dispersed in pairs, whereas they sometimes flock when they come abroad to reap their harvest in the more open places.

All the tanagers properly so called are natives of the American continent, chiefly of the tropical, or at all events of the warmer parts, and it is as such that they are peculiarly characteristic of South America, which rivals, in the numbers and the splendour of its feathered inhabitants, the oriental islands, and all the richer districts of the East; and in the humming-birds, the cotinges, and the tanagers, the one part of the world stands much on a par with the other. In the birds of paradise, the nectar-suckers, and the rollers, as is the case with the finely-coloured birds of tropical Asia, we cannot find any parallel among the birds of our comparatively cold climate that can be compared with those painted children of the sunny lands. This we could not expect; for the birds are characteristic of their native countries exactly in those very particulars in which those countries differ from our own, and the birds are among the means which we must use in seeking to obtain a knowledge of the countries which they inhabit.

They prefer the thickets on the margins of the forests, rather than the depths of the forests themselves; and in this again they resemble our finches, which are bush birds rather than tree ones. At one season of the year they find an abundant supply of food in the berries which those bushes yield, and in the seeds of various herbaceous plants with which the thickets are entwined; but when the supply there fails, they approach the cultivated grounds and the dwellings of the country people, often levying heavy contributions on the crops. When they come to the more humid and fertile places they perch upon the tops of the lofty trees, in order to be safe from the attacks of the numerous reptiles; as, were they to repose on the ground or on the bushes and low branches, the brightness of their colours would speedily disclose them to those snakes which are such destroyers of birds.

As is the case with most of the richly-coloured birds of tropical countries, few of them have much music in their voices; but there are some songsters among them, and the few that are, are much prized by the people of a country where birds are so many, and singing birds so few. Their nests are in general elaborately formed, constructed externally of small twigs and bits of stalks, and lined with wool, feathers, or down. They are of a hemispherical form, and the birds labour at the construction of them with the most indefatigable industry. The eggs in a hatch are but few, not exceeding two or three in number; but in most parts of the country they breed at least twice in the year. This double hatch in the twelve months is very common among the birds of tropical countries, whether the eggs in the hatch be few or many; and it is remarkable that the birds retain this instinct long after they have been naturalised in countries very different from their original one. We have an instance of this in our common domestic poultry, which there is little doubt came originally from the south-east of Asia; for though, by artificial treatment, they may be made to breed at almost any time, they have a natural tendency to breed in the spring and the autumn.

We can understand why the breeds of such birds as the tanagers should be less numerous than those of our finches and linnets, just as the latter are, generally speaking, less numerous than those of the warblers. The days are long with us at the time when our little birds have their most severe labour, that is, when they have to feed the young; while in the tropical regions the days are but little more than twelve hours, and the twilight is comparatively short, in consequence of the sun's rays descending almost perpendicularly, and consequently much sooner getting to that depth below the horizon at which twilight ends than when his course is more oblique.

Thus, as compared with the warblers, the finches and analogous tribes have really much more labour in finding food for their young, as the substances which they collect have to be gathered from a wider pasture, and are in themselves less nutritious. The eggs of our finches average about five in a hatch, and the tanagers two or three, which brings the annual productiveness of the two races very nearly to an equality. The eggs of the tanagers have some resemblance to those of the finches. They are oval, without any definite pointedness at the narrowest end, of a white ground, more or less greenish or bluish, and mottled with small spots of brown, or russet. The birds are also about the size of our finches and linnets, or perhaps in some of the species a little smaller; and they are neatly and firmly made, and very energetic in their manners.

When it is mentioned that the species of these birds amount to about sixty, it will be readily understood that there must be a considerable difference in their haunts and the details of their habits. Differences of species among birds or any other animals are not given to them for the sake of mere variety or distinction, but for adapting them to the performance of different offices in the grand economy of nature. It is true that, especially in the finer shades, we do not see the difference in the object and use; but this does not in the least affect the universality of the principle, which holds equally in the case of the most minute difference as of the most conspicuous, and equally in those cases in which we are unable to see it as in those of which we can easily give a full and satisfactory explanation. It is of very great consequence to us to bear this always in mind, and never to pass over the slightest difference of appearance without endeavouring to ascertain the cause; for if we pass over these minor matters in a careless manner, the habit is fostered by our natural love of indolence, and we are certain to be, or to become, equally careless in matters of more importance.

Upon this principle, it would be absurd in us to suppose that there could be sixty species of tanagers in the same regions of South America, all inhabiting precisely the same kind of grounds, and practising the same economy in every thing; because it is quite clear that this would be a diversity without a use, and we have no instance of any such diversity in nature, nor could we at all reconcile it with that wisdom of design and perfection of execution, which run so completely through the whole, and which always appear the more conspicuous the more completely that we examine any one individual part.

The vast number of species of the tanagers, all agreeing in their generic characters, and consequently in their general habits, and all differing specifically and in the details, naturally lead us to expect a corresponding variety in the character of those places over which the birds have to range; and when we turn our attention to the physical condition of South America, we find that it has every diversity of surface, and consequently of surface production, that we can well imagine. On the parallel of the equator, taking it from the lands not of perpetual verdure merely, but of the very excess of perpetual verdure, at and near the place where the Amazon pours its mighty flood into the Atlantic, across Chimborazo to the shores of the Pacific, we have every variety of surface and of climate that can be imagined; and, with the exception of those differences in the length of the day, and consequent accumulating of the winter into one time of the year, and the summer into the opposite, we have all the varieties which can be met with on the surface of the globe. In many places too we have the greatest seasonal diversities that can occur in a tropical portion of the globe—absolute barrenness from drought at one time, and the most exuberant fertility at another. Then we have a very striking contrast in the country on the two sides of the Andes. The coast country on the east constantly receives the fertilising influence of the trade-wind, and the luxuriance of the vegetation corresponds; while on the west, or Peruvian side, we have a country comparatively parched, until we recede so far inland as to come within the range of the mountain rains.

Such a country must demand a very great diversity of those little birds which, from their numbers in all regions, appear to perform so important a part in the system of Nature; and this seems one of the reasons why the tanagers, which consume the surplus of the smaller fruits, are so very numerous in species, and so varied in their individual habits, at the same time that their general characters are so much the same. But in whatever place they have their principal habitation, the tanagers are chiefly wing birds, moving by short and jerking flights, and feeding on the perch much more frequently than on the ground. On the latter they do not run, as is the case with the thrushes, which, as a family, are placed immediately after them; they hop, or proceed on the ground with a partial use of the wings when they move rapidly. Some of them are found chiefly in the depth of the large forests, but even there the trees are really bushes to them; for they inhabit the tops among the small twigs, and use the wing in passing from one part of the tree to another. Others again live on the confines of the woods, where the bushes in general lose their leaves in the dry season; and the birds which inhabit these must migrate when the produce of the season is exhausted. Those which live most habitually in the woods, are mostly in pairs, or solitary when not in the breeding time; and those that visit the meadows and cultivated fields are more social, and come in flocks. In all these particulars we find that they observe the very same law as the birds of Europe.

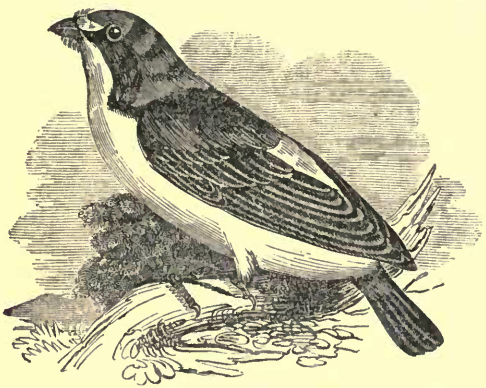
In the tropical parts of the continent of South America, the cultivated grounds bear so very small a proportion to those which are still in a state of nature, that they do not materially affect the general character of the country. It is different in a small portion of the coast of Guiana; but even there, the cultivated portion stands to the uncultivated much in the relation of a narrow hem to a wide garment. But in proportion as this cultivated part is small as compared with the country in a state of nature behind, the seasonal visitations of the birds to the cultivated fields are numerous and destructive. It is the same in the countries to the south of the equator; for there the tanagers come from. "They perch in mass and plunder the gardens both of fruits and of the seeds of leguminous vegetables. In the West India islands it is still the same. There, the slopes of the mountains, and all places which are not adapted for the kind of cultivation which is followed as the most profitable, is covered with wood or brush of some kind or other, and very many of the trees composing these woods and brushes, yield berries and other succulent fruits, which feed multitudes of birds, and birds of this genus

or family in an especial manner. But, generally speaking, there are times of the year at which those wild supplies are exhausted; and at these times the birds resort to the plantations in great numbers, and do considerable damage."

In a popular sketch it would be impossible to enter into the details of so very numerous a race of birds as the tanagers; and though our limits would admit of it, it would be only a repetition of matters substantially the same, and varying only in very minute particulars. Those who wish to obtain detailed (museum) accounts of these and the other gaily coloured birds of tropical America, may consult Desmarest's "Natural History of Tanagers, Manikins, and Todies," published at Paris in 1805, in one volume folio. We must content ourselves with merely noticing one or two of each of the subdivisions into which they are divided by Cuvier. There are, 1. Bullfinch tanagers; 2. Grossbeak tanagers; 3. Tanagers properly so called; 4. Oriole tanagers; 5. Cardinal tanagers; and 6. Swelled-billed tanagers.

Bullfinch Tanagers. These are also called *Euphonous* tanagers, because they are the chief or the only ones that have any noise or notes worthy of being called a song. Their leading characters are: the bill short, and exhibiting, when seen from above, an enlargement at each side of the base; and their tails are also shorter in proportion than those of the other subdivisions. These are among the most compact birds of the genus; and some of them are the most frequent and annoying visitants of the neighbourhood of barns, where they often make the people "pay too much for their whistle."

Organist Tanager (*T. musica*). This species is abundant in many of the West India islands, especially in Haiti, of the natural history of which we had tolerable accounts from the French, before it was expunged



Euphone Organiste, male.

from the catalogue of civilised countries by coming into the possession of the blacks, morally and intellectually depraved as they were by having been in that state of abominable slavery which has long been the withering blight of so many of the finest portions of the western world. We do not arraign the retributive justice which put that finest of all the West India islands in the possession of these people; but every one must deplore the circumstance of their getting it before they were capable of treating it properly, by which means the garden of the western world has been converted into a tangled and unprofitable wilderness. The bird in question comes near houses, and though its song cannot be considered a fine one as compared with that of the more choice songsters of the eastern world; it has a good deal of compass and variety. It is a small bird, the total length being about four inches; but as the tail is short, the body is long in proportion. The top of the head, the hind head, and the upper part of the neck are blue, with a black margin on each side; the quills and tail-feathers are black, with rich reflections of blue; the forehead, the rump, and all the under parts of the body are yellow; and the bill and feet are black. The female has the upper parts greenish-ash, and the upper part of the neck pale bluish-grey. It is an active and merry little bird, and shifts its positions on the trees with so much adroitness, that it is caught or killed with considerable difficulty.

Crested Tanager (*T. diademata*). This is a Brazilian species, or, at all events, it is known but as a native of that part of South America. It is a very handsome bird, and, among tanagers, it is one of considerable size, the length being six inches and a half. The upper parts are very brilliant blue, and the under ones the same colour, but considerably darker in the shade; around the base of the bill is deep velvet black; the back part of the head is covered with a fine cape of pure white feathers, in advance of which there is a tuft of silky feathers of a bright flame colour; the quills are black, margined with blue, and tipped with brown; the tail-feathers are also black, bordered with blue, but without any brown on the tips; the bill and feet are greyish-black.

Onglet Tanager (*T. striata*). Buffon gave this species the fanciful name of "Onglet," or ingrooved, from a little groove in the outside of each of the claws, which is not, however, connected with any known habit or peculiar mode of action in the bird. The upper parts are black; the head, the upper part of the hind neck, and the middle and lesser coverts of the wings, azure-blue, but with the roots of the feathers on the latter black; the breast and rump are orange-yellow; the tail-feathers greenish-black; the belly yellow; the bill black above and whitish below. The female is brown on the upper part, with the head and the lesser coverts of the wings mottled and streaked with blue and white; the quills and tail-feathers blackish; the fore neck reddish-brown, and the rest of the under part clear brown; the length, when full-grown, is about seven inches. This is a very handsome and familiar species, abundant in Paraguay, and well known from the proneness which it has to come about gardens and houses; but it is rather a pest to the inhabitants by destroying vast quantities of the seeds, of their leguminous plants, and also of their fruits. The epithet *striata*, which has been adopted as the specific name of this bird, is derived from the blue and white on the female, and not from any markings on the male bird. Indeed, the colours on the males of almost the whole of the genus are as remarkable for being entire, as they are for the brightness of their tints. It is probable that Latham, who applied the name, had seen the female, and described it as a species before he had any knowledge of the male. Other birds have sometimes been very awkwardly named in the same way.

Greenish Tanager (*T. chlorotica*). This is another one, of which the name has apparently been given from the female, and if there is any misapplication, Buffon stands charged with it. The upper parts of the male bird are brilliant violet-black; the forehead,

half the top of the head, the breast, the belly, the flanks, and the under coverts of the tail, deep and brilliant yellow; the quills black, with a white spot at about a third of their length from the base; tail-feathers black, with a white spot on each of the two lateral ones; the bill and feet are black. The female is brown upon these parts, which are black in the male, and greenish where the male is yellow. It is a small species, only four inches in length; and it occurs abundantly in Paraguay and also in Brazil. These are the principal species of the bullfinch tanagers; the most familiar, the most musical, and in some respects the most interesting of the whole. They are birds of gentle and rather social dispositions, and are often kept in cages, the beauty of their plumage making some amends for the inferiority of their music; and they are perhaps the ones that have the nearest resemblance to the females of Europe, though much more gay than these in their plumage; for though our goldfinch is a finely-marked bird, it must yield the palm of brilliance to the tanagers.

Gross-beak Tanagers. These have the bill conical, thick, arched, as wide as high, and rounded in the culmen of the upper mandible. The species differ in size, but they are, generally speaking, larger birds than the members of the former subdivision. Generally speaking, they have nothing that can be considered as a song, and some of them are remarkable for their silence. Several authors have separated them from the tanagers; but it seems more convenient to retain the genus but with the subdivisions that have been enumerated. The name *saltator*, or leaper, has been given to them, but not very correctly; as all the tanagers have a leaping and not a walking gait, and they are not the only birds that have it; for it is, in fact, a character of a very considerable number of the order, and the one from which it gets the name *Passeres*.

Black and White Tanager (*T. melanoleuca*). This is a Guiana species, and about seven inches in length. The upper parts are black, and there are two stripes of the same colour which extend down the breast, the ground of which, and the rest of the under parts, are pure white: the upper part of the bill is black, and the under part yellow; and the feet are black.

Yellow Tanager (*T. flava*). The upper parts are brownish-yellow; the streak over the eyes and all the under parts bright yellow; the coverts of the wings and the quills brown, with yellow margins; the bill black and the feet brown. It is rather a large species, measuring eight inches in length. Found chiefly in Paraguay.

Lead-coloured Tanager (*T. cærulesca*). Upper parts leaden-grey, with a yellowish streak across the region of the eye; the rump and wing-coverts bluish-black; a black spot at each angle at the gape; the under parts reddish-white; the bill and feet black. It is of the same size as the preceding species, and found in the same part of the country.

Poppy-red Tanager (*T. purpuresca*). The upper parts deep flame or fire-red, with some cloudings and reflections of a reddish-brown colour; the quills are brown, bordered with very bright red; and the coverts of the wings reddish-brown, margined with pure red; the under parts purple-red; and the bill and feet black. This is a very showy species, a native of the same country as the two preceding, but smaller in size, the length being seven inches. It must be borne in mind, however, that when these birds are spoken of as inhabiting one place of the warm portion of South America rather than another, all that is definitely stated is, that they have been seen and described as natives in that particular place; however, notwithstanding that, they may be equally numerous in other places.

Silent Tanager (*T. silentia*). This species is from some part of South America, which is not absolutely ascertained. It is six inches in length; the upper parts are also brown, with a band of bright grey, and one of white from the bill over the eye; the breast white, crossed by a broad band of black, and the rest of the under part white, without any marking of other colour; the bill and feet are black.

Russet-headed Tanager (*T. ruficapilla*). Upper parts bluish-grey; head, nape, and under parts russet-brown; forehead, space between the bill and the eye, and middle of the belly, blackish-russet; the quills and tail-feathers black, clouded with bluish-grey; the bill and feet black; the length seven inches.

Olive-green Tanager (*T. olivacca*). A large species, eight inches in length, and very common in Guiana; but not so annoying on the plantations as the more unusual tanagers; the upper parts are deep olive-green, with a white streak from the gape to the eye, and a black one under it; the chin white; the throat yellow, with a blackish band across; the fore neck and the under parts reddish-yellow, with the exception of the under coverts of the tail, which are russet; the bill and feet are brown.

Tanagers, properly so called. These have the bill conical, shorter than the head, equal in depth and in breadth; the upper mandible arched and rather pointed.

Archbishop Tanager (*T. archiepiscopus*). This species is very generally distributed, being found both to the east and the west of the Andes, from Brazil to the extremity of Peru; but the height at

Archevêque, male.

which it has been met with on the mountains has not been stated. The upper parts are olive-green; the head, neck, and breast, slate-blue, with violet reflections; the rump and belly grey; the quills and tail-feathers blackish-brown, margined with yellowish-green; the lesser coverts of the wings are bright golden-yellow, and the bill and feet black. The length of the male bird is about seven inches. The female is a little smaller, and has the upper part brownish-grey, with green reflections; and the under part ash-colour, with reflections of violet. The other markings are the same as in the male, only the tints are not so bright.

White-headed Tanager (*T. leucocephala*). Pale blue, with a slight tinge of ash-colour on the upper parts; the quills and tail-feathers black, with bluish borders; the forehead and circle round the eyes are velvet-black; and the top of the head bluish-white, with some reddish feathers next the black; the under parts are black, the bill black, and the feet ash-colour. The length is seven inches, and the species is described as being one of the birds of Paraguay.

The Slave Tanager (*T. palmarum*). This species is also called the palm tanager, from being often found on palm-trees. It is a native of the West India islands, and six inches in length. The upper parts are brown, with olive-green reflections; the wing-coverts, quills, and tail-feathers, are brown, with olive-green borders; and the under parts whitish, with longitudinal spots of brown; the bill and feet are horn colour.

Bishop Tanager (*T. episcopus*) is a native of Guiana, and six inches in length. The male has the upper plumage greyish-blue, with reflections of green and violet; the lower part of the back, the rump, and the under parts, lilac-purple; the lesser coverts of the wings bluish-white, the middle ones violet, and the greater ash-colour; the quills and tail-feathers blackish, with blue borders; the bill and feet black. The female is altogether olive ash-colour, but deeper in the shade on some parts than on others.

Green and Red Tanager (*T. cayana*). This species is found in Guiana, and is four inches and a half in length; the upper parts are green; the top of the head red; the upper neck and rump golden yellow; the sides of the head black; the throat bluish-grey; the under parts mottled with yellow, red, and slate-grey; the quills and tail-feathers bordered with golden green; and the bill and feet blackish. The female is olive-green colour, and yellow with green reflections.

Blue-headed Green Tanager (*T. Linnæi*). This is also a native of Guiana, and a quarter of an inch shorter than the last mentioned. The upper parts are mottled with green and yellow; the wing-coverts and middle tail-feathers are green; the quills and lateral tail-feathers brown, with green borders; the top of the head and the upper part of the neck, both behind and on the sides, violet-blue, with green reflections, and the roots of the feathers blackish-brown; the throat yellow, the middle of the belly golden-yellow, and all the rest of the under part mottled with yellow, green, and reddish-brown; the bill is black on the upper mandible and grey on the under, and the feet are grey. This and the preceding are two exceedingly pretty little birds.

Red-cap Tanager (*T. gularis*). This is a Brazilian species, six inches in length. The upper parts are black; the head and upper part of the throat bright red; the lower part of the throat dull purple; the sides of the neck and the breast pure white; the quills and tail-feathers blackish, and the feet grey.

Seven-coloured Tanager (*T. tatao*). Velvet black on the upper part; head and lesser wing-coverts green; rump orange-yellow; lower neck and greater wing-coverts violet-blue; breast and under parts sea-green; bill and feet black; length six inches. The female has the same distribution of colours as the male, but they are much less brilliant in the tint. It is found in Guiana, and other richly-wooded countries, near the sea or the great rivers.

Blue-headed Tanager (*T. cyanocephala*), is an inhabitant farther into the woods than the last, and considerably smaller, being only five inches long. It is black on the upper part, with most of the feathers bright green at the tips, which gives it a very rich, though not gaudy appearance. The head and chin are bright turquois blue; the cheeks and neck red; the lesser coverts black, with orange tips; the quill and tail-feathers brown, with green borders; the under parts green, and the bill and feet black. The female has the head and chin bluish-ash, the cheeks and nape reddish-brown; and the colours of all the other parts much duller than those of the male bird.

Red-head-and-throat Tanager (*T. ruficapella*). This is a Brazilian species, five inches in length. The upper parts are clear olive-green; the head and throat deep red, with a spot of yellow upon each side of the neck, on the rump, and the under tail-coverts; the lower neck and upper part of the breast deep yellow, and the belly paler; the quills brown, with greenish borders; the bill black above and yellow below; and the feet brown.

Three-coloured Tanager (*T. tricolor*). Upper parts blackish brown, with the borders of the quills and tail-feathers bright green; the nape and sides of the neck greenish golden-yellow; the forehead and throat black; the smaller wing-coverts violet-blue; the breast and belly bluish-green; the bill black, and the feet grey. The length about five inches. The female has all the colours paler in the tint than the male. The native country is Brazil.

Varied Tanager (*T. varia*). This is also a Brazilian species, of the same size as the former, but very different in the colours. The upper part is mottled with black and yellow; the head and chin greenish-yellow; the middle of the throat black; the quills and tail-feathers black, with greenish borders; the breast and belly clouded with green and blue; the bill black, and the feet reddish.

Green Tanager (*T. virescens*). This is a North American species. It is olive-green on the upper part; the top of the head blackish; the region of the eye white, with a grey spot between the bill and the eye; the quills and tail-feathers brown, with greenish borders; the coverts deep olive-green; the throat whitish; the under part grey; the under tail-coverts yellowish; and the bill and feet black. It is five inches in length. The reader will not fail to remark that the colours of this species are much less brilliant than those of the ones which are confined to the tropical parts of the continent.

Green Tanager of Brazil (*T. virens*). The upper parts bright green; two spots on the cheek, and also the neck, black; a blue streak from the angle of the gape down the side of the neck; the smaller coverts of the wings very brilliant bluish-green; the middle and larger coverts green; the quills and tail-feathers black, with green borders, the borders with rich reflections of blue; the fore neck yellow; the under part greenish yellow; the bill and feet brown. The total length six inches. A comparison of the colours of this species with the preceding one will show better than any writing on the subject the difference in gaiety of colour between a bird of temperate latitudes and a tropical one.

Oriole Tanagers. These have the bill conical, slightly arched, and notched toward the tip. They are not so numerous as the species of most of the other sections, and the colours of some of them run much upon yellow, which is the chief reason why the name *Oriole*, or golden bird, has been given them.

They have been made a genus under the name *Tachyphonus*, or "swift sounding," probably from the rapidity with which they utter their chirping note; but there is not much use or necessity for the name.

Desmarest's Tanager (*T. Desmaresti*). This is a very small Brazilian species, being only four inches in the total length. The upper parts are mottled with black and yellow; the front and middle of the fore neck black; the top of the head greenish-blue; the sides of the head and all the under parts yellow; and the quills and tail-feathers brown, bordered with yellow; the bill brown, and the feet reddish.

Finch Tanager (*T. fringilloides*). A Brazilian species, five inches in length. Upper parts greyish-ash; the head with two tufts of red feathers; the sides of the neck, the quills, and the tail-feathers, very deep black; the under parts white, and the bill and feet blackish. It is doubtful whether this species should be arranged in the present subdivision, and the same remark may be applied to the next species.

Black Tanager (*T. nigerrima*). A native of Guiana, measuring seven inches in length. The whole plumage is black, with the exception of the lesser coverts of the wings, which are white. The female is red, darker on the upper part than on the under. There are some other species which have been classed in the same genus with these, as separated from the tanagers. In the case of this genus or family of birds there is room for a conflict between the colourists and the structurists, and certainly the colourists have *most to say* upon the subject, as the birds differ far more in colour than they do in structure.

Cardinal Tanagers (so called from their red colours). These have the bill conical, a little vaulted, and with a projecting tooth upon each side. Some of them are found in the southern parts of North America, principally in the valley of the Mississippi, and respecting them we have advantages which we have not in the case of the others, as their habits were observed and described by Wilson. They are birds of passage, and migrate to considerable distances northward in the summer.

The Scarlet Tanager (*T. rubra*). This bird makes its appearance in the middle states of America about May, and finds its way as far to the north as Canada.

Le Tangara du Canada.

It is a bird of the wild woods rather than of the cultivated places, though it visits the orchards, and sometimes builds in them. The usual note of the bird is short and jarring, and appears to come from a much greater distance than it really does, so that hearing the bird is no very certain guide to a sight of it. Occasionally, however, the male utters a more mellow note, though even that is not properly a song. The food of the bird is hornets, wasps, wild bees, and other large insects, and toward the end of the season the berries of some of the *vacciniums*, and other small wild fruits. Wilson puts in a plea for the bird in the following passage:—"Among all the birds that inhabit our woods, there is none that strikes the eye of a stranger, or even of a native, with so much brilliancy as this. Seen among the green leaves, with the light falling strongly on his plumage, he really appears beautiful. If he has little melody in his notes, he has nothing in them to disgust. His manners are modest, easy, and inoffensive. He commits no depredations on the property of the husbandman, but rather benefits him, by the daily destruction in spring of many noxious insects; and, when winter approaches, he is no plundering dependent, but seeks, in a distant country, for that sustenance which the severity of the season denies to his industry in this. He is a striking ornament to our rural scenery, and none of the meanest of our rural songsters. Such being the true traits of his character, we shall always with pleasure welcome this beautiful inoffensive stranger to our orchards, groves, and forests."

The nest is built about the middle of May. It is placed on a horizontal branch of a tree, simple in its structure, being composed of dry vegetable fibres, without any elaborate lining with softer matters. The eggs are three in number, of a dull blue colour, spotted with purple brown. The birds have only one brood during their sojourn in the United States; but, as they depart as early as August, it is not unlikely that they may have an autumnal brood in the more tropical country to which they retire.

The male, when arrived at his full size and colour, is six inches and a half in length, and ten and a half in the stretch of the wings, being much better winged than those tropical species which are not migratory. The clothing plumage is of a most brilliant scarlet, and the quills and tail-feathers black, but sometimes with a little white on the tips; the margins of the inner webs of the quills are also generally white or whitish; the tail is much forked, which agrees with the habit of the bird in snatching insects on the wing; the bill is large and strong, and, like that of the rest of the section, tumid; it is of a yellowish horn colour, but subject to changes with the seasons. The moult commences about the 1st of August, the scarlet feathers being partially displaced by greenish-yellow ones, which gives the bird a mottled appearance, and the whole change of the body-plumage has not taken place when the bird departs for the south. Where they retire, and when they regain their scarlet livery, are not known, but they have it perfect when they return to the north. This, however, is true of the mature birds only; for the young of the preceding year have some green mottlings when they first come, though these soon disappear, and they shine out in all the splendour of their parents.

The manners of these birds are fully as attractive as their plumage, gay and beautiful as that is. Both birds are very vigilant in watching and protecting the nest, and also in feeding the young, even after they are considerably grown. The following anecdote, given by Wilson, is too characteristic for being omitted in noticing so numerous a genus of birds, of

the manners of by far the majority of which we know absolutely nothing:—"Passing through an orchard one evening, I caught one of these young birds that had but lately left the nest. I carried it with me about half a mile, to show it to my friend, Mr. William Bertram; and, having procured a cage, hung it up on one of the large pine trees in the botanic garden within a few feet of the nest of an orchard oriole which contained young, hoping that the charity or tenderness of the orioles would induce them to supply the cravings of the stranger. But charity with them, as with too many of the human race, began and ended at home. The poor orphan was altogether neglected, notwithstanding its plaintive cries; and, as it refused to be fed by me, I was about to return it back to the place where I found it, when, towards the afternoon, a scarlet tanager, no doubt its own parent, was seen fluttering round the cage, endeavouring to get in. Finding this impracticable, he flew off, and soon returned with food in his bill, and he continued to feed it till after sunset, taking up his lodgings on the higher branches of the same tree. In the morning, almost as soon as day broke, he was again seen most actively engaged in the same affectionate manner; and, notwithstanding the insolence of the orioles, continued his benevolent offices the whole day, roosting at night as before. On the third or fourth day he appeared extremely solicitous for the liberation of his charge, using every expression of distressful anxiety, and every call and invitation that nature had put in his power, for it to come out. This was too much for the feelings of my venerable friend; he procured a ladder, and, mounting to the spot where the bird was suspended, he opened the cage, took out the prisoner, and restored him to liberty and to his parent, who, with notes of great exultation, accompanied his flight to the woods."

Such is the tale of most perfect and most graphic truth, told by one of nature's own ornithologists; and the tanager, and Wilson and Bertram, must share the admiration of every reader who can feel. It would not be right, however, to suppress Wilson's reflections—"The happiness of my good friend was scarcely less complete, and showed itself in his benevolent countenance, and I could not help saying to myself—If such sweet sensations can be derived from a simple circumstance of this kind, how exquisite, how unspeakably rapturous, must the delight of those individuals have been who saved their fellow-beings from death, chains, and imprisonment, and restored them to the arms of their friends and relations! Surely, in such godlike actions, virtue is its own most abundant reward!" Where, among the romances of human life, shall we find expressions so pure and warm from the heart as these; and who, that sees its aspirations rise to this height, would refrain from being an ornithologist—living, as one of nature's brotherhood, with the lovely and lively tenants of the wood?

Summer Red Tanager (*T. æstiva*). This species is found in nearly the same places, and at the same time, as the preceding, and either of them might be characterised by the epithet *red* or the epithet *summer*; for they are both red birds and both summer birds. The two are, however, at once distinguished from each other, and the present is by no means so brilliant a bird.

The male is not scarlet, but rich vermilion-red, most brilliant on the under parts of the body, and the inner margins and tips of the quills are reddish-brown; the bill is very large, and inflected with a prominence on the upper mandible, and it is of a yellowish horn-colour in its whole length; the tarsi and toes are light-purplish blue; the eye is large, and the iris hazel. It is rather larger, and also better winged, than the scarlet tanager, being seven and a half inches long, and a foot in the stretch of the wings. The female is rather smaller, and different in the colours, the upper part being brownish yellow-olive, the under part orange-yellow, and the tips and inner webs of the quills brown. The naked parts are the same colour as those of the male. The nest is in the woods, on a lateral branch of a tree, or on an evergreen, and rarely more than ten or twelve feet above the surface of the ground. Like that of the scarlet species, it is composed entirely of vegetable fibres, but a little more elaborately finished than the other. The eggs are three in number, and of a black colour. The nesting-time is in May and June; and in August the birds depart from the United States for the south. Whether they have or have not an autumnal brood on their southern retreat is a point which has not been ascertained.

The young differ much in colour from the full-grown birds, and these are also very differently coloured before or after the autumnal moult, or rather, perhaps, during the progress of that moult. The young are at first of a yellowish-olive on the upper part, something resembling the under part of the native female. They are partially mottled when they make their first appearance in the south, but acquire their full tint in the spring of that year. It is probable that those tanagers which visit North America in the summer return to Mexico, or to the narrow but thickly-wooded country near the Isthmus, in the winter, and do not pass either into the West India islands or into South America; at least, none of the species which are described as South American agree exactly with these in their characters. The South American ones have the tails nearly square, or rounded, or wedge-shaped, while those North American ones have them forked. This causes a difference in the style of flight, which has probably reference both to the feeding and the migration. They appear to feed more upon the wing, and more upon winged insects, than the South American birds, and they are certainly much more migratory in their habits, so that they are perhaps better entitled to be considered a separate genus than any of the other sections.

There is a beautiful provision of nature in the difference of colour between the females and young of these birds, and the old males, in the season of rearing the brood. The old males, in their red livery, are among the most conspicuous objects which can be placed in the green leaves of a forest. Their colour is the complicated colour of the leaves, and thus they mutually render each other more conspicuous. The colour of the females and young, again, is nearly that of the leaves themselves, and thus it is with difficulty that any enemy can see them while quiet, or in the nest. Now, in the hatching time, the female remains remarkably close and still, while, if any cause of alarm appears, the male is all bustle and activity, and can scarcely fail in drawing upon himself the attention of the enemy, at the same time that he is so alert that few enemies can harm him. This is equally true of the scarlet species and the darker red one. The green colour which comes upon the male at the time of the moult seems to be

equally conducive to safety. Birds, when moulting, are weak, and unable to escape danger, or defend themselves with the same vigour as when they are in full plumage. Both species moult early, while the snakes, which are the great enemies of the smaller forest birds of North America, are still in their summer activity, and the green colour renders the male less easily seen by them at the time when it is not necessary that he should exhibit himself conspicuously for the purpose of drawing away their attention from the female and the nest. There is no doubt that all colours, and all changes of colour, in birds are conducive, in some way or other, to safety, though the subject is so extended and so intricate that we have very little knowledge of it. That it is the male bird which, in all cases where there is a nuptial change, acquires the showy and attractive plumage, is of itself sufficient to establish the truth of the general principle ; and when once this is established, every observed fact becomes an addition to our knowledge.

The haunts of the summer red bird are not exactly the same as those of the scarlet tanager. It keeps more to the sandy flats which are covered with wood, and does not migrate so far to the north. Hence it is most abundant in the southern states near the coast, where much of the country is of that character. Its food, though analogous to that of the other species, is not quite the same. Coleoptera, and various wingless insects, are very numerous near the country woods of those places to which the birds resort in greatest numbers during the summer ; and of course the birds feed much upon these, though they do not refuse naked-winged insects when these come in their way. The tanagers, small birds as they are, do not appear to feed on the very smallest of the insect tribes. In the early part of the season, their food, like that of the scarlet species, appears to be almost exclusively animal ; but when the wild berries on the low bushes on the margins of the swamps are ripe, they live in a great measure upon these. The female has a feeble and chattering kind of note without the least music in it ; but, though not a regular songster, the male has a clear and trifling sort of whistle. When the beetles fly on the wing, which is the general habit of many of the earth and aquatic ones at a certain season, the red tanagers hawk for them on the wing in the open places, and catch them with no inconsiderable adroitness. Altogether, they are birds of no little interest.

Louisiana Tanager (*T. Ludoviciana*). This species inhabits farther to the west than any of those that have been mentioned, and our knowledge of it is far more limited. It is found to the west of the Mississippi only, and rather toward the mountains than in the low and damp plains near the river. According to the accounts we have of it, which are not, however, very perfect, it appears to frequent more arid and open places than either of the other two species of the same latitudes. We have thus each of these three migrant tanagers upon a different locality during the time they are in the United States ; the dark red one nearest the sea on the low sandy grounds, which grounds are, however, covered with cedar and other trees wherever there is a sufficiency of moisture. The trees in such places are very much injured by beetles and other insects ; and there is no doubt that the tanagers assist considerably in protecting them. The scarlet tanagers are more in the rich woods near the great rivers, where there is no doubt that they also, from their numbers and their activity, perform far from an unimportant part, both in wild nature and cultivated—the latter because they are birds of more habitable places than the former one. The Louisiana tanagers, again, are found more upon the dry prairies between the western branches of the Mississippi, in places where there are not continuous forests or many tall trees, but abundance of bushes, which afford them cover, and furnish them with insects in the summer, and supply abundance of berries in the advanced part of the season. The changes of plumage in this one are not very perfectly known. The wings, the tail, and principal part of the back are stated as being black ; the coverts of the wings being mottled with black and yellow. It is generally supposed that the males of these birds are, like the other species which migrate into North America, red in the summer ; but the fact wants to be more fully cleared up. Their habits on the breeding grounds are not quite the same. Both the others build in trees, generally in thick and close trees, though not at any great elevation ; but these western ones build in low bushes, and even in the tufts of tall herbage.

The common opinion is, that both this western species and the scarlet one pass into Mexico in the winter, and it is by no means unlikely. There has indeed been a Mexican tanager described, very much resembling the scarlet one, which comes into the United States ; that is to say, it is of the same size and colour, and has the tail forked ; but there is no information as to whether it is or is not a resident bird, or at what time of the year it appears in Mexico. It was not the policy of the Spaniards, while they had possession of the country, to let us know any thing about even its natural history ; and since the Spanish domination ceased, the state of things, in this respect, has not become better. At the time when Central and South America were first subjected to the iron yoke of Spain, the Mexicans were much lower in the scale of human nature than the Peruvians, and they again, in so far at least as spirit and enterprise were concerned, to the people farther to the south ; and whether that difference be mainly owing to climatal causes or not, the same difference remains to the present day. This is proved by the state of the natural history of those places ; for we have D'Azzara's very valuable information respecting the south, while of Mexico we have nothing of value. We must, however, briefly notice the remaining section of the tanagers.

Swelled-billed Tanagers (*Ramphoceles*). These have the bill conical, with the sides of the lower mandible swelling out toward the base. The species are not numerous, and one which has been described as the Canada tanager appears to be nothing else than the scarlet tanager, which has been already described as a summer migrant in the United States.

Jacapa Tanager (*T. purpureus*). This is the characteristic bird of the section, and the peculiarity is in the bill. Toward the tip that does not differ much from the bills of the rest of the family ; and the upper mandible and distal portion of the lower one are black ; toward the base the sides of the lower mandible are very tumid, and when the bird is alive, those portions are brilliant silvery-white, which, however, like the bloom on all the naked parts of birds, speedily fades after death. The male bird has the upper plumage black, with the exception of the head, throat, and breast, which are purple-red ; the feet are black ; the total length six inches. The female wants

the silvery-white on the lower mandible, and the colours are brown and dull purple. The birds are found in the tropical parts of South America.

Scarlet Tanager of Mexico (*T. rubra*). There are some doubts whether this may not be the same bird as the scarlet tanager of the United States, though the bill is not of the same colour. At all events they resemble each other so much in other respects, that a popular description of this one would be little else than repeating that of the other.

We shall not farther extend the list of these very abundant and beautiful birds; and we have given an outline of the colouring of so many of them, merely to show what endless variety Nature can produce in this way, with almost equal beauty throughout the whole series. Whatever happens to be the particular tints and markings of any of these birds, there is a delicacy in the colour which, those who have not seen tropical birds in the living state cannot readily understand. Their manners, too, are gentle in all the species, though at the same time lively. They are indeed, generally speaking, birds of great activity; and though their broods are not numerous, they are attentive parents, and have their paternal duties to perform twice in the year. They give a great deal of liveliness to the borders of the forests, in those situations where the true climbers, and other characteristic birds of the depth of the forest shade, rarely come. The characters of those forests can hardly be described; for there is every kind of country within a short distance, and, being in most places completely in a state of nature, each place has its characteristic inhabitant—exactly the one which is fitted to its physical state, and its seasonal condition at the time that it is seen. Upon the margin of the arid waste, or that place which is apart in the rains, and barren as a trodden path in the drought, we have one of these birds on the very first bush that we come to; and, as is the case in our own country, that one usually has a little song to welcome one to the study of the mighty museum of living Nature, which lies hidden in the wide and deep shade of the all but interminable forest. Years, centuries, must however roll over our heads, or equal periods of oblivion over the generation which now inhabits the earth, before the volume of this mighty book of Nature shall be opened even to the most zealous and able inquirer. While this is the case, there need no man be under the slightest apprehension that the pleasure of discovering either the facts or the laws of Nature shall ever have an end.

TAPIR (*Tapirus*). A genus of pachydermatous mammalia, of which there are two living species found at places of the globe which are nearly the antipodes of each other—South America and the Oriental Isles. This is not the only point in which these two regions agree in their natural history, and differ from all other places. South America is, indeed, an extensive country, with a very varied surface, and therefore we cannot speak of the whole of it as being comparable with the isles of the East, which being small, as compared with it, in their individual, and even their collective extent, have their natural character much more uniform. But the shores of South America, upon which the trade-wind beats, and the valleys of the rivers as far inland as the influence of the trade-wind extends (which, under the equator, where the continent is broadest, is nearly three-fourths of it, including Brazil and the greater part of the valley of the Amazon), has very much the character of the eastern islands, and also of the Malay peninsula—in short, of the whole of that portion of Asia which is under the influence of the trade-wind of the Pacific. The east side of Africa is not of the same character, because the ocean to the east of it is cut off from the Pacific by Australia, and converted into a monsoon sea by the alternating action upon each other of the sea in the south and the land in the north. This is the true reason of the anomaly which we always meet with from Africa when we compare the natural history, and more especially the zoology, of the tropical parts of the earth; and it is necessary that we should bear them in mind, if we are to study the general relation of that natural history in a profitable manner.

Those regions which enjoy the continual action of the trade-winds appear to have a power of preservation and endurance in them which we do not meet with in places which are less under the controul of any air current from the sea. Their forests do not appear to wax old like the forests of other places, but to be the same day after day and century after century; and thus we may be prepared to meet with, in them, both plants and animals which have perished from the other parts of the earth, or, if not animals of the same genus or species with the lost ones of other regions, yet animals of the same order.

In the article MAMMALIA, to which we beg to refer the reader, there will be found some remarks on the pachydermata, and, among others, that this order of animals is little else than a collection of fragments, having much less similarity to each other than the animals of almost any other order. If we except the phoca genus, which have but little in common with the other pachydermata, we find that all the rest belong to a remote state of the globe—a state in which it is, or must have been, covered by an exuberance of coarse vegetation. It is true that some are fitted for eating the roots and seeds or fruits of that vegetation, as, for instance, the hog; while others can almost subsist by gnawing the succulent twigs which grow by the banks of the rivers, as is the case with the hippopotamus; but in the portion of the system which lies between them we find that the succession is constantly broken, and that we are in want of one or more races to make out the connexion, so that we might understand how the animals could work together with anything like the same harmony which strikes us at once in other parts of the system.

It is the vegetable feeders which are of the most value to us in that part of natural history, by which we seek to trace the relation of the kingdoms of nature to each other, and the whole to the physical condition of the globe. If we take the ruminantia, for instance, we can easily trace them, in a very regular and obvious series, from the buffalo on the swampy plain, by the sea, or the broad river, to some light and bounding animal on the mountain-top. So tracing them, we can see their perfect adaptation to the state of things as now existing. But, when we have recourse to the pachydermata, we can make no such general allocation to all the principal varieties of surface as we now find them. We have stated that the phoca family are an anomaly among the pachydermata, and could not very easily be brought into any series with the rest, even if we were to suppose that as many fossil races should be discovered as would fill up the other blanks. The camel family stand in the same anomalous position

among the ruminants; and it is not a little curious that these two anomalous families, of different orders, should have their native localities near, or somewhat resembling, each other, and that they should be used for nearly similar purposes by man—should be the "beasts of burden" by way of eminence. Such, however, is the fact; and it is a fact, the investigation of which is far from being unimportant, only it is inconsistent with our present object, and incompatible with our limits.

The tapir is a genus which stands at a break in the series, and with it the pachydermata, if we begin them with the elephant, may be said to terminate. It may be taken up from the rhinoceros, with which the tapirs have more characters in common than with any of the rest. But even here there is a wide difference, and some lost genera come in between, as well as the living genus *Hyrax*, which is very different in its habitat. The last ones appear to approach more nearly both to the rhinoceros and the tapir.

One of the selast ones is the *Palæotherium*, which appears to have been at one time very plentiful in Europe, as there are about a dozen fossil species in the Paris basin only. Some of these are equal in size—that is, from their skeletons they must have equalled in size the rhinoceros of the present day, while others could not have been larger than small sheep. They occur in great numbers in the calcareous deposits, and their accompaniments being fresh-water shells, and other aquatic remains obviously not marine, show that they must have inhabited the shores of lakes, or other banks of slowly-flowing rivers. They had the teeth very like those of the tapirs, and, like them, they must have had the muzzle drawn out into a fleshy and flexible snout, as the places for the insertion of the muscles for the moving of such a snout are quite obvious on the bones. They had a toe fewer on each fore-foot than the tapirs, and differed from them in many minor particulars; so that, though their haunts and habits must have been similar, they could not have been exactly the same. The other last genus, *Lophiodon*, had the teeth different, formed into transverse elevations in the lower jaws, which is evidence of these having to bruise more stubborn food than the preceding species.

Our present business, however, is with the tapirs, of which, as of very many of the pachydermata, there are remains of fossil species in places where there have been no living native ones within the period of recorded history. The generic characters of the tapirs are as follow: six incisive teeth, two canines, and fourteen grinders, in each jaw, the latter equal in number above and below; the intermediate incisive teeth smaller than the lateral ones, and thus giving them something the appearance of additional canines; the canines of moderate size, with a space between them and the cheek-teeth, the latter with two transverse riders on their crowns; the jaws are long, and the mouth is thus simply furnished with all the three kinds of teeth, which indicates that the animal must have corresponding labour in eating; the mouth is a ragged, or what we would call an "ugly mouth," capable of bruising very hard and tough substances; there is, however, nothing of a murderous or carnivorous character about it; but the three kinds of teeth complete, always in the absence of any thing carnivorous, indicate a miscellaneous feeder, of which the common hog is a familiar instance; the nose of the tapir is elongated, forming a moveable proboscis, but not a prehensile one, like that of the elephant, and proportionally much smaller than in that animal; the eyes, as in most of the order, and in all the long-snouted ones, are very small, and the ears of moderate length, erect, and moveable; the fore feet have four toes each, and the hind feet three, with a small hoof on the extremity of each toe, the hoofs rather pointed, and divergent, but not in the least resembling claws; the tail is very short, and the hind part of the body droops much to its insertion; the skin is very thick and strong, forming slight folds or wrinkles on the flanks and some of the parts, and it is thinly covered with very short hair, which lies flat, and shows the whole form of the animal; that form is heavy, and the expression is dull and stupid, and indicative of nothing that can be called spirit. It partakes a little of the horse, of the hog, and of the rhinoceros, but it has not much likeness to any of them. The females agree with those of the horse and the rhinoceros, in having two mammæ situated in the groin, but no neutral ones like the hog. There are considerable differences between the two species, as we might be prepared to expect from their habitats being so wide asunder.

American Tapir (*T. Americanus*). When full grown, this species is about the size of an ordinary donkey, and, small as it is, it is the largest of the land mammalia of the rich and humid places of South America. The head is very thick and clumsy, elevated at the occiput, and bearing in the profile some slight resemblance to that of a hog, but without any of the energy which is characteristic of that animal in the wild state, or of the intelligence which it has when domesticated and well attended to. The eyes are very small, and the trunk of the nose is much smaller than that of the hog, and its motion is more feeble, and of a different character. The cartilaginous point only of the hog's snout has motion on the peculiar bone, but that of the tapir can move a little both downwards and laterally. It has not action enough for actually seizing any substance, but it may assist the animal in opening up a passage among the thick and tangled vegetation. It is not used in rooting in the ground, and it is not adapted for it. It has no cartilaginous termination, but is almost entirely composed of muscles. The body of the animal is thick and clumsy; the tail is very short and straight, ending abruptly, as if it were a stump; the colour varies from blackish-brown to brown, with a shade of dull fawn colour. The covering of the body, as was said, is smooth, but the male has the trace of a mane along the ridge of the neck.

This tapir is pretty generally distributed over the rich humid and shady parts of tropical America, but it is nowhere very abundant; and it is so dull and unsocial in its manners, that it is rarely seen even in those places where it occurs most frequently. It is not fond of the company of its own species, like the greater number of the pachydermata, never more than a pair being seen together, and rarely more than a single individual. It is very much of a nocturnal, or, at all events, of a twilight animal, in its feeding, and dozes away the greater part of the day, sleeping in the shade of the close sprays near the streams, from which habit, and the obscure colour of its body, one may pass close to it without being aware that it is there. In the night it comes abroad, and feeds on wild fruits and other pulpy and succulent vegetables, if it can find them. If they are not to be had, it is

not very particular as to the choice of a meal, for it can gnaw twigs, or eat carrion; and it is said at times to swallow the same sort of fat clay which report mentions as part of the seasonal food of some of the Indian tribes of the Orinoco, and some other damp and wooded places. Like many of the order, it is very tenacious of life, and affords another proof of the general law, that the more passive and sluggish that life is in any animal, it is extinguished with the greater difficulty. It is some time before even the most serious wound takes effect upon it; and D'Azzara mentions that he has seen one continue to run for some time after two musket-balls had passed through its heart. It is fond of the water, and swims well with a leaping motion something like that of a pig; but it does not dive or repose in the water like the hippopotamus. The water is usually its retreat, however, when it is wounded, and probably also its last resource against the attacks of the jaguar. The Indians, who are by no means particular in their appetite, hunt it with avidity, and readily eat its flesh; but it is not relished by the Europeans or their descendants. The Indians shoot it with their poisoned weapons, or kill it with those of their usual warfare, and one is esteemed a prize for a family. The Europeans also sometimes hunt it, using dogs to drive it from its cover; but this is done from sport, or from the idea that it injures their plantations, which it is very apt to do to those that lie near the woods.

When attacked it offers but little active resistance, and never bites, though its mouth is tolerably well adapted for that purpose. It utters a complaining cry, which is a querulous kind of hiss, and not in the least resembling the squeak of a pig in affliction. Its first attempt is to escape by creeping into the brush-wood, which it does with much ease and speed considering its voluminous size. This is also understood to be its first and readiest resource in case of an attack from its feline foe, as it is much more dexterous in threading the brake than the jaguar. Its head is indeed remarkably well adapted for boring through tangled places, being in the form of a conical wedge, and so thick toward the posterior part, that wherever it opens a way, the rest of the body can pass, thick and clumsy as that is. Its only means of active resistance is said to be kicking with the heels, in which it is represented as being rather dexterous, and to which mode of defence it has recourse, when it cannot force its way into the place where it has made the attempt. When hard pressed by the dogs, it will also seize them by the back with its rough mouth, and shake them till the skin is lacerated or torn off, but it is unable to give them a regularly wounding bite. The females bring forth their young, which is generally only a single one, in the month of November, which answers to the May of our year; but the male lives apart, and takes no interest in the progeny; and even the female is said to have but very little affection for her young.

The tapir is thus one of the most passive of the mammalia, and one which stands low in the scale, both in sensation and in action. Its sight is, in all probability, not very keen, as that is a sense of which it does not often make use. Its skin is also not well adapted for being a general organ of touch; and the miscellaneous nature of its food prevents us from supposing that it can have much taste. Their ears and nose being the organs of sense that are most developed, they most likely depend most on smelling for their food, and on hearing to keep out of the way of danger.

Their passive nature renders them easily tamed, if taming it can be called in animals which cannot be made to harm any thing. We are not aware that they are in any instance bred in confinement, as they do not possess any obvious property that makes them worth breeding; but when taken young, they go about the house inoffensive to all other animals, never attempting to escape, and eating indifferently of any kind of food, animal or vegetable, of which, however, they require a very considerable quantity. We omitted, in noticing the structure, to state that the head and neck of the tapir, as far as the shoulders, are fortified with a sort of shield, by means of which it can raise the bushes out of its way without sustaining so much injury as an animal having only ordinary skin. On the head this shield consists of a thickening of the outer table of the cranial bones; but on the neck and shoulders it consists of a very thick and indurated skin. The full-grown animals, though they vary a little in the shade of their colour, have it entire without any markings; but the young ones are dappled over something in the same manner as fawns, or rather perhaps spotted hogs. Taking it altogether, there are not many animals more destitute of attractive qualities than the American tapir.

The Malay Tapir (*T. Indicus*), is a much more recent addition to the animals known to Europeans than the tapir of tropical America, and it differs in many particulars. It is not met with in continental India, or we believe in Ceylon, but only in the Malay islands and peninsula, though in how many of them is not known. It is altogether a much more massive animal than the American tapir; thicker in the body, shorter and thicker in the head, and with the legs much shorter and stouter, and the feet broader; but the number of toes and hoofs is the same as in the other, and the character of the mouth differs little if any thing. The feet are adapted for walking on softer ground than those of the American tapir, and the animal appears to be more aquatic in its habits. The animal is perhaps a little heavier than the American, but it is not quite so long. The flexible part of the snout is a little larger in proportion, being seven or eight inches; but the bones which support its face are shorter. The outline of the profile is also more convex, and the snout is, in its integument, a little more like the proboscis of the elephant, though it is not actually prehensile, otherwise than by pressing against the under lip; the eyes are small, and the ears rounded, with white hair around their margins; the skin is very thick and strong, with very little hair, what there is, is very short, and no vestige of a mane on the neck or shoulders; the colour from a little behind the fore legs and shoulders, quite round the body as far back as the groin, and down the rump to the root of the tail, is of a uniform sandy white in the mature animal, and the rest of the body and the legs are black. This marking gives it a very odd appearance, as if it were a jet black animal with a dull white cloth wrapped round its body, from near the fore legs to the rump. This white patch is not, however, constant in its shape and size; for in some specimens the middle of the belly is black; and it is by no means improbable that there may be still greater differences of colours than these; for animals which have their colour broken into large patches, as these have, are seldom constant either in the size or the shape of the patches. The young are much

more varied in the colour. They are represented as being beautifully mottled with black, white, brown and fawn-colour; the stripes and spots of fawn being upon the upper part of the body, and the white ones toward the under part. The colour changes when it is about half a year old.

It appears that, though a recent addition to our zoological catalogues, it is far from rare in many parts of the Malay country, both in the islands and peninsula. The tribes of different parts, both of the coast country and the interior, have different names for it, which is one pretty strong proof of its being a native animal in them all. It is probable that Europeans resorting to these islands have been aware of its existence for a long time; but that a double mistake was committed respecting it. It was considered as a hippopotamus, and thus that animal, of which there is no living instance but in Africa, was transferred to the Malay country; and it was confidently said, that there was no species of tapir but the American one. The researches conducted by Sir Stamford Raffles, and also by the French naturalists Diard and Duvaucel, brought to light many of the singular productions of those interesting countries, and make us wish, for the sake of natural science, as well as for the arts and the advantage of those places themselves, that they had continued a little longer.

The full-grown ones in those parts of the country which are most favourable for them are large animals, as much as eight feet in total length, and more than six feet in the circumference of the body. But as they are animals of concealment during the day, and also of retired places; and as, under the former system of treating the natives of these countries, it was by no means safe to make excursions to any distance from the fort or factory, there were not the means, even if there had been the desire, of knowing much about the natural history.

A living specimen, which Sir Stamford Raffles sent from Bencoolen to Bengal, while it was yet young, showed the same inoffensive disposition as the American one. It was taken to Barrackpore, where a collection of animals is or used to be kept; and it went about quite at its ease, being fond of the water, and often entering into the ponds and tanks, in which, contrary to what is stated of the American one, it walked on the bottom under the water, and showed little or no disposition to swim. The length of the movable snout fits it for a habit of this kind, as it can breathe at a much greater depth than a short-nosed animal; and the structure of its feet, and the whole air of its body, are much more aquatic than those of the American. Of its breeding time, or the period of its gestation, or indeed of any of its habits in its native haunts, we know little or nothing. It seems to be a law among the pachydermata, and it is rather a curious one, that those genera which have many mammæ on the belly in the females, and numerous litters at a time, are also animals of very short gestation; while those which have but two mammæ in the groin, and produce but one or rarely two at a birth, have the period of gestation much longer. This makes them doubtless inferior to the others in productiveness; but there is a compensation in nature, the animals are in themselves much more hardy and long lived; and their own strength, and the places which they inhabit, conspire in making them much more secure from enemies. In a state of nature the two may be found at no very great distance from each other, but they are never exactly on the same kind of ground; and as generally inhabiting every part of the world, they evidently belong to very different states of it. The tapirs belong to those with only two mammæ, and they occupy nearly the same kind of ground; and hence we may conclude, that the countries where they are now found only in the fossil state were very different in their physical state from what they are now.

Two fossil tapirs have been mentioned, one as occurring in France, and the other in North America. Of the remains of the French one, there can be no doubt; but the American is much more questionable.

The French one is the gigantic tapir (*T. giganteus*), and it well merits the name; for the bones show that it is well entitled to the epithet, as they indicate a size and strength not inferior to those of the rhinoceros, or even of the elephant itself. Their horns are found in the alluvial deposits, at least judging from the teeth, which are almost the only bones that have been found; but such is the perfection to which comparative anatomy has been brought, that the size and the leading characters of an animal may be tolerably made out from a single bone.

The supposed American species is a much smaller animal, though larger than the bony tapir of that continent. It has been called *T. mastodontoïdes*, from the resemblance of its remains to those of the mastodons, especially those of the large one, which are found in the same places of North America; and it is highly probable that they have not belonged to a tapir at all, but to a mastodon, which resembles the elephant more in all those characters that can be made out; so that Europe is in the mean time the only part of the world in which we can distinctly say there are the fossil bones of a tapir.

TARANTULA, or TARENTULA, the ordinary name given to many large species of spiders, including those of the genus *Mygale*, but more strictly applied to a species of *Lycosa*, found in the south of Italy, and especially in the neighbourhood of Tarentum in that country, whence it has obtained its ordinary name, and which has become famous not only on account of the supposed venomous effects of its bite, which are stated to have been followed by death or tarentismus, but also from the supposition that music and dancing were the only remedies against this insect's bite. The *Tarantula* belongs to the division of the cunicular or mining *Lycosæ*, which inhabit subterraneous intrenchments, which they construct for themselves. The most elaborate account which we possess of this spider is given by M. Dufour in the Annales des Sciences Naturelles for 1835, and which has been translated in the new series of the Magazine of Natural History. M. Dufour had studied its habits in different parts of Spain, and is convinced that the species which he investigated is the true *Tarantula* of the ancients, of all authors who have written upon tarentismus, and of Baglivi, Linnæus, Fabricius, &c. It is on the upper side of the body of a grey colour, varying to blackish or clay-coloured, with a paler margin to the body; the cephalothorax more or less clouded; the mandibles black, with the base in front greyish; the back of the abdomen with two or three somewhat arrow-headed marks and transverse posterior fascia of black; beneath it is black; the belly velvety-black, with the margins and anus broadly ochraceous; the trochanters and base of the femora and tibiæ having two black spots. It varies in its length from ten to fourteen lines.

The following particulars relative to the habits of this insect are concisely abstracted from M. Dufour's Memoir above quoted. It is in exposed dry barren places that the *Tarantula* constructs its burrows in the earth, and which are an inch in diameter and a foot in depth. For securing both a safe retreat and a place of ambuscade, the *Tarantula* has the instinct to construct its passage at first in a vertical direction; but at four or five inches from the surface it turns in an obtuse angle, forms a horizontal bend, and then reassumes the perpendicular. It is at the commencement of this bend that the *Tarantula* establishes himself as a vigilant sentinel, and never for a moment loses sight of the entrance to his abode; and it was there that at the time when M. Dufour discovered him, he was betrayed by his eyes glittering like diamonds, and rendered bright like those of a cat by the darkness. The ordinary entrance to the burrow is surmounted by a funnel somewhat similar to that formed by some of the sand-wasps (*Odynerus*), composed of fragments of dried wood, united by a little clay, and lined within with a tissue formed of the threads of the *Lycosa*, and which is continued through the whole interior. It is easy to conceive how useful this skilfully fabricated drapery must be both in preventing the crumbling in of the earth, or any such accident, and also in assisting the *Tarantula* in scaling its fortress. The funnel, moreover, protects the burrow from inundations, and fortifies it against falling bodies, which, swept by the wind, would be likely to close it up; it also serves as an ambush, by offering to flies and other insects upon which the *Tarantula* feeds an enticing resting-place.

M. Dufour then details the various manœuvres he was compelled to employ, in order to obtain specimens of the spider, by digging or enticing them out of their holes; from this detail it appears that the spider is both wary and courageous whilst in his retreat, but confused when found out of it. The Apulian peasants adopt another plan for capturing the *Tarantula;* according to Baglivi, these country people make a buzzing noise like the humming of a bee at the mouth of the hole, which is mistaken by the spider for its prey, in pursuit of which it comes out of its hole, and is immediately caught. Notwithstanding the obnoxious appearance of this creature, it is capable of being tamed; and M. Dufour gives us the history of a specimen which became so contented and tame, that it would come out of its hole and eat from his fingers the fly that was brought for it.

According to the old authorities, the bite of the *Tarantula* occasioned an inflammation in the part, which in a few hours brought on sickness, difficulty in breathing, and universal faintness. The person afterwards was stated to be affected with delirium, and sometimes to be seized with a deep melancholy, the symptoms returning annually in some cases for several years, and afterwards terminating in death. According to others, the symptoms produced by the poison were similar to those of malignant fever; whilst by others the skin exhibited only a few erysipelatous spots. Music, it was pretended, was the only remedy. A musician was brought, who tried a variety of airs, till at last he hit upon one that urged the patient to dance, the violence of which exercise produced a proportional agitation of the vital spirits, attended with a consequent degree of perspiration; the certain consequence of which was a cure. Such are the circumstances which have been generally related and long credited regarding the bite of this animal. Kircherus in his Musargia gives a very particular account of the symptoms and cure, illustrated by histories of cases, amongst which he mentions a girl who, being bitten by this insect, could be cured only by the music of a drum; relating also that a Spaniard, trusting to the efficacy of the music, submitted to be bitten in the hand by two of these spiders of different colours, and possessed of different qualities. The venom was no sooner diffused about his body than the symptoms of the disorder began to appear, upon which harpers, pipers, and other musicians were sent for, who, by various kinds of music, endeavoured to rouse him from that stupor into which he was fallen; but here it was observed that the bites of the two insects had produced contrary effects, for by one he was incited to dance, and by the other he was restrained therefrom; and in this conflict of nature the patient expired.

Some authors indeed have carried their belief in this matter so far as to note down the tunes which they believed most serviceable for the *Tarentolati*, as persons suffering under tarentismus were called. Professor Haffenreffer, of Ulm, has set them forth in his work entitled "Traité des Maladies de la Peau."

It is in the Philosophical Transactions of our own country that we find the first attempts to disprove this fiction. So far back as 1672, a letter from Dr. Cornelio, a Neapolitan physician, was published, in which it is stated that "all those that think themselves bitten by *Tarantulas, except such as for evil ends feign themselves to be so*, are for the most part young wanton girls, whom the Italian writers call Dolci di Sale, who by some particular indisposition, falling into this melancholy madness, persuade themselves, according to the vulgar prejudice, that they have been stung by a *Tarantula*."

A century afterwards, in the same Transactions (for 1770), Professor Dominico Cyrillo, of Naples, states, that having had an opportunity of examining the effects of this animal in the province of Tarento, where it is found in great abundance, he finds that the surprising cure of the bite of the *Tarantula* by music, has not the least truth in it; and that it is only an invention of the people, who want to get a little money by dancing, when they say the tarentism begins. He adds, "I make no doubt but sometimes the heat of the climate contributes very much to warm their imaginations, and throw them into a delirium, which may be in some measure cured by music; but several experiments have been tried with the *Tarantula*, and neither men nor animals have had any other complaint than a very trifling inflammation upon the part like that produced by the bite of a scorpion, which goes off by itself without any danger at all. In Sicily, where the summer is still warmer than in any part of the kindom of Naples, the *Tarantula* is never dangerous, and music is never employed for the cure of the pretended tarentism."

The correctness of these remarks has been fully confirmed by several cases recently brought under the notice of the Entomological Society of France, by M. Lefebvre, and published in the *Annales* of that Society.

TARDIGRADA — Slow-goers. A family of mammalia of the order *Edentata*, including, of living animals, the sloths (see Ai and Unau), which are tree animals of moderate size, and the extinct *Megatherium* and *Megalonyx*, both of which have been animals of giant bulk; but their habits and the charac-

ters of the countries in which their bones are found, at the time when the animals were alive, are not known. The skeletons of some of them have been found in a much more perfect state than those of most extinct animals, the *Megatherium* in particular; and its remains are such as to show that it had been by far the largest and heaviest land animal of which we have any knowledge. The skeleton of an elephant seems weak and feeble beside it; and there is more matter in some of its single bones than in all the bones of the human body.

TARENTULA (Fabricius, Latreille). In the commencement of the article TARANTULA, we have said that this name, although strictly applicable to the *Tarantula* of Tarentum, had been employed for other large species of arachnidous animals. And Brown having misapplied it in his History of Jamaica to the Linnæan *Phalangium reniforme*, belonging to the modern genus *Phrynus* of Olivier; Fabricius, unaware of the establishment of the latter genus, employed the name *Tarantula* for the species of *Phrynus* and *Thelyphonus* (Latreille, see PHRYNUS), which name, *Tarentula*, Latreille has injudiciously retained in the Règne Animal; although for the two subgenera he preserved the names *Phrynus* and *Thelyphonus*.

TARUS (Clairville; CYMINDIS, Latreille). A genus of coleopterous insects, belonging to the family *Carabidæ*, and subfamily *Brachinides*, of moderate size and depressed form; the thorax is cordate truncate; the body oblong; the maxillary palpi filiform; and the labial terminated by a large hatchet-shaped joint, at least in the males; the head is not narrowed behind into a neck, and the tarsi are not dilated. The type of the genus is the *Carabus humeralis* (Marsham), pitchy black, with the humeral angles of the elytra reddish. The species are of rare occurrence, and are found beneath stones. Stephens describes eight as inhabitants of Britain.

TAXUS (Linnæus). A genus of three species and several varieties of evergreen trees, belonging to the natural order *Coniferæ*. This is the well-known yew, a native of Britain, remarkable for its longevity, the toughness of its young branches, and durability of its timber. It is moreover remarkable for its poisonous effects on cattle that eat the twigs, especially after these have been a little dried: cattle bred where yew-trees grow, are never hurt by browsing it green. The tree yields seeds plentifully, and by which seedlings are raised.

TECOMA (Jussieu). A fine ornamental genus of evergreen and deciduous shrubs and climbers, natives chiefly of North and South America. The flowers are didynamous, and the genus belongs to *Bignoniaceæ*. *Tecoma Capensis*, and *Grandiflora*, are favourite greenhouse climbers, and easily propagated by cuttings.

TECTONA (Linnæus). A genus of a single species, belonging to *Verbenaceæ*. It is one of the largest timber trees of India, and rivalling the British oak for bulk as well as durability. It is propagated by cuttings in stoves.

TELEPHIUM (Linnæus). A genus of only one species as yet described, bearing pentandrous flowers, and belonging to *Portulaceæ*. This is the *Orpine* of English authors (though the *Sedum telephium* is the true *Orpine* of English fields), and is introduced into the flower garden for embellishing rock-work.

TELEPHORIDÆ (Leach). A family of coleopterous insects, belonging to the section *Pentamera*, and subsection *Serricornes*, and nearly related to the family of the glow-worms (LAMPYRIDÆ, which see), from which they are distinguished by having the body in both sexes always furnished with wings, and by the maxillary palpi being scarcely longer than the labial; the body is long and rather narrow, and of a soft consistence; the antennæ are moderately long and slender.

By Linnæus, the name of the blister-fly (*Cantharis*), was inappropriately applied to these insects, which are still described under that name by many systematic writers; whilst by others they are called *Telephorus*, which name was given to them by Schaeffer, and which they ought to retain. By Geoffroy they were constituted into the genus *Cicindela*. They make their appearance in the early summer months, abounding in our gardens and hedges, and are well known to children under the name of soldiers and sailors, probably on account of their different colours, red, buff, and blackish-blue, being their chief hues. Their flight is slow and heavy. The larvæ are black, and of a velvety appearance, with the legs, antennæ, and palpi reddish; they are rather long, depressed, and of a soft consistence; the head is scaly, and the mandibles are very robust; beneath the terminal segment of the body there is a fleshy retractile appendage which the insect employs whilst in motion as a seventh leg. They reside in moist earth, and feed upon other insects. In the perfect state also they are insectivorous.

It has been recorded, that in certain seasons during winter, a great extent of the snow with which the ground was at that time covered in various parts of Sweden, swarmed with the larvæ of these insects, as well as with other living insects; and it has been supposed that these creatures had been raised and transported by sudden gusts of wind during the violent tempests which overthrew many of the large trees, especially of the fir tribe, in those countries. Such has been regarded as the origin of what has been called "showers of insects." The species discovered in such situations, and occasionally even upon the frozen lakes of the country, are probably those which make their appearance early in the year. The name of the genus *Telephorus* is derived from the Greek, and is given to these insects in allusion to their habits of killing and devouring other insects.

The genera are *Telephorus*, *Silis*, and *Malthinus*. In the first the elytra are of the ordinary size, with the margins of the thorax entire. The second differs in having the posterior angles of the thorax notched; and the last has the elytra abbreviated. The typical genus *Telephorus* is very extensive, there being nearly forty British species. The type is the *Cantharis rusticus* of Linnæus. The *Cantharus lividus*, *rufus*, *fuscus*, *obscurus*, of Linnæus, are also common species.

TELLURIUM, a mineral usually found combined with gold and other metals of a less valuable character. In the native state it is blended with iron and gold, the latter being in very small quantities. The ores of *Tellurium* are only found in the mines of Transylvania and in Siberia. Dr. Clarke has given a long account of the *Tellurium* mines in the fourth volume of his Travels.

TELOPEA (Dr. R. Brown). A genus of a single species, and one of the most magnificent flowering

trees found in Australia. The flowers belong to Linnæus' fourth class, and to the natural order *Proteaceæ*. It is the *Waratah* of the natives; and the utmost skill of our practical botanists has been exerted to flower this fine plant, and they have succeeded by growing them in a compost of light loam, heath-mould, and sand; keeping the pots well drained, and in an airy situation in a greenhouse, and watering them cautiously. They are raised chiefly from imported seed; but they may be also increased by cuttings planted in sand but not at an high temperature.

TENEBRIONIDÆ (Leach). A family of coleopterous insects, belonging to the section *Heteromera*, and division *Melasoma*, distinguished by having the body furnished with wings (of which the *Pimeliidæ* and *Blapsidæ* are destitute). The body is oval or oblong, depressed, or but slightly elevated, with the thorax square or trapezoid, and as broad behind as the base of the elytra; the palpi are dilated at the tips, the terminal joint of the maxillary being triangular or hatchet-shaped; the mentum is narrowed at the base, leaving the maxillæ exposed.

By Linnæus, the families *Tenebrionidæ*, *Blapsidæ*, and *Pimeliidæ*, were all included in the genus *Tenebrio*, which takes its name from tenebra, darkness, and is given to them in allusion to their darkling habits. By Fabricius, the genus *Tenebrio* was restricted to the insects of the present family, and by the still further restriction of modern authors, the name is generically confined to the meal-worm beetle, *Tenebrio molitor* of Linnæus. The other genera are *Crypticus*, *Epitragus*, *Opatrum*, *Toxichum*, *Sarrotrium*, *Chiroscelis* and *Upis*, Mr. Stephens adds *Diaperis* and some other genera placed by Latreille in the division *Taxicornes*, as well as *Stene*, *Usoma Alphitobius*, *Pedinus*, and several other allied genera.

The typical genus *Tenebrio*, as now restricted, comprises those species which have the body elongate, rather narrow, and sub-depressed; the thorax is broader than long; the upper lip is coriaceous and entire; the antennæ have the five terminal joints rather depressed and thickened, and the fore legs simple. These insects delight in obscure situations, hence their colours are of corresponding hues. They chiefly frequent the lower rooms of houses, cellars, &c., in moist situations, especially delighting in bake-houses, corn-mills, and other places where wheat is kept, upon which the larvæ feed; these larvæ are termed meal-worms, and are well known to bird-fanciers as a favourite food of the nightingale and other cage birds, and by whom they are reared in great quantities; it is essential, however, to have the tops of the pans in which they are kept closed with a leaden cover, as they will make their way through wood. These larvæ are cylindrical, about an inch in length, very smooth, of a shining yellowish red colour, composed of twelve scaly segments exclusive of the head, which is rather depressed, and furnished with two mandibles, antennæ, and very minute palpi; each of the three anterior segments of the body is furnished with a pair of short scaly legs; the terminal segment is conical, with two small brown hooks, and furnished on the under side with a fleshy retractile proleg, which is employed by the insect when in motion as an extra leg. The meal-worm changes its skin several times; it avoids the light, and when exposed in the midst of its food, it immediately endeavours to burrow itself into the adjacent biscuit or flour in which it has taken up its abode. After the last shedding of its skin, it appears as a pupa, without having constructed any cocoon. After remaining about six weeks in this state the perfect insect makes its escape from the pupa skin, being at first of a pale reddish colour; it soon, however, attains its ordinary black hue. It immediately seeks its partner, and wanders but little from the situation in which it was reared. This is the typical species of the genus, and is the *Tenebrio molitor* of Linnæus; it varies in length from five to eight lines, is of a brownish-black colour above, dark pitchy-red beneath; the thorax as broad as the elytra, with two posterior impressions, and the elytra are finely punctured and striated.

There are three other British species; one of which, *T. lævis*, Stephens, is unique in the collection of the writer hereof.

According to M. Lacordaire, *Tenebrio gigas* (an inhabitant of Brazil, where it resides under the bark of trees), ejects a caustic fluid from the extremity of the body when disturbed, to the distance of nearly a foot. Other smaller species of the same country cover themselves entire with the same matter.

TENOIDÆ, or TÆNOÏDÆ, the ribbon-fish family. The eighteenth family of those into which Cuvier divides the spinous-finned fishes. In their characters they approach pretty near to the mackerel family; but they differ much in shape. They are very long in the body, and flattened in the sides, and have the scales small. They are divided into three tribes or sections.

1. The muzzle long, the gape deep, the lower jaw projecting beyond the upper, and the teeth large. There are two genera: *Lepidopus*, with the ventral fins in the shape of two scaly plates, the body long and slender, a dorsal fin along the whole length, a low anal fin, and a well-formed caudal. *Trichiurus* have the mouth, teeth, and general form of the body the same, but no ventrals or caudal, and the tail drawn out in the form of a slender thread.

2. The muzzle short, and the gape small. Of these also there are two genera: *Gymnotus* have no anal, but a long dorsal, with the anterior rays produced, and forming a sort of tuft; the ventrals long, and the tail ending in a sort of hook; they can crawl and climb; their flesh is soft, and decays rapidly. *Stylophorus* have the general characters of the other, but the tail drawn out into a slender filament longer than the body.

3. The muzzle short, and gape opening obliquely. Of these also there are two genera: *Cephala* (ribbon fishes), the dorsal and anal fins long, extending to the base of the caudal, which is also well developed. *Lophotis*, the head with an elevated bony crest, to which a long and strong spine is articulated, with a membrane on the posterior edge, the opening of the month directed upwards, and the eyes very large.

All these fishes are remarkable for the slenderness and thinness of their bodies as compared with the length; some of them have a rich metallic lustre, and appear like silver ribbons.

TENTHREDO (Linnæus; or rather TENTHREDINIDÆ, Leach). A family of hymenopterous insects, known under the ordinary name of saw-flies, distinguished by having the abdomen attached to the thorax by its entire breadth, by the organs of oviposition not being exserted, and by the form of the larvæ, which, instead of being footless grubs, like the maggots of wasps, &c., are provided with a great number of legs, resembling the caterpillars of lepidopterous insects.

Under the article SAWFLY we have given various details relative to the natural history and structural peculiarities of these insects, reserving for the present article the technical details of the family.

The mandibles are generally elongated and compressed, the lower lip divided into three fleshy lobes, the maxillary palpi always long, and composed of six joints, and the labial four-jointed and short; the wings large, and exhibiting numerous cells; the abdomen cylindrical and nine-jointed; behind the scutellum are to be observed two small rounded bodies, generally differently coloured: the antennæ are very variable in their construction; in some being long, slender, and cylindrical; in others short and terminated by a large knob; in others three-jointed, the third joint consisting of a long and cylindrical club; and in others beautifully pectinated or ramose. The structure of the saws, which are in fact the chief characteristic of the groups, is detailed in the article above referred to.

The family is exceedingly numerous, the species generally of large or moderate size; and the colours often handsomely varied. They are entirely herbivorous in the larva state, occasionally doing much mischief.

The genera are numerous. Those of *Perga*, *Syzygonia*, *Pachylosticta*, and *Cimbex* (from which last Dr. Leach has separated many of the species, under the names of *Trichiosoma*, *Amasis*, *Zaræa*, *Abia*, &c.) have the antennæ short and clubbed. The genera *Hylotoma*, *Schizocerus*, and *Ptilia*, have the antennæ three-jointed and terminated by a long cylindrical club; those of the males of *Schizocerus* are divided into two long equal branches. The restricted genus *Tenthredo*, together with *Allantus*, *Dolerus*, *Nematus*, *Pristiphora*, *Selandria*, *Fenusa*, *Dosytheus*, *Emphytus*, *Cræsus*, *Cladius*, &c., have the antennæ simple, and generally nine-jointed. In *Pterygophorus* and *Lophyrus* the antennæ are deeply bipectinated in the males, and in the genera *Tarpa* and *Lyda* they are long, setaceous, and multiarticulate; the genera are also distinguished by the variable number of the cells of the upper wings.

The genus *Tenthredo*, as restricted by a late writer, comprises those species which have nine-jointed antennæ, with the third joint of the same length as the fourth, and with two marginal and four sub-marginal cells. Stephens describes about thirty British species, the type being the *Tenthredo Rapæ* of Linnæus.

TENUIROSTRES — Slender-billed birds. A family of the order *Passeres*, comprising the nut-hatches, creepers, humming-birds, and hoopoes. They differ much in their appearance and habits. See BIRD.

TEPHRITIS (Latreille; TRYPETA, Meigen). A genus of dipterous insects, belonging to the family *Muscidæ*, having the abdomen terminated by an elongated, cylindrical, and exserted tube; the head is transverse and rounded, the antennæ short and three-jointed, the seta at the base of the third joint being naked, or scarcely pubescent; the alulets small, the wings vibratile when in action, but laid flat upon the back when at rest. These flies are very beautiful, owing to the ornamental markings of the wings, which are varied with bars, circles, stars, &c., of endless variety of form. They are generally found upon composite flowers in the hot summer months, the females depositing their eggs amongst the seeds of those plants upon which the larvæ feed. Some species, however, introduce their eggs into the epidermis of the same plants, producing large galls of various sizes. Such is the case with *Tephritis cardui*, the type of the genus, which is the cause of the formation of the large galls often observed upon thistles. According to M. Catoire, the inhabitants of the Isle of France are scarcely able to obtain sound oranges, in consequence of the attacks of a species supposed to belong to this genus, but which we should rather conceive to be the *Ceratites citriperda* of MacLeay. (Zool. Journ.)

TEPHROSIA (Persoon). A genus of plants of very various habit; viz., shrubs, undershrubs, and herbs, scattered over every quarter of the globe. The flowers are diadelphous, and belong to *Leguminosæ*. They are nearly allied to the genus *Galega*.

TEREBINTHACEÆ. A large natural order, containing twenty-seven genera, and one hundred and forty-two species already described. There is so much diversity in the structure and qualities of the plants here associated, that botanists have found difficulty in making the order purely congenerous; this circumstance has caused the order to be separated into seven tribes, namely, *Anacardicæ*, *Sumachineæ*, *Spondiaceæ*, *Burseraceæ*, *Amgrideæ*, *Spatheliaceæ*, and *Connaraceæ*. The general character of the order is that the different genera are resiniferous, with mostly exstipulate dotted leaves, and imbricate æstivation of the calyx; superior ovaries, few in number, exalbuminous seeds, and the radicle of the embryo turned towards the hilum. It contains many useful and economical plants, as the cashew and pistachio nuts, the spondias and mangos of India. The *Balsamodendron*, *Icica*, *Amyris*, *Rhus*, and *Melonorrhœa*, are all plants yielding valuable resins, gum, varnish, &c., useful in the arts. Several of the genera and species are hardy, and all may be propagated by layers, cuttings, or seeds, as described under the various genera.

TEREBRANTIA (Latreille). A primary section of the *Hymenopterous* order of insects. See HYMENOPTERA.

TERMINALIA (Linnæus). A genus of ornamental trees, natives of India. The flowers are polygamous, and the genus belongs to *Combretaciæ*. *T. vernix* affords a resinous juice that is used in China as a varnish, and *T. Catappa* yields a black pigment, with which the Indians dye their cloth. In our collections these plants are increased by cuttings.

TERMITIDÆ (TERMES, Linnæus). A very extensive and at the same time destructive tribe of insects, placed by Linnæus in the order *Aptera*, on account of the apterous condition of some of the individuals, whilst the winged individuals he regarded as belonging to the order *Neuroptera*, placing them in the genus *Hemerobius* (*H. testaceus*). The small insects comprising the family *Psocidæ* of Leach (which see), were also placed by Linnæus in the genus *Termes*.

These insects are well known under the name of white ants, and are distinguished from other neuropterous insects by having the tarsi composed of four joints, the three basal joints being very small, the wings laid horizontally upon each other over the back when at rest, and far exceeding the length of the body, the head is rounded, the pro-thorax square or semicircular and depressed, as is the general form of the body; the antennæ are short, the mouth armed with strong dentate jaws, galeated maxillæ, and a quadri-lobed lower lip (thus very closely resembling

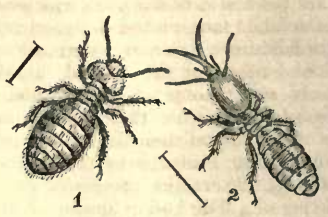
the mouth of the *Orthoptera*); the ocelli are three in number, placed on the forehead, the anterior one being not so distinct as the others; the wings are but slightly transparent and coloured, with the anterior margins incrassated, and the nerves very distinct, and not forming the beautiful net-work observed in other tribes of neuropterous insects; the abdomen is terminated by two minute conical two-jointed styles, and the legs are of moderate length and slender.

These insects, with the exception of one or two small species, are strangers to Europe, and most fortunate is it that such is the case, for their devastating powers, in the torrid zone, is immense; furniture, wood-work, and merchandise of all kinds, is attacked, and in a very short space of time entirely destroyed; nothing, in fact, escapes their destructive energies except metal and stone. Residing ordinarily on the ground, they form their burrows with such care and precision that they make a place of exit just beneath the feet of chairs, tables, &c., where these articles are suffered to remain stationary for any length of time; and then by working upwards they completely excavate the piece of furniture, leaving only the external pellicle. All this is effected without their presence being suspected, or in any manner indicated. In a very short time the supports of the piece of furniture are rendered so weak that it tumbles to pieces, crumbling to dust at the touch.

The African species of this genus have long attracted the attention of travellers, on account of the size and remarkable construction of their nests, but it was reserved to Smeathman to give the most complete and satisfactory account of their singular economy and habitations, and which was published by him in the Philosophical Transactions for the year 1781.

These nests may be said to surpass those of bees, wasps, beavers, and other animals, in the same proportion as the habitations of the most polished European nation excel the rude huts of the inhabitants of those countries where the termites abound; whilst, in regard to their size, it is certain that if the dwellings of mankind were of the ordinary size of the Egyptian pyramids, they would sink in comparison with the labours of these insects. The chief work of the construction of the nests of the white ants falls upon a distinct class of labourers, somewhat analogous in this respect to the workers of the hive, but these labourers are apterous and in the state of larvæ, not exceeding a quarter of an inch, but the structures which they erect are ten or twelve feet above the surface of the earth. Supposing a man's ordinary height to be six feet, Mr. Smeathman calculates that the building of these insects may be considered, relative to their size and that of man's, as being raised to near four times the height of the largest of the Egyptian pyramids, that is, corresponding with considerably more than half a mile! With respect to their interior construction, and the arrangement of the different parts of the building, they do not fall short of any human construction.

It will be necessary, however, before giving an account of the internal parts of the nest, to describe the different members of which the community is composed. Smeathman had described these different kinds of individuals; but it is to Latreille that we are indebted for a more precise account, this author having minutely investigated the economy of a species which inhabits the south of France, and of which the writer hereof saw a nest, with the inhabitants in full activity, in the city of Berlin, in the possession of Dr. Burmeister, (*T. lucifugum*). The community at large surpasses all calculation, far exceeding those of the ants or the bees.



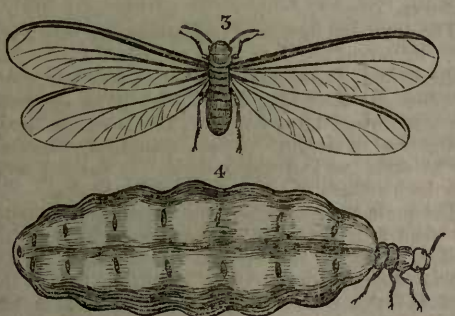
1 Worker. 2 Soldier.

The workers or labourers above mentioned nearly resemble the perfect insects, of which, in their ordinary winged state, a description has already been given; they are, however, smaller, with the body soft, and destitute of wings; the head is also larger, but is not apparently furnished with the least trace of eyes, a most remarkable circumstance, when the labour of this class of the inhabitants is taken into consideration. It is the duty of these insects to construct the nest, which is composed of agglutinated sand and earth, of varied form, being conical, turreted, cylindrical, &c.; to form roads, or rather covered-ways, diverging in all directions from the nest, and leading to every object of plunder within their reach; to attend at the proper time to the duties of the royal couple, and to take care of the eggs. The workers, we have said, are larvæ.

The pupæ first described by Latreille are very much like the larvæ, but they have rudiments of the four wings visible. In the nest of a small African species examined by the writer hereof, the pupæ so much resembled winged frog-hoppers (*Tettigonia spumaria*), that several entomologists were completely deceived at first sight on inspecting them. It has not been stated what share of labour falls to these pupæ.

The perfect insects differ from the workers in being furnished with wings, and in having the head rather smaller, although the general size is larger; their general appearance is indeed so unlike that of the workers that it is not surprising that Linnæus should have introduced them into different orders, although, if the structure of the mouth had been examined, their relationship would have been discovered. They are not to be discovered in the nest till just before the commencement of the rainy season, when they undergo their last change, preparatory to the formation of new colonies. There is a very great analogy in respect to the impregnation and subsequent treatment of these insects and the ants and bees, especially the former of these industrious tribes; like them the winged termites quit the nest soon after they have attained the perfect state, swarming in prodigious numbers during the evening or night, according to Latreille, during which period we may from analogy conclude that pairing takes place, although, according to Smeathman, this takes place afterwards. On reaching the ground again the wings of the termites fall off, as is also the case in the female ants, and they now become the prey of innumerable birds, reptiles, and insects; so that probably but very few pairs, out of the countless myriads, of which the swarm had consisted, contrive to escape, so as to lay the foun-

dation of fresh colonies. At this period they are also eaten by the Africans; and Smeathman says they are delicate, nourishing, and wholesome, when merely roasted in the manner of coffee, without any sauce or other help from cookery. The same author informs us, that the few fortunate pairs which happen to survive this annual massacre and destruction, and are found by the labourers, which are continually running about on the surface of the ground, are by them elected *Kings and Queens* of new states, and are immediately protected from their innumerable enemies, but with the loss of their liberty and ultimately of their lives, being enclosed by the workers in a chamber of clay, "where the process of propagation soon commences." The young queen of the hive-swarms is followed by a portion of the community, and the female ant, after swarming, and the loss of her wings, is guarded by the worker ants; there is therefore so much analogy in these circumstances, that we are almost tempted to consider that Smeathman must have erred in stating that the working termites imprison both the king and queen termes. That it should be necessary for the latter to be carefully guarded will be very evident, but why the king, in his helpless and wingless state (for we consider that the loss of wings is consequent upon and not precedent to pairing), should be shut up, seems questionable. We make these observations with hesitation, because Latreille (Règne Animal, v. 5, p. 255, 2nd edit.), and Kirby and Spence (Introd. vol. 2, p. 35) seem to adopt, without any hesitation, this statement of Smeathman.



3, Queen in the first or winged state. 4 Ditto, filled with eggs.

Soon after the imprisonment of the captured queen a great change takes place in her appearance. The abdomen, which at first was of the ordinary size, now increases in bulk, and at length becomes of such an enormous size as to exceed the bulk of the rest of her body 1500 or 2000 times. She becomes a thousand times heavier than her consort, and exceeds 20,000 or 30,000 times the bulk of one of the workers; in this state the matrix has a constant peristaltic or undulating motion, in consequence of which eggs, to the number of 80,000, are discharged in the course of twenty-four hours.

There still, however, remain to be noticed another class of inhabitants, which are totally unlike any other of the inhabitants, and of which there is no analogous example in any of the other tribes of insects; these are called *neuters*, although Fabricius erroneously considered them as *pupæ*. Smeathman calls them soldiers, from their duties in the nest, observing, that they have been supposed by some authors to be males and the workers to be neuters, but that they are in fact the same insects as the workers, only they have undergone a change of form, and approached one degree nearer to the perfect state; but this opinion is opposed by Latreille, in consequence of the large size of the head and the want of rudimental wing-cases, which would be exhibited were the soldier insects in the pupa state. Kirby and Spence think the soldiers may possibly be the larvæ of the males. Huber seems to doubt their being neuters. They are much less numerous than the workers, being in the proportion of one to one hundred, and considerably exceeding them in size; they are destitute of wings, and have no trace of the rudimental wing covers of the pupæ; the head is very large and horny, and armed with very long slender curved jaws; their duty is to guard the nest when attacked, for which purpose they are stationed nearer to its exterior surface, and they present themselves the first in case of a breach made in the walls; they bite with considerable force, and it is said they impel the workers to their labour when they are inclined to be lazy. It would be very interesting for persons abroad, having opportunities for so doing, to endeavour to discover what are the earliest stages of these soldiers' existence, in order to ascertain whether they remain permanently apterous, being, like the wingless specimens of *Velia currens*, figured in the article Insect, retarded in their transformations, their development being stopped short before their arrival at maturity, and thereby gaining an enlarged head, in order to compensate for their ultimate want of wings.

Such are the different classes of a community of white ants. Their habitation now requires more particular description. The forms of their nests are varied according to the species by which they are formed. The *Termes fatale*, Linnæus, (*Bellicosus*, Smeathman), whose history has been most especially

noticed, forms the largest nests, being, as above mentioned, ten or twelve feet in height, of a conical form, with numerous conical turrets on its sides; this is formed of clay, and being soon coated with growing grass, very much resembles a hay-cock. *Termes atrox* and *mordax* build cylindrical pillars three quarters of a yard high, with a projecting conical roof; whilst *T. destructor*, Fabricius, (*Arborum*, Smeathman), constructs its nests of different sizes amongst the branches of trees often seventy or eighty feet high. Of the strength of these erections Smeathman's account enables us to form a clear notion. When raised to little more than half their height, it is the practice of the wild bulls to stand as sentinels upon them, whilst the rest of the herd is

remaining below. When at their full height of ten or twelve feet, they are used by the Europeans as places to look out from over the top of the grass, which grows, upon the average, thirteen feet high. Indeed, Mr. Smeathman himself stood with four men on the top of one of those erections, in order to obtain a view of any vessel which might come in sight.

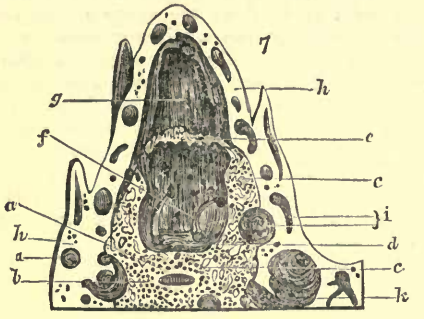


Fig. 7. Section of the nest of *Termes fatale*, on a scale of one inch to eight feet: *a*, the royal chamber; *b*, the apartments of the royal attendants; *c c*, the nurseries and magazines extending up the sides of the nest; *d*, the lower roof; *e*, the upper roof; *f*, two brioges reaching from apertures in the lower roof to some of the upper nurseries, *g*, the hollow dome; *h h*, the thick mud walls of the building, penetrated in various directions by passages, *i i*, of various sizes, chiefly in a spiral direction from the bottom of the nest to the upper parts; *k*, one of the great under-ground outlets of the nest.

The following account of the interior arrangement of the nest is descriptive of that of *Termes fatale* observed in Guinea, and other parts of the western coast of Africa, by Mr. Smeathman:—On making a longitudinal section of the nest, it is perceived that the lower portion of the building alone serves for the habitation of the community, the upper part forming an immense dome, serving not only as a defence against the weather, but keeping up a genial warmth in the inhabited parts of the nest, and which consists of the royal chamber, the nurseries for the young, the storehouses for food, and innumerable galleries, passages, and empty spaces. The royal chamber is placed in the centre of the building, nearly on the level of the ground. At first it is only about an inch long, and of a semi-oval form; but, as the queen increases in size, the apartments surrounding it are pulled down, and the space thrown into that of the queen's chamber, until it is eight inches or more in length; but, in order to prevent the escape of the queen, the entrances into this chamber are so small that workers only can enter. Around the royal chamber, and extending on all sides a foot or more, are an innumerable quantity of arched rooms, of different shapes and sizes, for the accommodation of the attendants and soldiers whose duty it is to wait on the queen. Smeathman calls these the royal apartments. Then come the nurseries or egg-chambers and the food magazines. The former, in the early stage of the colony, are ranged close to the royal chamber; but when the queen has attained a much larger size, the space required for her enlarged chamber, and for the apartments of her additional attendants, extends so much farther, that the nurseries are removed to a greater distance, being composed entirely of wooden materials, seemingly joined together with gums. Into these the attendant workers immediately carry the eggs produced by the queen, lodging them there as fast as they can obtain them from her, and communicating with each other by empty passages on all sides. In these nurseries Mr. Smeathman was induced to believe that the ants formed a kind of garden for the cultivation of a species of microscopical mushroom, appearing like a kind of mould, among which arise numerous globules about the size of a pin's head; and Mr. König, who published an account of the East Indian *Termites*, considered that this is the food of the larvæ, or very young insects, probably before they are sufficiently strong and active to leave the nest. The cares of the community for the education of the young progeny is necessarily rendered much less irksome than it is in the case of the bees or ants, because in those insects the larvæ and pupæ are inactive, and totally unable to provide for themselves; but in the *Termites* the whole period of the insect's existence, immediately after its bursting from the egg, is one of activity, the pupa not being quiescent, as in some other of the neuropterous insects.

The provision-cells are arranged without much seeming order amongst the vacant passages which surround the nurseries; they are chambers of clay, always well stored with provisions, consisting of bits of wood, gums, and the inspissated juices of plants. These cells, with the nurseries, are extended up the sides of the dome, reaching to about one-third from the top, and leaving an open area in the middle under the dome. At the top of the nurseries is extended a flattish roof, impervious to the wet, should the upper part be damaged. The lower part of the area, also above the royal chamber, has a flattish roof, also water-proof. Above the upper of those roofs the dome is hollow, but the outer walls of the nest are of very great thickness, and perforated with numerous passages, running from the top to the bottom of the walls in various winding directions, intersecting each other at different heights, and opening either immediately into the dome, in different places, and into the lower half of the building, or communicating with every part of it by other smaller circular or oval galleries of various diameters. The main underground galleries, by which egress and ingress to the nest is effected, are a foot in diameter, and run in a sloping direction under the bottom of the nest to the depth of three or four feet, where they branch out horizontally on every side, and are carried underground, near to the surface, to a very great distance. Besides the passages reaching from the lower to the upper magazines and nurseries, bridges of a single arch, of great extent, are built from the upper side of the lower roof above mentioned, and reaching to the upper apartments. Two of these are represented in the annexed engraving. By the assistance of these bridges a great saving of labour, in transporting the eggs to the upper nurseries, is effected.

Of the operations of these insects, in the construction of their abode, some idea may be obtained from the recital of the circumstances subsequent to the making of a breach in any part of their outer wall. One of the soldiers first makes its appearance, and walks about the breach as if to see whether the enemy be gone, and to discover whence the attack proceeds. In a short time two or three others appear, and soon afterwards a more numerous body, who rush out as fast as the breach will permit them, their numbers increasing so long as any one continues to batter the building. During this time they

are in the most violent bustle and agitation ; while some are employed in beating with their mandibles upon the building, so as to make a noise which may be heard at three or four feet distance. On ceasing to disturb them, the soldiers retire, and are followed by the labourers, who hasten in various directions towards the breach, each with a burden of mortar in its mouth ready tempered. Though there are millions of them, they never stop nor embarrass each other, and a wall gradually arises which fills up the chasm. A soldier attends every 600 or 1000 of the labourers, seemingly as a director of the works, for he never even touches the mortar. One in particular places himself close to the wall which they are repairing, and frequently makes the noise above mentioned, which is constantly answered by a loud hiss from all the labourers within the dome, and at every such signal they immediately redouble their pace, and work as fast again. The obstinacy of these soldiers is remarkable ; they fight to the very last, disputing every inch of ground so well as often to drive away the negroes, who are without shoes, making even the white people bleed profusely through their stockings.

It is of course impossible for us to enter into the numerous details of the economy of these insects recorded by Smeathman, König, and others. Our sketch, though slight, has comprised the most material points in their very peculiar economy ; but we cannot close this article without quoting Mr. Smeathman's admirable observations upon the general effects in the economy of nature at large of the presence of these and other similarly obnoxious creatures. They are the observations of a true naturalist, who had had ample opportunities of seeing and judging of their action.

" It may appear surprising how a Being perfectly good should have created animals which seem to serve no other end but to spread destruction and desolation wherever they go. But let us be cautious in suspecting any imperfection in the Father of the universe. What at first sight may seem only productive of mischief, will, upon mature deliberation, be found worthy of that wisdom which planned the most beautiful parts of the world. Many poisons are valuable medicines—the storms are beneficial—and diseases often promote life. These *Termites* are indeed frequently pernicious to mankind, but they are also very useful, and even necessary. One valuable purpose which they serve is to destroy decayed trees and other substances, which, if left on the surface of the ground in hot climates, would in a short time pollute the air. In this respect they resemble very much the common flies, which are regarded by mankind in general as noxious, and at best as useless beings in the creation. But this is certainly for want of consideration. There are not probably in all nature animals of more importance ; and it would not be difficult to prove that we should feel the want of one or two species of large quadrupeds much less than of one or two species of these despicable-looking insects. Mankind in general are sensible that nothing is more disagreeable or more pestiferous than putrid substances ; and it is apparent to all who have made observation that those little insects contribute more to the quick dissolution and dispersion of putrescent matter than any other. They are so necessary in all hot climates, that, even in the open fields, a dead animal, or small putrid substance, cannot be laid upon the ground two minutes before it will be covered with flies and their maggots, which, instantly entering, quickly devour one part, and, perforating the rest in various directions, expose the whole to be much sooner dissipated by the elements. Thus it is with the *Termites*. The rapid vegetation in hot climates, of which no idea can be formed by anything to be seen in this, is equalled by as great a degree of destruction from natural as well as accidental causes. It seems apparent, that when anything whatever has arrived at its last degree of perfection, the Creator has decreed that it shall be totally destroyed as soon as possible, that the force of nature may be speedily adorned with fresh productions in the bloom of spring or the pride of summer ; so, when trees, and even woods, are in part destroyed by tornadoes or fire, it is wonderful to observe how many agents are employed in hastening the total dissolution of the rest. But in the hot climates there are none so expert, or who do their business so expeditiously and effectually, as these insects, which, in a few weeks, destroy and carry away the bodies of large trees, without leaving a particle behind ; thus clearing the place for other vegetables, which soon fill up every vacancy ; and in places where, two or three years before, there has been a populous town, if the inhabitants, as is frequently the case, have chosen to abandon it, there shall be a very thick wood, and not the vestige of a post to be seen, unless the wood has been of a species which, from its hardiness, is called iron-wood."

TERN. See Sterna.

TERNSTRÆMIACEÆ. A small natural order, comprising eleven genera and nineteen species ; small as it is, it consists of five tribes, namely, *Ternstræmiaceæ*, *Freziereæ*, *Saurauieæ*, *Laplaceæ*, and *Gordonieæ*. The plants associated here are all trees or shrubs, bearing handsome white or yellowish flowers ; they are nearly related to *Camellieæ*, from which they do not differ at all in habit. The greater number have a place in botanical collections, and are propagated by cuttings, layers, or grafting.

TESTUDINARIA (Burchell). A curious genus of African plants, bearing small diœcious flowers, and belonging to the natural order *Dioscoraceæ*. This is the elephant's-foot of travellers, so called from its large tuberous stem, resting on the surface of the ground, sending up annually a number of slender twining stems, and a fringe of fibrous roots downward. Young plants are imported from the Cape.

TETRAGONIA (Linnæus). A genus of herbs and undershrubs, chiefly natives of the Cape of Good Hope. The flowers are icosandrous, and being of a succulent habit belong to the natural order *Ficoideæ*. Like other succulents they are easy of propagation. One of the annual species is the *T. expansa*, or New Zealand spinach, a culinary vegetable lately introduced into our kitchen gardens.

TETRAMERA (Latreille). One of the primary divisions into which the coleoptera are arranged by the French authors, distinguished by having apparently only four joints in all the tarsi, but in reality having a fifth minute joint interposed between the last and the preceding joint, being often hidden between the lobes of the latter. The subsections belonging to this section are the *Rhyncophora* (types, *Bruchus*, *Attelabus*, and *Curculio*, Linnæus) ; *Xylophaga* (type, *Scolytus*, Geoffroy) ; *Longicornes* (types, *Cerambyx* and *Leptura*, Linnæus) ; and *Cyclica* (type

Chrysomela, Linnæus). The *Clavipalpes* of Latreille seem more naturally to be allied to some of the fungivorous *Necrophogous pentamera*.

TETRAMERIUM (Gærtner). A genus of West India evergreen shrubs, belonging to the fourth class of Linnæus, and to the natural order *Rubiaceæ*. The genus is nearly allied to *Coffea*, and was so called by Linnæus and Aublet. In our stoves the species are grown in sandy loam and moor-earth, and may be increased by cuttings.

TETRANTHERA (Jacquin). A genus of evergreen shrubs and trees, natives of Australia, India, and Mexico, separated from the genus *Litzea* of Lambert and others. The flowers are enneandrous, and the genus ranges among the *Laurinæ*. The species require the ordinary stove treatment as well in growth as in propagation.

TETRATOMA (Herbst). A genus of coleopterous insects, belonging, according to Latreille, to the section *Heteromera* and family *Diaperidæ*, distinguished by having the body of an oblong-ovate form, with the tibiæ narrowed and without spines, the antennæ as long as the head and thorax, and terminated by a four-jointed club; the two posterior tarsi have only four joints, nevertheless it appears to us that this genus much more nearly approaches some of the *Necrophaga*, or rather fungivorous beetles, and especially to the genus *Mycetophagus*. The dissections of these two genera, given by Mr. Curtis in his British Entomology, fully confirm this relation. There are two British species of small size, *T. fungorum* being the type. They are found in fungi, and under the bark of trees.

TETRIX, (Latreille); Acrydium, (Leach). A genus of small but curious orthopterous insects, belonging to the family of the locusts (*Locustidæ*), distinguished by having the hinder part of the head received beneath in a produced part of the prosternum, forming a kind of cravat; the lower lip is divided into four lobes, the tarsi have no pulvilli, the antennæ have only thirteen or fourteen joints, and the upper side of the prothorax is prolonged behind in the shape of a large scutellum, entirely covering, and occasionally extending considerably beyond, the extremity of the body; the elytra are minute, but the wings are large and folded up like a fan; the species are very small and obscurely coloured; they frequent warm grassy banks, and are occasionally very plentiful in such situations, as for instance, in one part of Battersea Fields, well known to collectors under the name of the "Acrydium Bank." The type is the *Acrydium subulatum*, Fabricius.

Tripetalocera ferruginea, figured in our plate Orthopterous Insects, from Malabar, and described in the Zoological Journal, No. 20, is distinguished by the curious structure of the antennæ, which have only six joints, and by the compressed keel upon the back.

TETTIGONIA. A generic name employed in entomology for several very distinct groups of homopterous insects. Fabricius, followed by the German writers, gave this name to the musical cicadæ. Stephens and Curtis employ it for the frog-hopper (*Aphrophora spumaria* of Germar), whilst Latreille gives it to another group, having the head, when seen from above, of a triangular form, without being very much elongated or flattened, the eyes not incised by the margins of the head, and the ocelli situated between them, or laterally. In this confusion of nomenclature (entirely resulting from the non-adoption of some fixed principle regulating the employment of long-established generic names, when it has been thought necessary to subdivide an old genus) it would perhaps be most advisable entirely to abandon the old name *Tettigonia*, and to give to the musical *Cicadæ*, or the Fabrician *Tettigoniæ*, the generic name of *Cicada* (as has already been done in the course of this work), to give to the frog-hopper the name of *Aphrophora* (see the article Cercopidæ), and to call the Latreillian *Tettigoniæ* by the generic name of *Cicadella*.

TETYRA, (Fabricius); Scutellera, (Lamarck), which see.

TEUCRIUM (Linnæus). A numerous genus of shrubs, under-shrubs, and herbs, the latter both annuals and perennials, the whole divided into six sections. The flowers are didynamous, and of course rank among the *Labiatæ*. Some of the species are ornamental and admitted into our hardy and greenhouse collections, and are all easy of propagation by seeds or cuttings. The English name is Germandia.

THALICTRUM (Linnæus). A genus of herbaceous perennials, mostly European, known in English lists as meadow rue. The flowers are polyandrous, and belong to *Ranunculaceæ*. They grow well in any soil in the open borders, and are easily increased by division.

THANASIMUS (Latreille). A genus of coleopterous insects, belonging to the family *Cleridæ*, having the antennæ gradually thickened, the maxillary palpi filiform, and the labial palpi securiform. The species are of moderate size, and from the peculiar character of their appearance and colours have obtained the specific names of *Formicarius*, *Mutillarius*, &c., from their resemblance to ants, *Mutillæ*, &c. One species is found in this country, *T. formicarius*, which is occasionally met with in considerable numbers under the bark of old stumps, where it is probable that its larvæ feed upon the larvæ of the wood-boring *Anobia*, which frequent the same situations.

THAPSIA (Linnæus). An umbelliferous genus of European perennial herbs, formerly called *Laserpitium* by Desfontaines, and easily increased in the open border by seed.

THEA (Linnæus). This is the celebrated and useful Chinese tea plant. The flowers are monadelphous, and being nearly allied, are stationed among the *Camelliaceæ*. We have had two species (or varieties) of this valuable plant in our collections for nearly seventy years; but notwithstanding the long and constant interconrse our merchants have had with the Chinese empire since 1768, it is still uncertain whether the green and bohea sorts we have in our gardens be or be not the true plants whence the manufactured commodity is obtained; for it is quite feasible to suppose that the tea-plant, so long and so extensively domesticated in that country, must have broken into many varieties, and the one producing the greatest number of leaves, and being at the same time of most moderate growth, would be preferred to varieties of more exuberant character. However this may be, a plantation of tea, seen in the neighbourhood of the city of Canton, appeared to be neither the green nor bohea of our gardens, but an intermediate sort. It is quite certain that the different descriptions of the manufactured article, both in the Chinese and home markets, arise entirely from the time of gather-

ing the leaves, the mode of curing, or from the district whence they are brought. The earlier in the spring the first leaves are gathered the richer the quality, and the more valuable the article, whether cured green or black. The tea grown on the sloping side of a hill is superior to that gathered from the summit, and both these are superior to that produced in the rich valley; hence several sorts may be sent to market by the same grower. The different descriptions of teas, however, are the produce of different districts, one being famed for black, another for green teas; and it has been affirmed that all the various sorts are gathered from the same species of the genus; this circumstance, however, still remains undetermined.

THECLA (Fabricius). A genus of small butterflies, belonging to the family *Lycænidæ* (which see), known to collectors under the names of hair-streaks, from the slender lines of white colour with which the under surface of the wings are in general ornamented. The caterpillars are very much like wood-lice, and hence are called onisciform larvæ. There are five or six British species, the handsomest of which is the purple hair-streak (*Thecla quercus*), which flies about the highest branches of the oaks, upon which the caterpillar also feeds.

THELPHUSA (Latreille). A genus of crabs belonging to the family *Canceridæ*, having the carapax or shell of a cordate-truncate form, the tarsi furnished with spinous warts or dentated, the lateral antennæ composed of very few joints. Several species of this genus of crabs are known, all of which, contrary to the usual habit of the tribe, reside in fresh water, having even the power to remain for a considerable period out of the water. The *T. fluviatilis* was well known to the ancients; it is very common in Italy, being found in lakes and streams; it is also often found to be represented upon antique Greek medals. It is about two inches in diameter, and of a grey or buffish hue, differing when dead, very smooth above, except at the sides, which are covered with small transverse impressions. It is eaten by Greek monks, and forms, during Lent, one of the Italian fast dishes. Another species, *T. Indica*, was discovered on the coast of Coromandel, where it is called by the inhabitants *Tille Naudon*; and Colonel Sykes has given an account of another species, *T. cunicularis*, which he discovered in the Deccan or Dukhun as he writes the name. It is called *Kenkra* by the Mahrattas, and abounds along the Ghâts. Their burrows are found in all the valleys, and on the most elevated table lands, from 2000 to 5000 feet above the level of the sea. In the abundant rains of the south-west monsoon, they are seen in a state of great activity running over the surface, and frequenting the public roads in such numbers that instances are constantly occurring of their being crushed under the feet of horses and cattle, those of foot passengers, or the wheels of vehicles. During the months of extreme dryness, December, January, and February, they are rarely seen out of their holes. As they are met with of all sizes, it is probable that the reproductive process takes place without having recourse to migration to the seashore, as is related of some species of land crabs. Indeed nothing of the kind had been even observed by Colonel Sykes, or his friends and native servants. The celerity and ease with which the two fore claws are used make them efficient substitutes for hands, and its rapid lateral movements at pleasure to either side, as objects attracted its attention, were very efficacious in enabling it to capture its prey, which appeared to consist of insects and animal matters of various kinds. This observation of Colonel Sykes (Trans. Ent. Soc. vol. i. p. 183) appears to have more weight, judging from the habits of the crabs in general, than the statement of Bishop Heber relative to the supposed food of these animals. "All the grass through the Deccan," observes this writer, "generally swarms with a small land crab, which burrows in the ground, and runs with considerable swiftness, even when encumbered with a bundle of food as big as itself; this food is grass or the green stalks of rice, and it is amusing to see the crabs sitting, as it were, upright to cut their hay with their sharp pincers, then waddling off with their sheaf to their holes as quickly as their sidelong pace will carry them."

THEOBROMA (Linnæus). A genus of South American trees, two of which are cultivated for the fruit, which, when manufactured, is the favourite repast chocolate. The flowers are polyadelphous, and the genus belongs to *Byttneriaceæ*. In our stoves they are grown in light compost, and are readily propagated by cuttings.

THEOPHRASTA (Linnæus). A genus of highly ornamental shrubs or small trees, having pentandrous flowers, and belonging to *Apocyneæ*. Natives of Hispaniola, they require the warmest part of our stoves, and may be increased by cuttings rooted in sand.

THEREVA (Latreille). A genus of dipterous insects, placed by Leach in the family *Mydasidæ*, but by Latreille in that of *Leptides*, having the wings not folded upon the body when at rest, and exhibiting many complete cells. The palpi are received, when at rest, in the oral cavity, and the antennæ terminate in a spindle-shaped mass, with a small articulated style at the tip. There are ten British species, the type being the *Bibio plebeia* of Fabricius. Some of the species are very common, being found in open parts of woods.

THLASPI (Dillenius). A genus of European weeds, called Shepherd's Purse; they belong to *Cruciferæ*, and are found everywhere.

THOMASIA (Gay). A genus of New Holland shrubs belonging to the fifth class of Linnæus, and to the order *Byttneriaceæ* of Jussieu. The genus was formerly called *Lasiopetalum*, and is best known in greenhouse collections by the old name.

THRIPS (Linnæus). A genus of minute but very curious insects, placed by Linnæus in the order *Hemiptera*, by Latreille in the *Homoptera*, but recently separated by Mr. Halliday as a distinct order under the name of *Thysanoptera*. The body is long, narrow, and sub-depressed, resembling that of a *Staphylinus*; the antennæ short and composed of eight joints, the terminal joint being unarmed by a seta; the four wings are of equal size and form, long and linear, deeply fringed with hairs on all sides, and laid horizontally upon the back; the tarsi are short and terminated by a vesicle instead of the ordinary ungues; the rostrum is described by Latreille as being small or scarcely distinct, but the mouth is not rostrate strictly speaking, but armed with mandibles and palpigerous maxillæ, and thus entirely differing from the other haustellated insects.

These insects are of exceedingly minute size, few exceeding a line (one-twelfth of an inch) in length; they are very active, seeming to leap rather than fly

when disturbed. At such times also they elevate the posterior extremity of the body like a *Staphylinus*, giving it various movements. They are found upon flowers and plants, and under the bark of trees. The different species of this genus are well known to gardeners from their attacks upon different trees, cucumbers, &c., their punctures upon the leaves giving them a dead appearance, curling them up at the sides, and appearing as soon as the least verdure is seen, at which time they are in the larva state, although some are perfect. The larvæ are long and of a faint yellow, and when fully grown are nearly the size which they attain in the winged state, which is very small. For some time after the insect attains the winged state, it retains nearly its original colour, but afterwards turns nearly black. They especially infest melons, cucumbers, vines, kidney-beans, &c., particularly attacking the blossoms; the marks which they produce being in patches, and deeply scalloped. They also attack the young leaves of peaches and nectarines as soon as they appear in the spring, which causes them to shrink up, and they also prey upon the bloom before it expands. They feed in the interior or fructification part, which weakens it materially, and causes the blossom-bud to fall off before it is formed into fruit (Major on the Insects injurious to Fruit Trees).

The student must consult Mr. Halliday's Memoirs upon these insects, published in the Entomological Magazine, where numerous species are described.

THROSCUS (Latreille). A genus of coleopterous insects, belonging to the section *Pentamera*, apparently forming the connecting link between the families *Elateridæ* (having the elongated form and the produced prosternum of that family), and the *Byrrhidæ* or *Dermestoidæ*, having the antennæ terminated by a three-jointed club. The species are of a small size, and are found in sand-pits or upon trees. The type is the *Elater dermestoides*, Linnæus, of a brown colour.

THRUSH (*Turdus*, perhaps rather *Turdidæ*, the thrush family, or *Merulidæ*, the blackbird family), a family of dentirostral birds, of the order *Passeres*, which, after all the reductions that have been made, is still both numerous and interesting. Thrushes, or birds bearing considerable resemblance to thrushes, are found in almost every part of the world. Those which inhabit the high latitudes, and places which are otherwise very seasonal in their character, are in general migratory; and those which inhabit places of more mild and uniform character are in general stationary; but a good deal depends on the particular kind of places which the birds haunt. Thus, a bird whose habit it is to reside in the copses, gardens, and hedge-rows of the warm and cultivated districts of a country, can find food all the year round; while in the wilds a bird finds no food in the winter.

Among birds which are so widely spread over the world, there must of course be many differences of habit, to suit them to the different localities in which they are placed, and the different purposes which they have to answer in the grand system of nature. It is therefore not possible to give any description of the manners of a thrush that will apply to all thrushes, even in the most restricted view that we can take of the family. Their use in nature must obviously be very general; for all the children of nature, and all their organs and adaptations, are made for uses; and then, as the use varies, the structure must vary along with it, so as that the two may be always in harmony.

Thrushes have been celebrated birds from very remote antiquity, not only on account of their songs, but of their flesh. A distinction is made among them of merles and thrushes, the former having the colour entire, and the latter broken and mottled. The blackbird and the common song-thrush are instances of these, but the distinction is not a very important one. When we mention that the number of species that have been described amounts, exclusive of doubtful ones, to between 140 and 150, it will readily be understood that a minute description of them all would be incompatible with the character of the present work. Nor is it necessary, for there is a considerable resemblance among them, varying chiefly with the different characters of the places they inhabit.

The other genus which they resemble most are the shrikes (see LANIUS); but they are not so exclusively animal in their feeding, many of them subsisting upon wild berries in the autumn and winter, though they prefer small animals, especially mollusca and worms, when these can be obtained.

The generic characters are: the bill of middle size, sharp edged, compressed, and recurved at the tip, with a notch near the point, and a few loose hairs over the base; the nostrils oval, lateral, half concealed by membrane; middle toe not so long as the tarsus, and the outer toes joined to it at the base. We can afford to give only an outline of a few of the species.

MISSEL THRUSH (*T. viscivorus*). The largest of the European species, weighing about five ounces, and measuring eleven inches in length, and between sixteen and seventeen in the stretch of the wings. The general colour greyish on the upper part, and yellowish-white on the under, mottled with dusky spots, and with some white on the exterior feathers of the tail. The female paler on the upper part, and with a tinge of russet on the under. The colours are not very constant, however; but vary in different habitats, and even in different individuals in the same. It is common in the middle and cold parts of Europe, from the latter of which it in general migrates in the winter. It is a woodland bird, but it prefers the woods of low and fertile places. In Britain it is more abundant in the south than the north. The song of the male is loud and clear, and far from unpleasant; and it is one of the first songs of the year, being begun as early as January if the weather is genial; and if the song is once begun, the bird goes on despite the storm, even though one should ensue. The call-note, or usual cry of the bird, is not a song, but a harsh and grating scream. The nest is formed about March, rather in copses than in the wild and extensive woods, and in an orchard in preference to any other place. The external part is made of sticks, coarse vegetable fibres, moss, and an admixture of earth; and lined with finer vegetable matters and with wool. The eggs rarely exceed four or five; they are of a flesh-colour with dark rusty spots. The male continues his song during the incubation, and also shares in that labour; but when the young make their appearance, the providing of food for them leaves no time for singing. If the season is favourable there is a second brood, in providing for which contributions are levied on the small succulent fruits of the garden, whereas the brood of the spring are fed upon snails, slugs, and other small animals which

are garden pests. If any casualty befals the female, the male immediately renews his song; and if he should not be able to attract another, he continues the whole season over, so that the song of bereavement, which has been attributed to the nightingale and the turtle by the poets, is really by the missel thrush. With him, however, it is no song of lamentation; for in nature there is no remembrance of sorrow, it is a song of invitation to another; and if that other is not found till the very hot weather, then this bird occasionally bursts violently into song, at the time when most birds begin to be silent.

These thrushes, and indeed almost all thrushes, are unsocial birds, and very apt to quarrel and fight upon matters both of occupation and of gallantry. They are said, however, to be of some use to other birds in the case of a predatory foe appearing upon the breeding grounds. The male thrush, being a vigilant watchman, keeps sounding the alarm until all the finches and other small birds are mustered in a state of excitement; and then he leads them against the enemy, who, though a fierce bird, is seldom much of a soldier, and so he is beaten off, and the victorious birds return to their domestic labours. In winter and early spring the missel thrush generally feeds on the leaves of the misseltoe and the ivy, and it is from feeding on the former that the bird gets the name of missel.

The Song Thrush (*T. musicus*). This is "the thrush" by way of eminence, at least in England in modern times. In Scotland it is the *mavis*. It is considerably smaller than the missel thrush. The length is about nine inches; the extent of the wings about thirteen and a half inches; and the weight three ounces; the ground colour above is brownish grey, and that below whitish red, with many spots of dusky and rust colour; there is also a yellowish tint on the wing-coverts next the body; but the colour is, upon the whole, nearly the same as that of the missel thrush, only the small size readily distinguishes them; and this one has an air of greater hardihood than the other. It is also much more common, found in more bleak and upland places, and it ranges farther into the north on the continent of Europe.

In Britain the song thrush is, in great part of its motions, a resident bird, and one which merely comes nearer houses, and passes into the warmer districts, when the winter is very severe; but on the continent it is more migratory, and moves in great flocks on the autumnal migration. There is a particular summer attraction for it in the north of Europe. Great part of the surface there, beyond the tall forests of pines, is covered with extensive brakes of juniper, the berries of which are ripe in the summer, as they come to their size in the preceding year, and have only to ripen during the last year they are on the bushes. These bushes are close, and, from the spiny nature of the leaves, they are not very pleasant for birds of prey to beat; so they form a close and safe cover for the nests of the thrushes, at the same time that the leaves afford an abundant supply of food both to the birds and to their young. When this supply fails them, or rather, when it begins to be buried up by the snow, which comes suddenly and in great quantity, the birds are driven southward, and they proceed to more genial climates. The north of Russia, rather than that of Scandinavia, or the flats on which the junipers grow, are far more extensive. Hence the autumnal migration of thrushes is more to the eastward of the Baltic than across that sea. They, however, distribute themselves along the southern shores of the Baltic; and it has been stated that, in the city of Dantzic alone, little short of two hundred thousand have been captured and sold for the table in the course of one season. They occur in vast numbers upon the eastern migration, and find their way there not only to Greece and to Italy, but also, as is said, to Egypt, in which latter they arrive in October, and depart again in March. The birds which take these long journeys have not of course more than one brood in the year, and that brood is reared in the most northerly part of their range.

With us they may be partially migrant, and indeed there seem to be some varieties which are wholly so, for the thrushes which are the greatest favourites with the bird-catchers, as song birds, are not seen before March, or after September. Those which do not make long journeys, or pass into places where the summer is short, breed twice, or even in some instances three times, in the course of the season. The nest is a compact structure, formed externally of moss and fibres, and strengthened with an admixture of mud. It is generally in the corner of a hedge or bush, or of a thick tree, but seldom at any considerable elevation above the surface of the ground. The eggs vary from three to six, being more numerous when the birds breed only once in the year, and have their broods later in the season. The ground colour of the eggs is pale greenish blue, and they are mottled with small spots of rust-colour and black, most abundant toward the larger ends. Every one knows the song of the thrush. It is very sweet, and has considerable compass. In a state of wild nature thrushes are not without a pugnacious tendency; and, even in confinement, they menace with their bills if annoyed. They have, however, a good deal of what is usually called intelligence, and can be made to repeat musical airs, or in some instances to articulate words. When the family are called *Thrushes*, this is the bird which may be considered the type, that is, the one from which the principal characters of the family are taken; but when they are called *Merles*, the one next to be noticed is the typical bird.

The Blackbird (*T. merula*). The blackbird is larger than the song thrush, and nearly as long as the missel, but not so stout and heavy a bird. The general colour of the plumage is black; and the bill, the feet, and a circle round the eye, are tawny yellow. The bird does not, however, need any particular description, as it is one which is well known to every body.

The blackbird is very common in all the temperate parts of Europe, and also of Asia, and it is by no means so discursive in its habits as the song thrush, though it is a migrant in the east of Europe and in Asia. Blackbirds are even more solitary in their habits than thrushes, and, even where they are migratory, they do not collect in such numbers in the autumn. In the richer parts of Britain, where they may be considered as stationary, they are always solitary except in the breeding season. They are also very wary birds, and keep themselves much out of harm's way, although they are very familiar, that is, court the neighbourhood of houses, and appear in gardens, even in the open places of cities, in the cold season.

They belong to that class of birds—a class in habit, though it consists of many orders, according to

the arrangements of naturalists, which increase rather than diminish as the country is more thickly peopled and better cultivated. In no places are they more abundant than in the market gardens, where vegetables and fruits are grown to supply the consumption of populous towns and cities. In the rich grounds on the Middlesex side of the Thames, from Westminster upwards, as far as the market-gardens are continued, blackbirds are very numerous. They are at the same time highly useful in clearing the ground of snails and slugs, which are among the worst enemies of some parts of the growth and produce, and also among the most difficult to be got rid of by human means. In walking along the green lanes among the gardens alluded to, the numbers of the blackbirds, and the activity of their labours, are a very pleasing sight; and one might readily imagine (though it is of course a mere matter of imagination) that the birds feel that they are as useful as the human labourers who are at work in the same grounds. They are familiarised to all the ordinary sights and sounds, caring little for the scarecrows which are set up for intimidating other birds; and although no bird is very fond of the report of a musket, blackbirds appear to be less alarmed by it than most others.

The song of the blackbirds, which, although there is not very much music in it, is soft and mellow, begins early in the spring, not quite so early as the missel thrush, but not very long afterwards. They breed once, twice, or three times in the season, according to the nature of the situation. In cold parts of the country, where the summer is short, they breed only once, and their song does not begin till the season is considerably advanced; and when once it ceases it is not again renewed the same year. Where they breed twice or thrice in the year, the song is heard, with little intermission, from first to last; for although the male does not sing after the young are hatched, yet the hatches not being at exactly the same time in all the pairs, one or other is in song from the time of the first impulse in the spring to the development of the last brood in the autumn.

The external part of the nest consists of moss and lichen, worked up with mud, and the structure lined with fine vegetable fibres and feathers. Both parent birds labour at the construction of the nest, and with so much assiduity that, though the fabric is rather an elaborate one, it is finished in about a week. The eggs vary from four to six, and are of a greenish blue colour, with obscure though numerous markings of rust-colour. The male takes a share in the incubation, though not quite so large a share as some other birds. The nests are usually in close concealment, and still further concealed by their substance resembling that of the mossy trunks against which they are placed; they do not, however, avoid places which are frequented by human beings, for a nest may be often seen in a shrub close by a summer-house in which there is company every day, and the bird will sit with perfect unconcern, within a few feet of those who are in the house, if they do not actually meddle with her or her eggs. The more woodland ones, in situations where there is no cover for them in the gardens, are a little more timid, but their nests are generally so placed that they are not very likely to be seen; and the birds repair to the nest and quit it so warily that they do not betray the exact place where it is situated; in fact, it is always so placed that the bird can escape to a considerable distance, under the cover of the sprays, before it makes its appearance, and then, as it doubles after it is seen, there is no retracing its passage to the nest. The young blackbirds are hearty feeders, and thus the parent birds have to capture a vast number of worms and all sorts of larvæ for their support—the snails and slugs being generally down at the time when the birds have their broods, more especially their first one for the season. In winter the blackbirds are very partial to the cover of evergreen shrubs, partly, no doubt, because those afford more shelter and concealment than the leafless sprays of deciduous trees and bushes, and partly also because food for them is found in the shelter of these plants, when there is none where the earth is freely exposed to the atmosphere.

Fieldfare (*T. pilaris*). This is a slender-bodied and well-winged bird, and as such of a much more migrant and discursive character than any of the species hitherto noticed. It measures about ten inches in length and sixteen in the stretch of the wings, and weighs about four ounces; the upper plumage is brown red, the under clouded with dusky, with the tail feathers black, except the tips of the outer ones, which are white, and the top of the head and the rump are of a hoary or whitish colour. The plumage is, however, subject to considerable varieties.

It appears as a regular winter visitant in Britain, and in all the middle and south of Europe, and in Egypt; and it abounds in Asia, where also it is a seasonal migrant, coming southward in the autumn and retiring northward in the spring. In Britain it generally appears about the end of September, but sooner or later according to the character of the season. It is not the season with us, however, but the season in those places from which they come, that regulates the time of their appearance and the numbers in which they appear; and thus they often appear early and in abundance when the weather is serene and warm, and do not come when it is turbulent and broken. Their coming in numbers is, however, always a sign that the winter has set in, early and with severity, in the north; and when that is the case we generally find that our turn of it is sure to come. Thus the early appearance of fieldfares, and indeed of all birds which summer in the north, may be taken as a certain omen of a severe winter. They always come in little flocks, which may be seen on the wing beating about for those grounds which are most suitable for them. They arrive much more early in the northern parts of the country than in the southern, and they seldom reach the south of Europe before the end of autumn. In very severe winter storms they are often driven upon our shores in great numbers, and in a very exhausted state. This happens when the storm comes from the north-east, and we may suppose that they are beaten to leeward on their flight to a more southerly part of the continent. In most parts of Britain they are only birds of passage, at least if the winter is severe, and they are more moveable with the storm than almost any other birds; they are also social birds in the winter, for though they range the moors and other pastures singly, they collect in flocks at night, in case of alarm, or of severe weather forcing them to change their ground. They roost for the night on the ground squatting in the herbage, but they assemble on trees; and if there are trees convenient in the neighbour-

hood, they make their evening assemblage there before they depart to the places where they are to repose. In countries were they are abundant, and there is plenty of food for them, their flesh is held in high estimation, as indeed is the case with that of all the thrushes.

The breeding place is not positively ascertained, but it is in more northerly latitudes than the birds frequent in the winter; and many of the European ones do breed in the north of Russia and Scandinavia; but it is supposed also that a considerable number, especially of those that winter in Italy or in Africa, breed to the south of the Baltic. The nest is in trees or bushes, and the eggs from four to six in number, of a sea-green colour, mottled with rusty brown.

Red-wing (*T. iliacus*). This species migrates about the same time as the fieldfare, and is often found in company with it, but they are easily discriminated; and this one is more apt to be confounded with the common thrush than with the other. It is a smaller bird, however, being only about eight inches long, and two ounces and a quarter in weight. The upper parts are greyish, the under whitish, and the whole marked with dusky spots; the under sides of the wings and the body under them are rusty red, from which the bird gets its name; its colours are altogether more clear and bright than those of the song thrush, and its bill is blacker.

The red-wing is a northern bird in the breeding season, though perhaps not so much so as the fieldfare. It does not breed with us, at least the fact of its doing so is not very well ascertained; but it does breed in some places, south of the Baltic, upon the continent; and it is not improbable that they may breed in some parts of Britain, although the nest has not been found, or the song of the male heard. With us they have a sort of shrilly cry, between a squeak and a whistle; but in the northern parts of the continent, where their breeding has been well ascertained, the male has an agreeable song. They breed on the bleak and bushy grounds in Holland and Germany, and generally in places where there are wild berries; but their summer food consists of insects and their larvæ and worms. When their wild food fails in the autumn, and, indeed, whether it fail or not, they are apt to visit the orchards and gardens, and levy contributions on the smaller fruits; but, as is the case with all birds which are insectivorous in the breeding season, the ravages that they commit in the latter part of the season are more than compensated by the services which they perform in the spring.

The red-wing, though it resembles the song thrush in the appearance, and also in some of its habits, is not so much a woodland bird. The nest is generally in cover of some kind or other, but it is in the cover of a hedge or bush, rather than in that of a tall tree. The breeding season, at least in the more southerly places, where the birds breed, is from April to June inclusive; and in the southerly places there are usually two broods within this period. The eggs, as in most of the others, vary from four to six, of a pale greenish-blue with dusky brown spots. This species is subject to very considerable differences of colour; and some individuals have been met with almost entirely white when it comes as an autumnal migrant; the red-wing, like the fieldfare, prefers the open fields and the commons where there are hedges and brakes to the thick cover of the woods.

Ring-Thrush (*T. torquatus*). This species, which is also called the ring-ouzel, the blackbird being called the black-ouzel, resembles the blackbird more than it does the speckled thrushes; but its haunts are, in some respects, the very opposite. It is dusky black, with a white collar forming a crescent on the upper part of the breast; its length is eleven inches, the extent of its wings seventeen, and its weight four ounces. It is well formed for flight, being thick and firm at the shoulders, and tapering to the rear, and the flying feathers, both of the wings and the tail, are strong and elastic. It is a migrant bird, but its migration is a compound one, regulated both by difference of ground and difference of latitude; and sometimes the one of these, and sometimes the other, predominates in bringing about the general result. It appears on the low grounds in the temperate parts of Europe both in the spring and in the autumn. In the summer they disperse over the upland tracts, not the lofty mountains, but the secondary hills, where they are most partial to wild and rocky places.

In Britain, the chief place for their spring appearance is the middle of the south coast, from which they diverge along the heights, being rarely if ever found in the great valleys or the places which are the favourite haunts of the warblers. The nest is in a bush or tuft, or on the ledge of a rock where there is an overhanging canopy either of rock or of vegetation. The male sings when in the wilds, but the song is not a loud one, though rather sweet and agreeable. It is usually delivered as the bird stands perched on the point of a rock, or the top of some elevated stone. Ground insects appear to be their chief food in the breeding season, and such insects are especially abundant in those places which the birds frequent at that season. The nest is formed of moss and lichen, of which the rocky places furnish an abundant supply; these are consolidated with mud, and the whole lined with fine vegetable fibres; the eggs are from four to six, but very rarely the latter number; they resemble those of the blackbird; but the ground colour inclines more to green, and the mottlings are more definite. There is one rather formidable enemy of which the ring-thrush stands in danger on its rocky pastures, and that is the martin, which spends the summer upon nearly the same grounds.

The birds are usually on the low grounds again about the month of September; but they do not remain in Britain all the winter; and on the continent they also retire to the south at that season.

Solitary Thrush (*T. solitaris*). This is also called the blue thrush from its colour. It is a European species; but we are not aware that any specimen of it has hitherto occurred in Britain, even as a straggler. Indeed it has but little tendency to migrate; and its migration, in so far as it does shift its ground with the seasons, is not in latitude. It inhabits the mountainous parts of the south of Europe; and mountain birds seldom have much tendency to migrate, more particularly in countries not in very high latitudes. In such places they have only to move up the hill in summer, and down in the winter; and a few thousand feet of change in this way is equivalent to a considerable range in latitude. The general colour is blue, with grey margins to the feathers; the bill and arch of the eyes yellow; the size rather smaller than that of the common blackbird, but the habits a good deal the same; the bird is shy and wary, and builds its nest in the most difficult parts of

the mountain rocks; the eggs are of a paler tint in the ground than those of most of the thrushes; they are sometimes so obscurely marked as to appear entirely white, and at other times they have obscure dusky mottlings. Its song is remarkably loud and clear, and therefore it is sought after; but it is delicate in confinement, and is rather fastidious in the delivery of its song.

Those which have been enumerated are the principal thrushes of Europe; but there are many other birds which have been called thrushes, among which the dippers, the porters, and in other parts of the world the ant-eaters, have been included. America is, as one might readily infer from its woods, its waters, and its great abundance of insects and other small animals, a very favourable country for thrushes. Our limits will admit of a notice of one or two of the leading ones only.

Mocking Thrush (*T. polyglottus*). This, as its name implies, is a bird of many tongues, and from the readiness with which it acquires and uses them, it is one of the most remarkable of the feathered race. It is found both in North America and in the West Indies, and it is a migrant; but it has less and less of the migratory habit in proportion as it inhabits regions farther to the south. Indeed, it is only in the most northerly part of its range, and during winters of more than usual severity, that it wholly leaves the same locality at any season of the year. The berries of the cedars (junipers) and other evergreens which grow so luxuriantly in the swamps of the southern parts of the American states, together with the berries of many of the bushes, both evergreen and deciduous, which cover the less humid wastes with one continuous brush of underwood for many miles, furnish these birds with an ample supply of food even in the most severe weather, so that covering up by the snow is the only thing which can completely shut up the stores from the bird; and in the close evergreens, on the swamps especially, this can but rarely happen. Accordingly, the song of this bird begins in the southern states as early as February, even in the warmest winters; though it is much later in the northern states, not before April, or even May, in places very far north.

The nesting time, of course, varies as much, though the nest is not begun, even in the south, before the first of April; and in the north, it is four or six months later. A close and solitary bush or thicket is preferred to any portion of the continuous wood, and the bird does not hesitate to build in the close vicinity of human habitations, if the best place for its nest should happen to be there. This nest is constructed with a good deal of care, always of vegetable matters, and those matters vary of course with the localities, as is the case in the nests of all birds which nestle over a wide range of country. The eggs are rarely more than four, and the brood are hatched in two weeks, so that there is time for a second brood over nearly the whole range of latitude in which the bird is to be found; and, as is pretty generally the case with birds which have two broods in close succession, the destruction of the second, if it should occur, is followed by the production of a third. The defence of the nest cannot be stated in any words but those of Wilson: "During the period of incubation, neither cat, dog, animal, or man can approach the nest without being attacked. The cats, in particular, are persecuted whenever they make their appearance, till they are obliged to retreat; but the whole of his vengeance is most particularly directed against that mortal enemy of his eggs and young, the black snake. Whenever the insidious approaches of the reptile are discovered, the male darts upon it with the rapidity of an arrow, dexterously avoiding its bite, and striking it violently and incessantly about the head, where it is very vulnerable. The snake even becomes sensible of its danger, and seeks to escape; but the intrepid defender of his young redoubles his exertions, and, unless his antagonist be of great magnitude, often succeeds in destroying him. All its pretended powers of fascination avail it nothing against the vengeance of this noble bird. As the snake's strength begins to flag, the mocking bird seizes and lifts it up partly from the ground, beating it with his wings; and when the business is completed, he returns to the repository of his young, mounts the summit of the bush, and pours out a torrent of song in token of victory."

This gallant and successful defence of the nest against foes which destroy so very many birds, and birds of apparently far greater powers than the mocking bird, would be a recommendation, though the bird had no other. But the air, the action, and the music of the bird, all tend powerfully to recommend it—"The ease, elegance, and rapidity of his movements, the animation of his eye, and the intelligence he displays in listening and laying up lessons from almost every other species of the feathered creation within his hearing, are really surprising, and mark the peculiarity of his genius. To those qualities we may add that of a voice full, strong, and musical, and capable of almost every modulation, from the clear mellow tones of the wood thrush to the savage scream of the bold eagle. In measure and accent he faithfully follows his originals—in force and sweetness of expression he greatly improves upon them. In his native groves, mounted on the top of a tall bush or half-grown tree, in the dawn of a dewy morning, while the woods are already vocal with a multitude of warblers, his admirable song rises pre-eminent over every competitor. The ear can listen to his music alone, to which that of all the others seems a mere accompaniment. Neither is this strain altogether imitative. His own native notes, which are easily distinguishable by such as are well acquainted with those of our various song birds, are bold and full, and varied seemingly beyond all limits. They consist of short expressions of two, three, or, at the most, five or six syllables, generally interspersed with imitations, and all of them uttered with great emphasis and rapidity, and continued, with undiminished ardour, for half an hour or an hour at a time. His expanded wings and tail glistening with white, and the buoyant gaiety of his action, arresting the eye, as his song irresistibly does the ear, he sweeps round with enthusiastic ecstacy—he mounts and descends as his song swells or dies away—and, as my friend Mr. Bertram expresses it, he bounds aloft with the celerity of an arrow, as if to recover or recal his very soul, expired in the last elevated strain." While thus exerting himself, a bystander destitute of sight would suppose that the whole feathered race had assembled together on a trial of skill, each striving to produce his utmost effect, so perfect are the imitations. He many times deceives the sportsman, and sends him in search of birds which are not

perhaps within reach of him, but whose notes he exactly imitates. Even birds themselves are frequently imposed on by his admirable music, and are decoyed by the fancied calls of their mates, or dive with precipitation, into the depth of thickets, at the scream of what they suppose to be the sparrow-hawk." "In his domesticated state, when he commences his career of song, it is impossible to stand by uninterested. He whistles for the dog; Cæsar starts up, wags his tail, and runs to meet his master. He squeaks out like a hurt chicken, and the hen hurries about, with hanging wings and bristled feathers, clucking to protect its injured brood. The barking of the dog, the mewing of the cat, the creaking of a passing wheelbarrow, follow with great truth and rapidity. He repeats the tune taught him by his master, though of considerable length, fully and faithfully. He runs over the quaverings of the canary, and the clear whistling of the Virginia nightingale, or red bird, with such superior execution and effect, that the mortified songsters feel their own inferiority, and become altogether silent, while he seems to triumph in their defeat by redoubling his exertions."

The bird is not only thus varied, superior, and free in the performance of his music during the day, but, when the proper circumstances stimulate him to the task (or rather the pleasure), he is to the full as ready to pour his song in the ear of night—not that he sings darkly, or "in shadiest covert hid," but he is as vigilant in the night as the day; and the instant that the rising moon begins to make its appearance, the bird breaks forth into song; and he is perhaps the only feathered thing in the woods that specially welcomes the queen of heaven with a song. He does this in domestication as well as in a state of nature; for, if his cage is so placed as that he even sees the rising moon, he begins to sing to it the moment that it makes its appearance. These birds are of course in great request among the keepers of cage-birds; and they can not only be reared from the nest, but they will breed in confinement—only, the breeding of them is attended with a very considerable degree of trouble, though they appear to be much more hardy birds than the finer species of the warblers.

It appears that this interesting thrush, which is not persecuted like some others, is becoming less numerous, and more of a summer visitant in the central states of the American union, in proportion as those states become more thickly peopled and more extensively cultivated. This does not seem to arise from any dislike which the birds have to the neighbourhood of man; for, as has been noticed, they will build in the immediate vicinity of houses. There seems to be some change of the climate, a hotter summer and colder winter probably, and a less productive state of the country on the average of the year. Something of the same kind is found in the inferiority of the crops; and it would not be difficult to find an adequate cause, were that not foreign to our subject.

The mocking thrush is about nine inches and a half long, and thirteen inches in the extent of the wings; but Wilson says that the birds of the second brood are smaller, that is, continue smaller in their maturity than the birds of the first brood. The upper parts are clear light grey immediately after the moult, but change to brownish ash colour; the quill and tail-feathers are black; the first and second rows of the wing-coverts have white tips; in some males the coverts of all the primaries are white, and in others they are brown; the bases of some of the primaries are white as far as the coverts extend; the tail is wedge-shaped at its termination, and has the lateral feathers white, and white tips to all the rest except the two middle ones; the chin is white; the cheeks, sides of the neck, and all the under parts, brownish white; the bill black above and whitish on the under part; the legs and feet black, and stoutly made. The young birds have the under part spotted; but in the old ones the colour, though differing in different individuals, is entire. There is very little external distinction between the male bird and the female when they are mature.

The Cat Bird (*T. lividus*). This is another American species, and an interesting one as well as the mocking bird, though its interest is of a very different character. It is a summer migrant, and moves about the same time as the mocking bird, but it is much more common, and is on the increase on the cultivated grounds, while the numbers of the other are diminishing. They winter, in the greater part of their numbers at least, in the southern parts of the States, and very soon after the dead of the year they are in motion. In Georgia they make their appearance in spring, and are gradually later and later, as the places to which they come are more northerly, till they reach the northern states, about the middle or the end of May. After their arrival they soon begin the labours of the year, the nest being placed in bushes, thickets, and trees, but not very carefully concealed. It is formed externally with coarse vegetable matters, and lined with finer fibres. The eggs are four, or sometimes five, of a greenish blue, without spots; and there are generally two, and sometimes three, hatches in the course of the season.

The cat-bird is nine inches in length; the upper parts are dark slate-black, and the under parts rather a paler shade of the same colour; the vent-feathers and under coverts of the tail are very dark red; the tail-feathers, the crown of the head, and the bill, are deep black.

The reason why this species gets the vernacular name of "cat-bird" is not any resemblance which the bird has to a cat either in its appearance or its habits, but wholly on account of the sound of its cry. "In spring and summer," says Wilson, "on approaching thickets of brambles, the first salutation you receive is from a cat-bird; and a stranger, unacquainted with its note, would instantly conclude that some migrant orphan kitten had got bewildered among the briars, and wanted assistance, so exactly does the call of the bird resemble the cry of that animal. Unsuspicious, and extremely familiar, he seems less apprehensive of man than almost any other of our summer visitants; for, whether in the woods or in the garden, where he frequently builds his nest, he seldom allows you to pass without approaching to pay his respects in his usual way." This bird is very common in most parts of the United States, so much so, that there is hardly a bush or thicket, or close array of small trees in a garden or orchard, which is without its cat-birds. They follow the steps of civilisation, for there are no cat-birds observable in the western settlements; when these are first taken possession of all is wilderness; but when they have been brought to even a mode-

rate state of culture, the birds are sure to make their appearance. They are about the least suspicious of all birds, and will allow very considerable liberties to be taken with their nests without deserting them. Some of the eggs may be taken out, or the nest itself may be shifted to a new situation, and yet, if it is placed so that she can see it, the female will return to her incubation as if nothing had happened; whereas, if the half of this liberty were taken with the nests of most birds, they would desert them. Wilson tried whether they would carry their indifference to circumstances to a greater length than this. He put two half-fledged young of one nest into another nest, in which the female was sitting upon five eggs, to see whether she would sit while the intruders were there; but she ejected them from the nest, and resumed her duty. They were not injured by their fall, and the male bird fed them with great attention.

Notwithstanding the obvious connection that there is between these birds and cultivation—for there is no animal that follows the progress of culture but what is in some way useful to the cultivator, whether he may happen to be aware of its use or not—notwithstanding this, the cat-bird is one of those species which meet with no protection, or even with cold and passive neglect; for it is one which the people of the States eagerly destroy, without being able to give any reason for their proceeding, or indeed knowing anything about the matter. It does not appear that this ignorant persecution has the smallest influence upon the number of the birds; for, in spite of it, they are multiplying in all parts of the country, while many of the races which do not meet with the same annoyance are diminishing in numbers. It is true that the birds are great plunderers of the produce of the gardens, and always ready to take the earliest and the best. This is plain and palpable; and the good which the birds may do, as a set-off against these depredations, is by no means so apparent. It is even so with our conduct towards mankind. He who takes to the amount of more than twenty shillings in a dwelling-house is a thief, and in peril of the merited gallows; but he who has prevented thousands of pounds from going to the comfort of dwelling-houses, by standing, in one of the many ways in which people can so stand between his fellow creatures and the honest earning of their bread, may, if he is rich, be the very best man in a country.

The cat-bird suffers not a little from the snakes, which are so abundant in many parts of America. The nest is in general near the ground, and the snakes steal upon it and devour the contents. If the male bird sees the snake, however, he instantly gives battle; and, though he is not perhaps so ardent and determined a warrior as the mocking bird, he is very often victorious. Considering the rapidity with which poisonous snakes start from their coil, and the certainty with which they strike, it is astonishing how dexterously these birds avoid the blow in their combats. We believe, however, that it is only during the breeding season that the valour of the birds is wound up to this pitch; and the boldness and certainty with which birds of naturally timid disposition and harmless manners beat off, without any formidable arms, animals stronger than themselves, and armed expressly for destruction, shows how much mere energy can triumph over the most formidable mechanical opposition.

Wood Thrush (*T. melodus*). This is another American species, partially migratory like the two former, and nearly at the same seasons, but its appearance and locality are different. Both of the preceding ones would be blackbirds or merles, if we were to make the distinction pointed out by our typical birds; and this one would be a thrush, as it has the under part mottled like our song thrush. This is the song thrush of the American forests, and it is really much more of a forest bird than those which resemble the blackbirds; for they are rather bush birds or brake birds.

This species is smaller than our thrushes, though some of the American ones are still smaller. The length is eight inches, and the stretch of the wings thirteen. The bill is an inch long, bent and notched at the tip of the upper mandible, and brown save the base of the lower mandible, and that is flesh-coloured. The legs, which are long, are also flesh-coloured, but a shade lighter. All the upper parts are tawny brown, passing into reddish brown on the top of the head, and into olive ash colour on the rump and tail; the chin, throat, and breast white, the last with a tinge of buff colour, and finely mottled with dusky black, running in chains of spots from the gape, which chains intersect each other on the breast and belly. The lower belly and the vent feathers are pure white; the eyes large, clear, and black, and surrounded by a white circle, and an iris of chocolate red round the black pupil; the gape yellow. The male and female birds are very like each other in appearance.

These birds range very extensively along the continent of North America, being found all the way from the Floridas to Canada, and even to Hudson's Bay. In the extreme north they are wholly migratory, and in the south they are stationary, and the characters are of course mixed in the middle latitudes. These thrushes are shy and retiring birds, not often quitting the woods, and are only solitary or in pairs. The male bird is a pleasant songster, and continues to sing in those gloomy states of the weather when most other birds are mute. The song is begun early in the morning, ceases in the heat of the day, and is resumed again in the evening. The song is often delivered from an elevated perch, the summit of the tallest tree in the grove, and two of the birds so perched will often sing with strenuous rivalry against each other.

The nest, as in most of the thrushes, is usually situated near the ground, in a low and sheltered situation, by the bank of a small stream where the herbage is luxuriant; and the nest is concealed in a thick bush. Withered leaves form the first or basal layer of the nest, and above these there is a frame-work of small twigs and stems, well plastered with mud, and last of all a lining of fine vegetable fibres. The eggs are four in number, or more rarely five, of a pale bluish colour without any mottlings. Berries in the season when they are abundant, and larvæ and beetles in the summer, appear to be the principal food of these birds.

The Robin (*T. migratorius*). The epithet which has been given as the specific name of this bird shows how unwise it is to name any bird after a particular habit; for it is one of the least migratory of all the thrushes of America, at least in so far as migration in latitude is concerned. Its migration is towards the coast in the winter, and back into the interior in the summer, and even this applies but to a very small

portion of the length of the United States; for, except in the south, numbers of the birds remain in the coast country to breed. All along the line, however, they collect toward the shores in great numbers when the winter is severe.

The length of the bird is about nine inches and a half; the bill shorter in proportion than that of the wood thrush, and yellow; and the feet dark brown, with very strong black claws. The head, neck behind, and tail, are black; and the intermediate portion of the upper part ash colour; the wings black, margined with ash; the inner tips of the two lateral tail feathers white. There are three small spots of white near the eyes, and the throat, which is black in the ground colour, is streaked with white. The upper part of the breast is black, and the remainder of it, as far as the thighs, bright orange red. The last is the part of the marking from which the bird gets the popular name of the robin. Behind this reddish colour the under part is white, varied with longitudinal streaks of dusky ash colour. The females have all the colours paler, especially the red on the breast. The nest is built in trees and bushes; the external part, as in the others, plastered with mud. The eggs are generally five, and of a fine aquamarine green, without any markings. In summer the birds feed chiefly upon insects and worms, and in winter upon different kinds of berries, especially those of the poke (*phytolacca*), a plant the berries of which have a rich carmine-red juice, and the young shoots are eaten as asparagus; but the whole of the plant has very active medicinal qualities, which, it is said, the berries communicate to the flesh of the birds that feed upon them. Otherwise the flesh of these birds is held in high estimation, and they may be had in very great numbers; for they extend over the whole breadth of North America, as well as the length, and congregate upon the low grounds when the weather is severe.

Rust-coloured Thrush (*T. rufus*). This is the largest of all the American thrushes, being nearly a foot in length; but it is not proportionally so well winged as most of the others, the extent of the wings being only about an inch and a half more than the length. The upper parts are bright reddish brown, with two bars of white, margined with black, on the wings; and the tips and inner webs of the quills dusky. The tail is very long and broad, rounded at the end, and of the same reddish brown as the body. All the under parts are yellowish white, but with the breast and the sides under the wings beautifully marked with longitudinal rows of long and pointed black spots. The bill short, stout, and without any notch in the upper mandible, but the upper mandible projecting over the tip of the lower, and having its base bent with strong and stiff hairs; the general colour black, but the basal part of the lower mandible whitish. The legs very stout, and of a brownish ochre yellow; the irides of the eyes bright yellow. The female has less white on the wings than the male, and the black markings on the breast and sides less elegant and less conspicuous. In other respects there is but little apparent difference. This is popularly called the brown thrush, and also the thrusher, though for what reason the latter name has been given to it does not very clearly appear. The song of this thrush is pleasant, not unlike that of the song thrush of Europe; and the bird is rather a favourite, though probably not upon that ground on which he is most entitled to favour. In the nesting time he consumes a vast number of ground beetles and their larvæ, more especially those which are so destructive to the crops by eating the roots in the ground. In clearing away those noxious creatures he sometimes pulls up the young plants; and therefore, as is the case with the rook when performing a similar service to our fields, he is sometimes accused of injuring the crops. The nests are formed in May, generally in the cover of a thick bush near the ground, composed first of sticks, then of dry leaves, and lastly of vegetable fibres, but without any plastering of mud. The eggs are usually five in number, of a pale bluish colour, and speckled over with small spots of a rusty brown colour. There are in general two broods in the year. These birds are of gentle disposition, and bear confinement tolerably well; but, like the rest of the class, they are seen and heard to the greatest advantage in free nature.

Solitary Thrush (*T. solitarius*). This is a secluded and comparatively a silent species, inhabiting the close vegetation of some of the swamps in the southern parts of the United States, and having little song, being upon the whole one of the most retiring birds of the whole family. It is a small bird, and has been described as the "little thrush" (*T. minor*), though the same name has been given to other species. It is only seven inches in length, and ten in the expanse of the wings. The upper parts are deep olive brown, without any markings; the lower parts dull white; the ear-coverts, the throat, and the upper part of the breast, are dull cream colour, the latter marked with longitudinal spots of blackish brown; the margins of the wings paler than the rest of the upper part, and the tips of the quills dusky; the tail forked, and it and its upper coverts fox colour; the bill black, with the exception of the basal part of the lower mandible, which is whitish: the legs dusky; and the irides black. The nest is usually placed in a tree or bush, against the upper side of a branch, and it is very compactly formed, but without any admixture of mud or plaster. The outside is formed of the dried roots of grass united with smaller and more flexible fibres, or with horse hairs if these are to be had in the locality; and the inside is finished with very fine vegetable fibres. The eggs are four or five, of a pale greenish blue colour, with blotches of olive most numerous and conspicuous near the thick end.

Wilson's Thrush (*T. Wilsonii*). This species was, we believe, first noticed by Wilson, and by him called the tawny thrush, with a caution that it should not be confounded with the tawny thrush of Pennant's "Arctic Zoology," which Wilson says is the species which he has described as the wood thrush. These birds appear to breed in regions farther to the north than the United States, as they appear in the middle states only in the autumn, and again in the spring. The length is about ten inches, and the stretch of the wings a foot. The upper parts are tawny brown, and the under parts white, with a tinge of ash colour where they meet on the sides of the lower part of the breast and under the wings. The upper part of the breast and the throat are dull cream colour, but the chin is white; the breast marked with pointed spots of brown; the shafts of the tail-feathers projecting beyond the webs; the bill black, with the exception of the base of the lower mandible, which is flesh-coloured; the angles of the gape yellow; the

eye large and dark, inclosed in a narrow ring of white; the legs long and slender, and of a pale brown colour.

Such are brief notices of the principal thrushes of Europe and North America. There are other species or varieties in both of these parts of the world; and there are very many in other parts, of which our limits will not allow us to take notice. Viewed as a family, they are indeed one of the most numerous in the whole class; and, though not gaudy, they are in general handsome birds, pleasant singers, and valuable as food.

THUJA (Linnæus). A genus of ornamental evergreen trees, mostly natives of America and the north-eastern parts of Asia. The flowers are monœcious, and the genus belongs to *Crucifera*. The arbor vitæ is a well-known plant, being common in every shrubbery. The hardy species are raised from seeds, and the greenhouse ones from cuttings.

THUNBERGIA (Linnæus). A genus of highly ornamental climbing shrubs, mostly natives of the East. The flowers are didynamous, and belong to *Acanthaceæ*. They are almost ever-flowering plants, produce seeds freely, and if not, are easily propagated by cuttings.

THYMELÆA. A natural order, containing eleven genera, and above one hundred species. They are shrubs or trees, very rarely herbs, with jointless branches, sometimes spiny, and the bark tenacious. The leaves are alternate, simple, entire, and without stipules. The flowers are regular, and for the most part collected into axillary or terminal spikes or bunches, though sometimes solitary. The perianth is single, tubular, coloured, with a cleft limb, and the lobes imbricate on æstivation; stamens definite and peregynous, with two-celled anthers opening lengthwise, laterally or centrally; the germen is free, simple, one-celled and one-seeded. The wood of some of the genera is remarkably soft, and the fibres so tenacious as to be easily separable, appearing like ribbons of fine lace. The fibres of *Lagetta* and *Dirca* are capable of being made into cordage. The genera comprised in this order are the following, viz.:—*Dirca, Lagetta, Daphne, Gnidia, Lachnæa, Passerina, Stellera, Dais, Struthiola, Pimelea,* and *Trophis.*

THYMUS (Linnæus). A genus of undershrubs, some of which are cultivated as pot and medicinal herbs. The genus belongs to *Labiatæ*, and are universally distributed over the northern hemisphere. The powerful scent of thyme, and the essential oil extracted from it, renders it a useful plant, whether wild or cultivated.

THYSANOTUS (Dr. R. Brown). A genus of tuberous-rooted herbs, natives of Australia. The flowers are blue, finely fringed, and hexandrous, and belong to the order *Asphodeleæ*. The species, of which there are four already described, grow freely in a mixture of sandy loam and moor-earth, and are increased by division or by seeds.

THYSANURA (Leach; Thysanoures, Latreille). An order of apterous hexapod insects, belonging to the class *Ametabola* of MacLeay, and distinguished by the more or less cylindric form of the body, provided with only six legs, and destitute of wings, which undergo no other change than an increase of size, and furnished on the under side of the body, at the sides or the extremity, with peculiar organs of motion, consisting, in the family *Lepismidæ*, of a double series of moveable appendages like false legs, terminated by articulated setæ, and in the *Podurida* of an elongated appendage furcate at the extremity, and applied, when at rest, along the under side of the body. These insects are of small size, and very active, the appendages on the under side of the abdomen enabling them to perform long leaps. They are chiefly found in damp situations under stones, moss, &c. They have been much neglected by naturalists; but a valuable memoir is published in the first volume of the Transactions of the Entomological Society of London, upon the Irish species, by R. Templeton, accompanied with beautiful figures. Some of the species, however, appear to us to be established upon insects in the larva state.

These insects are very interesting, not only on account of their position amongst annulose animals (being regarded by Latreille and Leach as true insects, and by MacLeay as belonging to a distinct class, *Ametabola*), but also from the modifications in the structure of the mouth; some of the species possessing a development of the trophi as great as in the most perfectly mandibulated insects; whilst in others the mouth is so obscurely organised, that neither Latreille, Savigny, nor Templeton, have been able to trace its formation. In some species the eyes are merely rudimental ocelli, but in others they are perfectly reticulated. We may also specially notice the beautiful scales with which the body is covered, and the apparent want of spiracles along the sides of the body, and which Latreille, notwithstanding a very minute examination, was unable to discover. M. Guerin has, however, very recently presented to the French Académie des Sciences a memoir, in which he announces the existence of bronchiæ in one of the species of this order. They are placed under the abdominal segments, and by the side of those appendages which are compared to the false legs of the *Crustacea*. They are inclosed in little membranous bags of a similar organisation to those of the respiratory organs of a great number of the inferior *Crustacea*. This discovery of bronchiæ in these insects appears important in various respects, and more especially because it establishes a link between two classes hitherto regarded as certainly separate as regards their mode of respiration.

TICK. The species of insects of which the genus *Ixodes* is composed are thus named. They are of small size, and belong to the class *Arachnida*, and order *Monomerosomata* or *Acari*. The body is swollen and leathery, having on the upper side, in front, a scaly plate. The head is small, and furnished with a powerful rostrum composed of two retroserrated plates, which the insect inserts into the flesh of dogs and other animals upon which it is parasitic, and upon whose blood it subsists. The palpi are articulated, and enclose the sucker. In the West Indies they attack the horse and ass in such quantities, that it is the usual practice to have these animals fetched up from grass once a-week to be "ticked." They especially attach themselves at the base of the ear, and, if neglected, will sometimes become so numerous that the animal loses all power of raising its ears at will. Their powers of reproduction are so great that the animals attacked sometimes sink under their attacks.

The typical species is the *Ixodes ricinus* (*Acarus ricinus*, Linnæus), which is parasitic on the dog. It is serviceable to anoint the infested parts with oil or soft soap. The species of this genus require a more

minute examination than has hitherto been given to them. There is an interesting memoir upon their curious mode of oviposition contained in the last part of the Annales de la Société Entomologique de France.

TIGRIDIA (Jacquin). A genus of bulbs, natives of Mexico, bearing remarkably curious, though fugitive, flowers, belonging to the class *Monadelphia* of Linnæus, and to the natural order *Iridaceæ*. The plants flower well in the open air; and, as soon as the flowering is over, the bulbs must be taken out of the ground, and hung up in a dry warm room all winter, and replanted in spring, when all danger of frost is over.

TILIA (Linnæus). A genus of deciduous timber trees, commonly called the lime or linden-tree. The flowers are polyandrous, and the genus ranges among the order to which it gives a title, viz.:—

TILLIACEÆ. A natural order, containing twelve genera and above seventy-seven species. The order consists of trees, shrubs, and many worthless herbs, none of which are remarkable for the beauty of their flowers, though some are fragrant. The lime is a forest-tree; and *Sparrmannia* and *Entelea*, as greenhouse plants, are amongst the most conspicuous in the order. In general the leaves are simple, alternate, and with deciduous stipules. The inflorescence is axillary or terminal, racemose or paniculate, seldom solitary, and the flowers are regular and united. The calyx is formed of four or five sepals, free or connate, and valvate in æstivation. The petals are equal in number to the sepals, and alternate with them, combined at the base, or free. The stamens are indefinite and distinct, filaments often sterile, anthers two-celled, and opening lengthwise. The germen is formed of from two to ten carpels. The style, when present, either free or united, and with the stigmas equal in number to the carpels. The fruit is dry, or like berries, of several cells, or by abortion one-celled. The bark of most of these plants is tough and strong, easily separable into layers, and from which mats, baskets, and cords are made. Lime-trees grow to a very large size; the timber is light, soft, smooth, close-grained, and not liable to be worm-eaten, and therefore fit for carvers and toymen. The flowers are the resort of bees, and the honey extracted is highly esteemed, and called *Kowno* honey. It is propagated by layers, cuttings, and seeds.

TILLANDSIA (Linnæus). A genus of rigid-leaved herbs, natives of the warmer parts of the tropics. The flowers are hexandrous, and the genus belongs to *Bromeliaceæ*. They are easily grown in the stove, and increase themselves by suckers.

TILLIDÆ (Leach). See CLERIDÆ.

TILLUS (Olivier). A genus of coleopterous insects, belonging to the family *Cleridæ*, having the antennæ terminated by a serrated mass, the last joint of the labial palpi large and securiform, and the third and fourth joints of the tarsi dilated. The species are not numerous, and are found on the trunks of old trees, or in decaying stumps. There are three British species, the type being the *Chrysomela elongata* of Linnæus.

TIN. A mineral known and employed for useful purposes from the remotest ages. Tin was in common use in the time of Moses, and was obtained at a very early period from Spain and Britain by the Phœnicians. The native oxide is the principal ore of tin, and the metal is obtained by heating it to redness with charcoal. It is found in abundance in Cornwall, Spain, and Saxony, as well as in the East Indies and South America. Its primitive crystal is an obtuse octohedron, of which the modifications are extremely numerous. It may be proper to add, that, in some of the valleys of Cornwall, tin is found in rounded nodules, mixed with pebbles and fragments of rock.

TINEIDÆ (Stephens; PHALÆNA TINEA p., Linnæus). A very numerous family of lepidopterous insects, having the wings more or less convoluted when at rest; the palpi generally four in number, the maxillary pair being often exposed and very distinct; the front of the head is clothed with long and erect scales forming a kind of crest; the antennæ often ciliated internally, and never exceeding the body in length; the usual colour of the upper wings being rather sombre, white, ochre or buff being the most prevalent colours, metallic tints being seldom found amongst them; the posterior wings are generally plain. Such are the characters by which Mr. Stephens separates a portion of the Linnæan *Tineæ* from the *Yponomeutidæ*; amongst which latter are placed the Japan moths with long horns (*Adelæ*), and many minute and splendid species ornamented with metallic markings. But the study of the minute *Lepidoptera*, as regards the relations of the different groups, may be said to be yet in its infancy. It is true that the figures of many species have been published, in which the markings of the wings are accurately displayed; but the real structure of the insect in its various details, as the position of the wing-nerves, the antennæ, parts of the mouth, legs, &c.; but, above all, the transformations of the different species, have been so much neglected, that it is impossible to construct at present any thing like a true classification of these tribes; and hence it is that we find in the works of Curtis and Stephens the greatest disagreement, not only as respects the outlines of the families, but even of the genera. In this case, therefore, it would be useless to give a list of the genera. It will be sufficient to mention that the most conspicuous genera placed in the family by Stephens, are *Galleria*, Fabricius; *Ilithyia*, Latreille; *Phycita*, Curtis; (*Phycis*, Fabricius, &c.); *Crambus*, Fabricius; *Ypsolophus*, Fabricius; *Lampronia*, Stephens; *Gracillaria*, Haworth; and *Tinea*. Some of these have been already noticed under their respective names. The typical genus *Tinea*, as restricted by Stephens and Curtis, comprises the species generally known under the name of clothes'-moths, which have the head very woolly, or rather furnished with a crest of elongated erect scales; the wings incumbent in repose and glossy; the maxillary palpi are as long as the maxillæ; the larvæ of these insects are very destructive to woollen cloths, feathers, furs, &c., which they feed upon, making cases of these materials in which they reside. Amongst the species of this genus (which comprises fifteen British species), the *Tinea tapetzella*, *vestianella*, *pellionella*, and *destructor*, are the most obnoxious. The proceedings of these larvæ in the construction of their tube-like abodes have been detailed by Reaumur and others, and which are made closely to fit the body of the caterpillar, and are enlarged from time to time according to its growth. This is effected by adding to its length bits of materials upon which it feeds, so that by causing it to feed upon stuffs of different colours, its case assumes the appearance of a Scotch plaid, as well as

by also widening it by partially slitting the case on the two opposite sides, and then adroitly introducing between them two pieces of the requisite size. The following practical observations are from the valuable work of Mr. Curtis: "Wherever these insects take possession, the only chance is to discard every thing composed of wool or hair if possible; and those things that are indispensable should be constantly used, or continually brushed and exposed to the light and air. All mattresses, paillasses, and sofa-cushions should be knotted with leather, not wool; and carpets ought to be cut out where book-cases and heavy furniture stand, so that the edges may be frequently turned up to be well brushed where there is no traffic. Moreen curtains and bed-hangings are very soon attacked if the room be shut up and darkened, and may be greatly injured in a few weeks. Light, the clothes-brush, and the cane are, I believe, the easiest and best remedies against the moth. It is astonishing how soon a house may be infested, for a few old birds'-nests, and even the cocoons of moths in the garden, will enable them to feed and propagate; when a female moth finding her way into the house, a colony is soon established, that it is very difficult to extirpate. I have been compelled to forego having carpets in my chambers from the devastations these little animals made; they were revelling in multitudes under my feet in the day, and flying about my candles by night; and I lately found that myriads had established themselves under the sofa-covers, where they luxuriated on the worsted knots that held the cushions together; they even attacked the small portion of feather on my pens, and my painting-brushes were frequently eaten up by them. This, however, I soon remedied by dipping them into spirits of turpentine, which is certain death to all insects. Cushions, &c. that are infested, may be cured by moderate baking. I have observed when any clothes have been attacked, that the moths invariably prefer the black suits; and so rapid are their operations, that I have found a caterpillar half grown on removing a coat which I had worn a fortnight before."

Mr. Waterton, whose observations as a practical naturalist are allowed on all hands, strongly advocates the constant use of corrosive sublimate dissolved in alcohol, as a perfect preservative against the attacks of insects when applied to the skins of birds, quadrupeds, wood, clothes, hats, the lining of carriages, furs, and ornamental feathers.

TINGIS (Fabricius). A genus of hemipterous insects, belonging to the family *Cimicidæ*, and distinguished from the restricted genus *Cimex* by having the antennæ terminated by an enlarged joint, the third joint being longer than the rest; the legs are simple, and the wings and wing-cases of ordinary size; the latter are, however, often homogeneous, and not divided into corium and membrane, as in the majority of the Linnæan *Cimices*. The species are numerous. They reside upon plants, puncturing the leaves of the flowers, and causing them to produce a kind of gall.

TIPULIDÆ (Leach; Tipulariæ, Latreille). A very extensive family of dipterous insects, belonging to the section *Nemocera*, having the sucker or proboscis short, and terminated by two large fleshy lips or beak-shaped, but perpendicular or bent beneath the breast. It contains only a pair of lancets, being in this respect very deficient in comparison with the allied family *Culicidæ*. The palpi are either turned back, or are occasionally bent forwards; but in the latter case these organs are short, and only one or two-jointed.

This family corresponds with the genus *Tipula* of Linnæus, and, since the time of that author, has so much increased in extent, that it has become necessary to introduce a great number of sub-divisions and genera, exhibiting great diversity of structure, although referable to a single type, which is chiefly characterised by the formation of the proboscis, which, with a very few exceptions, is an instrument incapable of inflicting that severe pain which follows the bite of the common gnat, which is the type of the adjacent family *Culicidæ;* and fitted only to suck up fluids from the surface of bodies, without the power of piercing the slenderest pellicle; a peculiarity of organisation dependent upon the slight avidity for food manifested by the *Tipulidæ* when arrived at the perfect state.

The diversity of form exhibited by so numerous a tribe of insects is especially observed to prevail in the antennæ, the disposition of the nerves of the wings, the form of the head, palpi, eyes, ocelli, and abdomen, as well as in the length of the legs. The tribes which are consequently established upon these modifications are conformed to the different modes of life of the larvæ, and the names which have been given to them, indicate these differences. There is generally a strong analogy between the characters of the perfect insect and its mode of life in the larva state. For example, the plumose antennæ are found in those *Tipulidæ*, of which the larvæ are aquatic (see Chironomus), whilst elongated trochanters are found in those species which, whilst larvæ, were residents in fungi.

This family is divisible into the following divisions or sub-families:—

1. *Chironomides* (*Tipules culiciformes*, Latreille). Male antennæ plumose, larvæ aquatic.
2. *Tipulides* (*Tipules terricoles*, Latreille). Antennæ not feathered; head produced into a muzzle; ocelli none; larvæ terrestrial.
3. *Mycetophilides* (*Tipules fongicoles*, Latreille). Head not produced into a muzzle; ocelli two or three; trochanters elongated; tibiæ strongly spurred; larvæ fungivorous.
4. *Cecidomyides* (*Tipules gallicoles*, Latreille). Head not produced into a muzzle; ocelli none; trochanters of ordinary length; antennæ moniliform; larvæ gallivorous.
5. *Bibionides* (*Tipules florales*, Latreille). Antennæ short, perfoliated, generally with fewer than twelve joints; legs of ordinary length; larvæ often residing in rotten dung and other vegetable debris.

The chief genera comprised in the sub-family *Tipulides* are: *Ctenophora*, *Pedicia*, *Tipula*, *Niphrotoma*, *Rhipidia*, *Lasioptera*, *Limnobia*, and *Trichocera*. The typical genus *Tipula* is distinguished by having the antennæ thirteen jointed, nearly setaceous and simple, with the joints cylindrical; the legs are long, and the muzzle is moderately long and narrow. The species of this genus are numerous, and are well known under the names of crane-flies, Harry long-legs, &c. Many of them are very common, especially in moist meadows, where they may be seen rising in swarms at every step, their legs serving them as stilts amongst the long grass. The females deposit their eggs in the earth, introducing them to a short depth by the assistance of the horny and sharpened ovipositor at the extremity of the body. The caterpillars are fleshy

footless grubs, which, as soon as born, attack the roots of grass or other plants in the situation where they are produced, and in a short time the plant droops and withers for lack of nourishment. When, as is occasionally the case, these larvæ are numerous, it may be well conceived that they are capable of doing much mischief.

Reaumur is indeed of opinion that the only food of the larvæ is the rich black mould in which they are found; but from the details given by other writers, it is evident that they feed upon the roots of plants, corns, and grass; and Kirby and Spence state that on turning up a square foot of dead turf two hundred and ten grubs were found beneath it.

There are nearly fifty British species of this genus. The most obnoxious being *Tipula oleracea* and *T. cornicina*, the first of which may be considered as the type of the genus. It is extremely abundant.

TIT, or Titmouse (*Parus*). A genus, or perhaps more correctly a little group, of conirostral birds, of the great passerine order in Cuvier's system. The characters of the genus are:—the bill slender, short, conical, straight, of great strength and power for its size, covered with a few short hairs at the base, and with the nostrils nearly hidden under the feathers; the feet very stout, with three toes to the front and one to the rear, the latter with the claw peculiarly strong and crooked, and all the toes quite free to their bases; the first quill of the wing is of mean length, or so very short as to be little else than rudimental, the second considerably shorter than the third, which is the largest in the wing. These are little birds, but they are birds of the most energetic disposition, and the most active habits; they are brisk, courageous, crafty, hardy, very pugnacious, and even ferocious; but these qualities are compensated by the smartness of their appearance, and the services they render to cultivators, more especially the cultivators of fruit trees. Notwithstanding their pugnacious dispositions, they are in so far social birds that they are generally seen in small parties. They are capable of enduring all climates, and of braving every state of the weather; and their muscular power, both in the way of action and of endurance, is greater than that of any other little birds, being well adapted to their bold and daring spirit.

We might naturally conclude that all this energy and power are not given them without an adequate purpose; and accordingly the office which they specially perform in nature, is one where the greatest energy and strength, combined with lightness of body, are required. Their chief office is to find and pick out from their hiding places in the bark, and especially the buds of trees, those insects and larvæ which no other birds can discover, or at all events capture. The lightness of their bodies, the rapidity of their motions, the astonishingly firm clutch which they can take with their feet, their keen and almost microscopic vision, and the readiness, smallness, and firmness of their bills, fit them admirably for the office. To see one of them reconnoitring a tree is quite a treat; it gets from bud to bud, one hardly knows how, for though we must suppose, from the analogy, that it can be done only on the wing, yet it is so momentary in the whole performance that the wings are not seen to move. The bird is clinging to one twig this instant, and in another instant it is clinging to another, but how the transition is made there is no time for observing; thus, the way in which it may come to the branch is a matter of no consequence, in so far as the sure footing of the bird is concerned. Upwards, downwards, latterly, outwards, or inwards, all are the same to the tit, for it never misses its clutch, and the position in which it may hang to the twig, or whether it hangs by one foot or by both, seems to be a matter of perfect indifference. Wherever the feet touches it is sure to gain a firm hold, and the instant that the foot is detached the wings are ready to receive the bird, whether the detaching be the result of intention or of accident. Thus they are enabled to clear of their insect destroyers those tips of the slender sprays which no other birds can command, and where yet the depredations of the insect are the most destructive; as perpetrated there, they stop the leading shoots, and destroy the symmetry of the tree. The services which these birds render in this way are very great, but they are performed with so much celerity that they do not appear in their full amount to our comparatively close and dull observation. Our incapacity of fully observing and appreciating them does not, however, in the least detract from the real value of the birds.

In their resources in the way of provisions, these birds are as remarkable as in the rest of their economy; though, when these are to be had, they prefer insects and their larvæ to every other kind of food, yet when the annual supply of these is over—and it is sooner over with them, as their business is chiefly with buds, and ceases when the shoots have acquired a certain degree of length—they have recourse to the farinaceous and oily seeds of vegetables, and they do not scruple to eat carrion if it comes in their way. They also stand accused of visiting the nests of other birds in the absence of the parents, and punching open the heads of the young and eating the contents. They are said to do the same to any sickly bird that may come in their way; but perhaps their doings in this respect may be a good deal exaggerated.

In the construction of their own nests they display a great deal of labour, and often not a little of ingenuity. The different species, and especially some of the sections into which the genus has been parted, differ much in this respect. Some build about the most elaborate structures that are to be met with among birds, an instance of which will be found described at length by referring to the article Bottle-tit, in the first volume of this work. Others form pendent nests at the end of the slender twigs which hang over streams and ponds; and many build in the holes of old trees; but wherever the nest is placed, it is always concealed or secured with great care, and rendered peculiarly warm and comfortable for the young; and all of them have more numerous broods than almost any other birds of the order. Thus we find that their powers of reproduction, as well as those of endurance, are suited to the very laborious office which they have to perform in the economy of nature.

Cuvier divides them into three sections or subgenera:—first, the *pari*, or tits properly so called; secondly, those which have been called bearded-tits, from the mustachios which are at the angle of the gape; and thirdly, those which have been called pendulous tits, from the fact of their suspending their nests from the ends of twigs. Some further divisions have been made by others, but they are of too minute a character for popular notice. See the

articles Bearded-reed Bird, Blue-tit, and Bottle-tit.

The tits properly so called have the characters which have been mentioned as denoting the genus,

Great Tit (*P. major*). This is a small bird, though a great one among tits. The general colour of the upper part is olive green, and that of the under part yellowish. The top of the head is black, marked off by bands of white along the temples, and the upper neck is yellowish. It is about five inches and three quarters in length, and eight inches and a third in the expanse of the wings. It is a very common bird in most parts of the eastern continent, migrant in the extreme north, and moving from the woods to the neighbourhood of houses in winter in the middle latitudes; but in most places it is a stationary bird, or, at all events, one which does not move far in latitude, though it may occupy different kinds of surfaces at different seasons of the year. They are most active birds, clearing the trees of insects with great dexterity. They are also bee-eaters, and rather injurious in situations where hives are numerous. They eat nuts, beech-mast, and other oily fruits, and they hold a nut very neatly in their claws, while with the bill they punch a hole in the shell, and very speedily extract the kernel. The nest is constructed of moss externally, and lined with down, feathers, or other soft matters; and the birds always prefer a hole of a tree, a wall, or some other substantial cover and concealment. The eggs vary in number; sometimes they are not more than six, but they are more frequently as many as ten or twelve. The young are produced in a very immature state, and quite blind, in which condition they remain for a few days; but they grow rapidly, and in about two weeks after coming out of the shell they are able to take to the wing. The young keep in company with each other during the remainder of the year in which they are produced; and they arrive at their full size when about six months old. They have nothing that can be called a song. In the pairing time their chirp is not unpleasant; but at other seasons it is rough and grating, something like the crushing of a cinder under the foot. This bird, not having any musical powers, need not be confined in a cage as a songster, and its pugnacious disposition makes it a very unsafe companion for song birds; but, if in a cage by itself, it may be taught some amusing tricks.

Cole-tit (*P. ater*). This is a much smaller bird han the former, being not much more than a quarter of an ounce in weight, while the great tit weighs about an ounce and a quarter. This one has the head black, the hind head white, and the rest of the upper part ash colour; the white extends some distance down the breast, and passes into yellowish white on the rest of the under part. The nest is always placed in concealment, and carefully made. A hollow of a tree, and the thickly matted herbage at the base of a young pine, or even close furze or broom, affords it not an unappropriate locality. The eggs vary from six to ten or twelve, but rarely the latter number. They are of a pure white colour, delicately spotted with rusted red. It is more of a forest bird than the great tit, and seldom comes to the vicinity of houses unless in very severe weather. Its usual food is insects and their larvæ; and in the winter season it hunts the crevices of the bark and the hybernacula of buds, for any insects, larvæ, or pupæ, that may be lurking there. Small as it is, it is very hardy and very generally distributed, being met with in the whole range of the eastern continent, from Lapland to the Cape of Good Hope. It is not, however, so generally seen, as the great tit or the blue; but that is as much owing to the peculiarity of its haunts as to the absolute inferiority of its numbers. It is a very wary little creature, and as it runs on the bark of trees with nearly the same celerity as the creepers, and runs in any direction, the sight which can be had of it is very momentary. With the exception of the long-tailed one (see Bottle-tit), it is the smallest of all the British species.

The Marsh Tit (*P. palustris*) is also a small species, though nearly one half heavier than the cole-tit. Its colours are similar; that is to say, the head is black, and the general tint of the rest of the upper plumage greyish. The back wants the greenish tinge which it has in the preceding species, and the head is not so black. The whole plumage is also less glossy. Though called the marsh tit, this cannot be considered as a marsh bird in the proper sense of the word, as it is not found in the fens, or actually feeding or living over the water in any situation. But it is fond of humid places which have a tangled vegetation of brakes and osier beds, and the stumps of old willows, alders, and other trees that like marshy places, but not absolutely the marshes themselves. It is a hidling bird, and not very often seen in proportion to its actual numbers. The nest is usually in the hollow of the stump of an old tree; and on this account osier plantations and oak copses which are cut for bark, and both of which are usually near the banks of streams, are favourable nesting places for this tit; but if these are not to be had, it seeks the cover of a brake or bush, or the thick underwood at the root of a tree. The nest is formed of moss, lined with softer matters, such as the down of the willow. The eggs are about the same in number as those of the cole-tit, and not very different from them in appearance, only they are a little larger in size, and rather more speckled about the thick ends. In summer the marsh tits consume great numbers of flies, bees, wasps, moths, and all the winged insects which are found in their localities. In winter that supply fails, and they are obliged to shift their ground. They do not frequent the trunks and branches of high trees so much as the other tits; but rather eat the ends of the larger *Compositæ*, many of which are sweet, and contain a great quantity of nutritious matter in a very small compass. In extreme cases they approach houses and farmyards, and readily eat any garbage that comes in their way. They are not so gay in their plumage, nor so active in their conduct, as the great tits, and especially not as the blue ones, but still they are lively birds.

The Crested Tit (*P. cristatus*) is a woodland species, most abundant in the cold latitudes and in upland places; it prefers the pine forests, and especially the junipers, and other close evergreens of more lowly growth, to the tall pines and spruces. It is exceedingly rare as a British bird, if it be any thing more than an accidental straggler. The upper parts are reddish-brown ash; the cheeks and sides of the neck are whitish; and the feathers on the top of the head stand up and form a sort of crest of a pyramidal shape, of which the individual feathers are black with white borders, which gives it altogether a hoary appearance. There is also a streak of black along the temple, and a black collar on the neck. The under

parts are reddish white, and the bill and feet lead colour. The length of this bird is about four inches and a half. It rarely quits its habitation among the close evergreens, even in the severest weather; for such places afford shelter at all times, and very generally food. The nests are in holes of trees, or other concealments, and not unfrequently in the deserted nests of other birds which build earlier in the season; but those they line and trim up, so as to give them that compactness and warmth which are characteristic of the nests of this family. Their eggs are ten or twelve in number, of a white colour, with small spots of dull red.

There are very many other species in all the three great divisions of the eastern continent, in Australia, in New Zealand, and in America; but they are not found in the very warmest and richer parts, as in central America and the Oriental Isles.

The "bearded reed-bird," already referred to, will serve as a specimen of Cuvier's *Moustache*, and indeed it is the only one that can be given, being the unique species of the division as far as is hitherto known. It reflects much credit upon the acumen of the great naturalist of France, that he should have separated this bird from the tits upon the ground of its organisation alone, and that this should be completely borne out by the habits of the bird, now that these have been ascertained with tolerable accuracy. His division *Ramiz* contains two species of which the nests are peculiar; one of them, a native of the south of Europe, and the other of the south of Africa; and it might not perhaps be amiss to give them the old specific name of the first of these, *Pendulinus*, as a generic one.

Pendulinus Narbonensis. This bird, to which some have given the very inappropriate name of the "mountain titmouse," is a marsh bird, frequenting the marshy banks of streams and pools, generally in lonely and desolate places where its haunts are not liable to be visited. It skulks about in a very wary manner, and is not often seen, and very seldom caught. It is met with in the south of France, in Italy, in the valley of the Danube, in the marshy parts of the south of Russia, and in Siberia. The upper parts are reddish grey; the nape and top of the head ash; the forehead and head as far as the eyes, and also the ear-coverts, black; the rump ash colour; the quills and tail-feathers blackish, margined with whitish red, and tipped with white; the throat white; and the rest of the under part white, with a rosy tinge. The bill is black, straight, rather long, and very finely pointed; for which we shall see that the bird has use, besides the capture of its food.

We mentioned that these birds inhabit marshy places, and they always have their nest at the end of a flexible twig pendulous over the water, by which means it is perfectly secure from reptiles. The chief material which they use is vegetable down, obtained from the willow, the poplar, from dandelion, thistles, and a variety of other plants which grow near the streams; this they weave into a frame or basket work of long, tough, and slender fibres, till it has the appearance and consistency of a piece of felt. It is closed above and firmly fastened to the twig by strong but flexible fibres, and they line the inside with a coating of the finest and softest down, so that the nest is as warm and comfortable as if it were lined with fur. The shape varies in different nests, and of course sometimes one kind of down predominates, and sometimes another; but the fabric is always the same. The lateral opening by which the birds enter is toward the water; and it often has a ledge or rim upon which they can alight, and feed the young after they break the shell, without actually entering the nest. The eggs are usually about six in number, of a white colour, with obscure spots of red. The birds are as attentive to the feeding of their young as they are to the construction of their pendent cradles; and there are indeed very few birds which have more labour in preparing for and rearing their progeny, and none that perform the work in a more elegant manner. We admire the nest of the heath-tit, and it is really a very pretty structure; but it is a fixed nest, and that of these birds is wholly at the mercy of the winds, and the flexible twig to which it is suspended contributes not a little to the safety of the fabric, and the comfort of the young birds while they are in it. The birds themselves are, as we have said, but seldom seen; but the nests are met with in considerable numbers, and command the admiration of the rustics. It is probable that the nests last for several years, with very little repair; and instances have been found of other birds hatching in them at a very late period of the year. The people of some of the wild parts, who are not a little prone to superstition, have a very strong impression of the protective virtues of these nests, for they hang them up over the doors of the cottages, quite sure in their own minds that, while the nest is there, the dwelling and its inmates are quite safe from the stroke of the lightning. Some have given it as their opinion that the first nest which a pair of these birds build is but a flimsy fabric, though even then it stands the weather; but that in succeeding years they give it an additional layer of materials on the outside, firmly incorporated with the former. This, however, wants confirmation.

P. Capensis. This, as the name indicates, is a native of Southern Africa. It is about five inches in length. The upper part greyish ash; the quills black with whitish margins; and the tail black on the upper surface, and white on the under. The under parts are bright ash colour, and the bill and feet black. Although the country which this bird inhabits differs a good deal from that inhabited by the preceding species, the mode of constructing the nest is very nearly the same; and indeed it is, in some respects, a more curious nest than the other. The principal material used for the fabric is the down of plants, as well as in the other; and the down of some of the *Stapelidæ*, which are so abundant in Southern Africa, is that which presents itself most readily. The principal nest is for the female and the eggs, but there is a separate and smaller apartment, which is entered by a tubular porch; and this serves as a lodging for the male, while the female is occupied in the duty of nidification. Both birds assist in constructing the nest, and both share in the protection it affords.

TODY (*Todus*). A genus, or rather small group, of syndactylic birds, which have sometimes been confounded with the fly-catchers and fly-hunters, from both of which, however, they are quite distinct. The birds which they most nearly resemble are the kingfishers; and, though the habits are not the same, they may be said to hold among American birds (to the tropical parts of which continent they are confined), the same place that the kingfishers hold in the ornithology of the eastern continent.

They have the bill large, depressed, obtuse at the

tip; the tarsi rather long; three toes to the front and one to the rear, the inner front toe united to the middle one as far as the second articulation, and the external as far as the third; the wings short and rounded. They nestle on the ground near the water, and have the nest under a projecting bank, so formed that it is protected from the rain. It is composed of a few straws and stalks, lined with downy matters. The eggs are four or five in number, of a grey colour, spotted with brown. The female bird sits with great constancy, and the male is assiduous in supplying her wants, and in feeding the young when they appear. In the pairing time the male has an agreeable little song, and the female often repeats a sort of call-note; but at other times they are remarkable for their taciturnity. They are very pretty little birds, feeding upon insects, and perfectly inoffensive in their manners. Though their wings are short, their flight is rapid and straight forward. They are perched sometimes in trees and bushes, and sometimes on stones and elevated points of the earth; but their colour is so like that of the bright green trees, that they are seen only in the latter situations. There is only one determined species—

Green Tody (*T. viridis*). The upper parts are altogether of a most brilliant green colour; the forehead is yellowish-green; the quills and tail-feathers brown, with green borders; the throat and fore-neck are of a bright red, with a gloss of bright orange, and the extremity of each feather fringed with white; there are white feathers at the angles of the gape, which extend toward the ear-coverts, where they rise into a tuft of pure aquamarine blue. The under part of the body is whitish, passing into bright rose-colour on the flanks; and the under coverts of the tail are greenish-yellow; the bill is yellowish-grey, with the tip black; and the feet are reddish. The total length of the bird is three inches and a half.

TOFIELDIA (Hudson). A genus of herbaceous perennials, natives of the northern parts of Europe and America. The flowers are hexandrous, and the plants are ranked among the *Melanthaceæ*. The species should be planted in moist peat-earth, and are increased by division.

TOMICUS (Latreille). A genus of coleopterous insects, belonging to the section *Tetramera*, subsection *Xylophaga*, and family *Scolytidæ*, comprising the destructive little insects known under the name of *Typographer*, or printer beetles. See the article Bostrichidæ.

TOPAZ. A mineral which derives its name from Topazos, a small island in the Red Sea. It is principally found of a wine-yellow colour, but is in some instances of a violet-blue. A single specimen of the latter colour, which is very rare, was sold for 1500 ducats at Vienna. The topaz occurs in Europe, Asia, and America. Those found in Brazil, which are so much esteemed in commerce, are dug in the district of Villa-Rica.

TORMENTILLA (Linnæus). A British genus of creeping perennial herbs, commonly called septfoil, belonging to *Rosaceæ*. This genus was formerly in repute for allaying the pain of toothache, but is now neglected.

TORTOISE. See Chelonia.

TORTRICIDÆ (Stephens; Phalæna Tortrix, Linnæus). A family of small lepidopterous insects, belonging to the section *Nocturna*, or moths, distinguished by the peculiar position and outline of the wings when at rest, the anterior pair being broad, and, when closed, forming a triangle dilated on each side anteriorly, and very slightly deflexed, thus somewhat resembling a bell. The palpi are generally only two in number; the head seldom deeply crested; the antennæ short and simple.

The family is exceedingly numerous, not only in species, but also in individuals, many of which "reside in the larva state within a leaf twisted or convoluted, by the larva itself, though some few reside within the pulpy substance of fruits, or even the medulla of plants. The caterpillar is usually naked, slender, with sixteen legs, and is very active, running with great rapidity either backwards or forwards." (Stephens' Brit. Ent. Trans. iv., p. 63). These little moths are seldom ornamented with metallic or brilliant colours, but they are, nevertheless, prettily varied with tints of grey, brown, buff, &c. Many of the species seem to be more especially attached to forest trees, the oak, birch, elm, &c., being occasionally very much infested with them. This is particularly the case with the oak, which in some summers is completely denuded of its leaves, over a great extent of ground, by the *Tortrix viridana*, a pretty little species, generally about three-fourths of an inch in expanse, having the anterior wings of a fine pale green colour, the anterior margin being whitish, and the posterior wings brownish. The female lays her eggs upon the leaves of the oak, which the caterpillar ingeniously curls up, fastening the curls of the leaf with silken threads, and thus constructing not only an abode in which it resides, and which fits the size of its body, but also securing a magazine of food, in the midst of which it takes its station, and in which, after having attained its full size, it becomes a pupa. When ready to escape, it protrudes the head part of the chrysalis out of one end of the whorl of the leaf, and then makes its escape. So numerous is it at certain times, that, by beating an oak brush, whole showers of the moths are shook into the air.

Two other species, being the largest of the family, also feed upon the oak. These are the *Tortrix prasinana* of Linnæus, and the *T. quercana*, constituting the genus *Hylophila*, Hubner (*Halias Treitschke*, Curtis); the latter of which varies in the expanse of the wings from an inch and two thirds to two inches. These are also of a green colour, with narrow oblique white bars on the upper wings. The caterpillars are not inclosed in a roll of leaves, and are naked, subcylindrical, and fleshy. They construct a very curious boat-shaped cocoon on the undersides of the oak leaves.

The species of the genus *Carpocapsa* comprises various species, which, in the larva state, feed upon the fleshy pulp of different fruits, *Carpocapsa pomonella* being the insect of which the grub is so often found in the inside of apples and pears, of which it causes the destruction, by depriving the stalk of its support. Several species of the genus *Orthotænia* (*Tortrix turionella*, Linnæus, *T. resinella*, Linnæus) reside in the larva state in the interior of the cones of firs of various kinds, which they greatly injure.

The family comprises more than three hundred British species, divided into a great number of genera, established upon minute structural differences, which it would require far too great space to detail, or even to give the list of the genera, which are by no means fully established at present, the observations made under the article Tineidæ being equally applicable to the Tortricidæ.

TOUCAN (*Ramphastros*). A genus of zygodactylic or climbing birds, having the following characters: the bill cellular, very large, and much longer than the head, broader than the forehead, and higher than the profile of the head, nearly straight in the greater part of its length, but a little curved toward the tip of the upper mandible, with a very conspicuous ridge on the culmen, and the tomia, or cutting edges of the mandibles, in general toothed. In the living bird the bill is generally beautifully coloured with brilliant prismatic reflections; but the colours fade, and the reflections go off entirely after the bird is dead. The nostrils near the base of the bill, partly covered by a horny lamina of it, and surrounded by membrane; the feet stout, with four toes, two to the front and two to the rear, the front ones united as far as the first articulation, and the external one longer than the tarsus; the wings of mean length, concave, and rounded, the third and fourth quills being the longest; the tail feathers ten in number.

The bill of the toucan seems so very large that the bird must be burdened by the weight of it; but it is in general very thin, and the parts of it which are thickened for giving it strength are not solid bone, but two very thin laminæ, very finely united by cross partitions, which give the maximum of strength with the minimum of substance, and the cellular openings which they form are filled with air, in the same manner as the cells of the hollow bones of birds; the food is seized with the sides of the bill, and before it can be swallowed the bill must be vented, and the food is kept in its place against the hollow of the upper mandible, by means of the feathered or barbed tongue. The action of the wind upon the bill appears to be that which is the most inconvenient to the birds, as they never fly or perch but with the bill to the wind. They eat fruits and insects, and in the summer they are great destroyers of the eggs of other birds. They nestle in the holes of trees, and keep very closely to the woods in the richest and warmest parts of the American continent, the only part of the world in which they are to be found. There are two sections or sub-genera of them, *Aracaris*, and *Toucans*, properly so called, which do not appear to differ very much in their manners. Some account of the whole, and of the place which they occupy in nature, will be found on reference to the article ARACARI, so that here we shall only have very briefly to notice the leading members of the toucans, properly so called.

The two sections inhabit the same regions, or, at all events, regions which are very similar. The toucans have the bills considerably broader than the head; the aracaris not quite so broad, and the horny covering of the bill is less compact and strong in the toucans than the others. Toucans are, in so far, social birds, for they are in general seen in small troops of about ten or a dozen; they are usually seen upon the wing or on trees, and rarely upon the ground, where their action is rather awkward. They do not walk but leap, and their hopping is ungainly, as their feet are very wide apart; this, however, gives them some advantage when they perch. On the wing their flight is straight forward, and the great bill is elevated so that it is rather above the axis of the body. Though zygodactylic they do not climb, either upon the boles of the trees like the woodpeckers, or upon the twigs like the parrots; they leap from one branch to another, using the wings for support, whether the leap be for a shorter distance or a longer. This difference of action upon the trees shows at once the difference of habit between the toucans and the other tree birds which we have mentioned. The food of the woodpeckers and other bark birds consists of substances which they obtain from the crevices of the bark, in small portions at a time, and that of the parrots of fruits which the birds must range for among the twigs. The characteristic food of the toucans being the eggs and young of birds which build in trees, is found in much larger quantities, and therefore it is sought for by more extended and energetic action than that of the others.

Like the nest-plundering birds of our own country, the toucans have no song, but only a harsh grating cry, bearing some resemblance to that of the raven; they are also very easily tamed if taken young, and far from particular in their food, though they require a good deal of it.

After the aracaris are separated, there is a pretty strong family likeness among all the true toucans, and the specific differences are in reality little more than differences of marking; for in them all the general colour is black, and the other colours, which are often very rich, are on the throat, breast, and rump. The following are the leading species.

WHITE-THROATED TOUCAN (*T. erythrorhynchus*). The upper parts black, the upper tail-coverts greenish yellow, the foreneck and upper part of the breast pure white, the rest of the under parts dead black; the upper mandible of the bill black, with a band of grey surrounding the base; the lower mandible red, with a band of blackish grey, and the feet greenish. This species is abundant in Guiana. The length is seventeen inches; it is, however, to be borne in mind that the tails of the toucans are long, and that the bodies are not quite so heavy as the length compared with that of the majority of other birds would indicate.

YELLOW-THROATED TOUCAN (*R. discolor*). The upper parts black with green reflections; the cheeks and throat greenish yellow; the breast, the upper part of the belly, and the coverts of the tail, bright red; the bill black at the base, grey in the distal parts, and red on the margins, and the feet blackish. This species is about the same length as the preceding, and found abundantly in some parts of Brazil.

TACO TOUCAN (*R. Taco*). Upper parts dead black, with the exception of the wings and tail, which have some lustre in the colour; the upper part of the neck white; a large gorget on the breast, and the under coverts of the tail, crimson; the bill curved in the form of a scythe-blade; the upper mandible yellow and greenish brown, these shades of colour separated diagonally by a black line; the lower mandible entirely of a greenish brown; the feet olive ash; the length twenty inches. This species has been met with in Paraguay.

TINAI TOUCAN (*R. tucanus*). Black on the upper part, with bronze reflections; cheeks, throat, and foreneck orange yellow; coverts of the tail sulphur yellow; the bill very long; the upper mandible green, with three large triangular spots of orange-yellow on the sides, a yellow streak on the culmen, and the tip blue; the lower mandible blue, clouded with green about the middle of its length; the feet bluish ash. The length twenty inches, and the native country Brazil.

There have been various other species mentioned, but they have little difference except in colour; so that when one is mentioned all the rest may be

readily understood, in so far as they have any popular interest.

TOURACO (Plantain-eater, *Musophaga*). A limited group of African birds, of which the place is not very clearly defined. They agree in the form of the wings and tail with some of the gallinaceous birds of the forests of central America; and they have, like them, three toes to the front, with a short membrane between the bases, but the outer toe is in general reversible, so as to make a perching though not a climbing foot, as it is in many of the owls. They are inhabitants of the close and rich woods by the banks of the rivers, and subsist chiefly upon different species of plantains and other succulent fruits. They nestle in holes of trees, and rarely quit the thick woods, or even alight on the ground within them. They can find appropriate nesting places with very little labour in the kinds of forests which they frequent; as there are always many of the trees in a state of natural decay, or internally reduced to powder by the labours of those insects popularly known by the general name of white ants. In their nests in the holes of the decayed trees, the female deposits four white eggs of rather a round shape, upon which she, alternately with the male, performs the incubation with great assiduity. The young birds remain in the company of their parents until the season of incubation again comes round. We shall shortly notice the two genera or sub-genera, the one of which has received the name *Corythaix*, as including the *Touracos* properly so called; and the other that of *Musophaga*, or the plantain-eaters.

Corythaix. These have the front plumed to the base of the bill, and a moveable crest on the top of the head.

Buffon's Touraco (*C. Buffonii*). General colour of the upper part bright green, with the quills and tail-feathers violet-blue; the head with an erectable crest situated on the nape; the lesser coverts of the wings green, the middle ones greenish-blue, and the larger clouded with the same violet-blue as the quills and the rump; a black spot under each eye; the under parts green, but a little paler in the shade than the upper parts; the bill carmine-red; and the feet black. The length of the mature bird is about seventeen inches. This species occurs in many of the more richly-wooded parts of the American continent; it is a very beautiful bird, and, as far as is known, very gentle in its manners.

Green and White-crested Touraco (*C. Persa*). This species has been, oddly enough, called a cuckoo by some of the authorities. The upper parts of it very deep and brilliant green with purple reflections; two white streaks across the region of the eyes, with a streak of purple between them; the naked membrane surrounding the eyes red; the head ornamented with a crest of numerous long and thread-shaped feathers, which are distributed in two rows that meet along the mesial line of the head; these feathers are the same green as the rest of the upper part for the principal part of their length, and white at the tips; the rump is blackish-green; the upper coverts of the tail very deep green; the primary quills are bright chestnut-red; the mandarin red, margined with brown; the tail-feathers deep green on the upper side, and blackish on the under, with the tips black; the lower parts green; the feathers on the thighs streaked with black; the bill whitish; the feet blackish; the length eighteen inches; and the habitat the rich woods of tropical Africa.

Red-crested Touraco (*C. erythrolapha*). Upper parts copper-green, with very bright metallic lustre; the crest on the head forms a sort of helmet, consisting of two close rows of very fine feathers about two or three inches long, which meet together at the top, and there form a red crest, which gradually passes into the deep green, which is the general colour of the upper part of the head; the primary and secondary quills are of a beautiful red, pale on the inner webs; the tertiaries and the coverts of the wings are green, with reflections of blue; the tail-feathers and their coverts are deep and rich bronze-green on the upper side, and a line of green on the under; on each side of the head there is a large patch of white which extends up to the forehead, near which it acquires a reddish tinge; the borders of the eyes are purple-red, with a tinge of blue; the bill is yellow; the feet are ash colour; the length is about seventeen inches; and the habitat Southern Africa.

These are the leading crested species, with the forehead feathered down to the base of the bill; and from the short notice which we have given, it will be readily understood that they are very rich ornaments in the luxuriant forests of which they are natives, from their beauty, their size, and their gentle and inoffensive manners.

Musophaga. These are understood to feed more exclusively on the banana and other sweet and succulent fruits, than the members of the preceding division. Like them, their place in the system has been misunderstood by some. They may be considered as the birds which, in their general characters, approach nearest to the *Alectoridæ* among the gallinaceous birds. See Alector and Gallinidæ. They have the upper mandible advanced on the head in a horny plate, which partially recurves over the front.

Gigantic Plantain-eater (*M. gigantea*). The upper parts bright shining blue; the head advanced with a black crest showing brilliant reflections of blue; the quills blue with black tips; the tail-feathers black, with a transverse band of russet; a gorget of bright green upon the throat; the under parts bright brown with clouds and glosses of red; the bill yellow-orange; and the feet black; the length five-and-twenty inches; so that in its own section, and generally among birds of such brilliant plumage, this splendid species merits the name of *gigantea*. It is a native of the equatorial parts, and the south of Africa.

Varied Plantain-eater (*M. variegata*). The upper parts greyish-ash, with an elongated spot of a blackish colour along the centre of each feather; a crest of elongated thread-shaped feathers on the top of the head, which, with the cheeks, throat, and upper part of the neck, are maroon-brown: the quills are black, variegated with white; the tail-feathers slate-grey with black tips; the under parts are white with a narrow blackish stripe along the middle of each feather; the bill and feet black; the length eighteen inches; and the native habitat the tropical part of Western Africa.

Violet Plantain-eater (*M. violacea*). Upper parts purple, with violet reflections; a large streak of white behind the eye; the quills crimson-red; the tail-feathers unequal in length, the central ones being the longest; the under part purple, marked with cloudings of ash-colour; the bill yellow, with the base of the mandibles covered by a naked skin, studded with red tubercles and extending to the eyes; the feet of a

brown colour; the length a foot and a half; and the native habitat Southern Africa. This is the species which approaches most nearly in its characters to the *Gallinidæ*.

TOURMALIN. A mineral that has the singular property of displaying distinct electrical phenomena by a mere change of temperature. This mineral was known to the ancients, who called it *Lyncurium*. Both *Tourmalin* and *Schorl*, with which it is associated, occur in prismatic crystals of a dark colour. This mineral generally occurs resting in beds, or single strata, and is found in every quarter of the globe.

TOURNEFORTIA (Linnæus). A genus of evergreen shrubs, natives of the East and West Indies. The flowers are pentandrous, and belong to *Borragineæ*. In the greenhouse they ripen seeds, by which they are increased.

TRADESCANTIA (Linnæus). A rather numerous genus of herbaceous perennials, many of which are ornamental. In English lists they are called spiderwort, from the irregular shape of the flowers and their appendages. They belong to *Hexandria*, and to the natural order *Commeliaceæ*. Open borders; division.

TRAGIUM (Springell). A genus of annuals, biennials, and perennials, all herbaceous. They stand in the fifth class of Linnæus, and in the natural order *Umbelliferæ*. *T. anisum* is the valued anise, so much cultivated in warm countries as a condiment, and for its medicinal qualities.

TRAGOPOGON (Linnæus). A genus of herbaceous biennials, chiefly natives of Europe, and commonly called goatsbeard. They bear large composite flowers, and their seeds have feathery appendages; hence their name. The *T. porrifolius* is cultivated for its spindle-shaped root as a culinary vegetable, under the name of *salsify*.

TRAPA (Linnæus). Is a genus called in English water-caltrops; found in India and in various parts of Europe. The flowers are tetrandrous, and the genus belongs to *Hydrocharideæ*. *T. natans* is a European plant. Some of the canals at Versailles are covered with it, and the fruit is collected and eaten as chestnuts. They are called jesuits'-nuts at Venice; and in some places they are called *galarin*, and much eaten by the inhabitants. *T. bicornis* are common in China, and form a common ingredient in stews, &c. *T. bispinosa* are esteemed by the Hindoos.

TRECHUS (Clairville). A genus of small coleopterous insects, belonging to the family *Carabidæ*, and sub-family *Harpalides*, from which it is distinguished by having the terminal joint of the palpi acute and conical, but longer than the preceding joint; the body is oval and sub-convex, and the posterior angles of the thorax are rounded. They are generally found at the roots of grass by the sides of ponds or dam-banks. There are about a dozen British species.

TREMANDREÆ. A natural order of plants containing only the genus *Tetrathica*, of which there are seven species. They are all small bushes bearing octandrous flowers, with foliage particularly neat and resembling some of the heaths. They are greenhouse plants, and are easily propagated by cuttings.

TREVIRANA (Willdenow). A single but highly ornamental plant, a native of Jamaica. The scarlet flowers are didynamous, and belong to *Scrophularineæ*. This plant was called *Achimedes coccinea* by Persoon, and *Cyrilla pulchella* by others; it affects sandy loam and heath-mould mixed, in which it grows freely. When the flowering is over, the pots should be kept dry; and against the growing season, according to Sweet, the root should be divided and repotted, to ensure a fine bloom.

TRICHILIA (Linnæus). A genus of West India trees, having decandrous flowers, and belonging to the natural order *Meliaceæ*. In our collections they are treated like other stove plants, and are increased by cuttings of the half-ripened wood.

TRICHIOSOMA (Leach). A genus, or rather sub-genus of *Tenthredinidous* insects, separated by Dr. Leach from the genus *Cimbex* (which see), but not adopted by continental authors. The species are distinguished by their hairy bodies, and by the four hind femora being toothed. There are nine British species. Type *Tenthredo lucorum*, Linnæus.

TRICHIUS (Fabricius). A genus of handsome coleopterous insects, belonging to the family *Cetoniidæ*, and separated from the great Linnæan genus *Scarabæus*. See CETONIIDÆ.

TRICHODIUM (Michaux). A genus of European and American triandrous flowering plants, belonging to *Gramineæ*. Two of them are found in Britain, viz., *T. caninum* and *T. cetaceum*; and the *T. decumbens* is cultivated in America.

TRICHOPTERA (Kirby). An order of insects established for the reception of the Linnæan genus *Phryganea*, and characterised by Mr. Kirby as follows: "Metamorphosis incomplete, mouth emandibulate, prothorax replaced by a collar; wings four, upper pair mostly hairy, lower ample, folded; neuration branching; anus without setæ; eggs extruded in a gelatinous mass." (Introd. to Ent. iv., p. 380). Mr. MacLeay, in the Horæ Entomologicæ, united the *Tenthredinidæ* with this order. By the French authors the *Phryganeæ* are placed at the end of the *Neuroptera* as part of that order.

We have already given, in the article PHRYGANEA, various details relative to the structure, habits, and classification of these insects, which renders it unnecessary to enter more fully into these matters in this place.

TRIDENTEÆ (Haworth). A genus of undershrubs, natives of the Cape of Good Hope, separated from *Stapilia* by the late Mr. Haworth. The flowers belong to *Pentandria*, and to the natural order *Asclepiadeæ*. Like other succulent plants, they require but little water, and should be planted in light porous soil.

TRIENTALIS (Linnæus). A genus of two little herbs, one of which is a native of Britain, and called winter-green. The flowers are heptandrous, and the plants belong to *Primulaceæ*. In the flower garden they are planted in loose soil, and increased by seeds.

TRIFOLIUM (Tournefort). A very extensive genus of herbaceous annuals, biennials, and perennials, commonly called trefoil, or clover. The flowers are diadelphous, and belong to *Leguminosæ*. They are mostly European, and all more or less pasture plants; a few of them are particularly valuable to the farmer, their introduction into agriculture having advanced the profits of that business, perhaps more than any other cultivated plant.

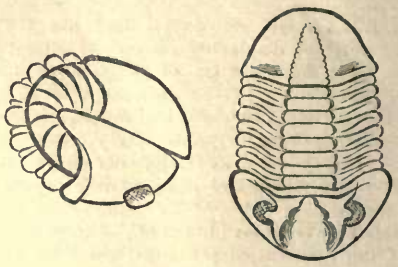
TRIGLOCHIN (Linnæus). A genus of rushes found in bogs in various parts of the world, and belonging to the order *Juncagineæ*. All are curious, and some of them economical, for mat-making, &c.

TRIGONELLA (Linnæus). A genus of herbs,

chiefly annuals. It is allied to the clovers, and consequently belongs to the natural order *Leguminosæ*. A few of the species are British, and the rest are distributed over Europe and north-western Asia.

TRILLIUM (Linnæus). A very curious genus of North American tuberous-rooted herbs, bearing showy hexandrous flowers, and belonging to *Melanthaceæ* (Hort. Brit.), or *Smilaceæ*, according to Sweet. They require to be planted in a shady peat-earth border; they increase but slowly by division.

TRILOBITES. A very extraordinary tribe of extinct animals, known in this country under the name of Dudley fossils, having the body composed of three transverse parts, and divided longitudinally by two deep impressions, forming three elevated lobes. The anterior part of the body is generally more or less semicircular or lunate, having on the upper side two large and generally reticulated eyes, shaped like kidneys. This part is succeeded by numerous (from six to twenty-four) transverse segments, and the body is terminated by a large semicirclar plate less distinctly articulated than the preceding part. Some account of these remnants of animals are given in the article Fossil Remains. No organs of locomotion or antennæ have been observed, and it appears to have been the habit of these animals to roll themselves up into a ball by bending the extremity of the body beneath the breast, and bringing it into contact with the head. Much diversity of opinion has been entertained amongst naturalists as to the relations in nature of these curious creatures. According to M. Alexandre Brongniart, who published a good monograph of them, they are most analogous to the *Limuli* and other entomostracous crustacea, provided with a great number of legs, of a more or less membranous construction, and which, it may be readily conceived, would have been entirely destroyed during the great overthrow which has reduced these creatures to their present state. This opinion has been strenuously maintained by Audouin. It is, however, opposed by Latreille, who observes that, supposing these animals to have been destitute of legs, they would naturally approach the *Oscabrions* (or *Gasteropodous Chitons*); or rather, that they constituted the primitive type of annulose animals, uniting on one side the last mentioned molluscous creatures with the entomostracous crustacea, as well as with the genus *Glomeris* (amongst the myriapodous insects); adding, that no branchiopodous *Entomostraca* has hitherto been discovered capable of contracting itself into a ball, which peculiarity is only observed in the crustaceous genera *Typhis*, *Sphæroma*, *Tylos*, and *Armadillo* (see a figure of the last-named genus in the article Chilognatha), and in the apterous genus *Glomeris* (also figured in the last named article); between which tribes there is a considerable hiatus. The genera *Calymene* and *Asaphus*, amongst the *Trilobites*, on account of their contractility, evidently approach the *Glomeris* and some of the isopodous crustacea (*Sphæroma*); but the *Trilobites* have the terminal segment of the body entire, and not furnished with lateral swimmerets as in the *Sphæromæ;* but the same negative character exists in the *Glomeris*, and especially in the genus *Tylos*, of which the upper side of the thoracic segments is divided into three lobes. The discovery of the genus *Serolis* on the coasts of Patagonia, has afforded another proof of the correctness of Latreille's idea of the oscillant situation of these creatures between the *Isopoda* and the myrapodous insects, the eyes in that genus being situated in the same vertical situation, and of the same lunate form, as in the *Trilobites*.



a Asaphus expansus. *b* The same rolled up.

Moreover, the body is longitudinally divided into three lobes like the *Trilobites*. The legs and caudal swimmerets scarcely extend beyond the sides of the body; but the antennæ are very large and distinct. This genus has lately been described and figured in detail in the Transactions of the Albany Institute, by Mr. James Eights, under the name of *Brongniartia*. Much of this diversity of opinion has resulted from the very much worn state of the *Trilobites*, which have, in many instances, been so rubbed, that their eyes have been entirely effaced; but it is questionable whether any *Trilobite* was ever destitute of those organs which Dr. Buckland has, in his Bridgewater Treatise, described at great detail in connexion with their fitness for the situations in which the animals are supposed to have resided. Mr. J. V. Thompson, in the last of his Zoological Researches, has adopted the opinion of M. Audouin, considering that the eyed *Trilobites*, *Calymena*, and *Asaphus*, are most approximate to those phyllopodous crustacea of which *Apus* is the type, and that the genera *Bucephalithus*, *Oygia*, and *Paradoxides*, are analogous to such phyllopodous genera as *Branchypus*, *Eulimena*, and *Cheirocephalus*.

The works of Brongniart above referred to, and that of J. W. Dalmad (Uëber die Palæaden oder die sogenannten Trilobiter. Nurnberg, 1828), and the works therein referred to, must be consulted for the determination of the generic and specific characters of these perplexing and singular animals.

TRIMERA (Latreille). A primary section of the coleopterous insects, having apparently only three joints in all the tarsi; but in effect having four, the third being very minute and buried between the lobes of the second joint. Latreille introduces into this section the families: 1. *Fungicoles* (typical genera *Eumorphus* and *Endochymus*, Fabricius); 2. *Aphidiphages* (*Coccinella*); and 3. *Pselaphiens* (*Pselaphus*). The relations of these three groups seem in nowise to warrant this association; the *Fungicoles* appear most nearly allied to some of the fungivorous *Necrophaga*, notwithstanding the diversity in the number of the joints of the tarsi, and the *Pselaphidæ* are even more closely allied to the *Staphylinidæ*. The *Coccinellidæ*, on account of their peculiar characters, and the insectivorous habits of the larvæ, are a very distinct group; but, perhaps ought not to be raised beyond the rank of a family, instead of constituting a section by themselves.

TRINGA. A genus of stilt or running birds, frequenting the margins of the waters, but rarely, if ever, wading; and seeking their food on the oozy banks rather than the sandy and pebbly shores.

They have sometimes been confounded with the sandpipers, and they are certainly near neighbours to these birds, but still there is a line of distinction between them.

The tringas are more aquatic than the sandpipers; that is, they seek their food on more soft and humid surfaces, although they neither wade nor swim. Their bills are about the same length as the head, slender, straight, or but very slightly curved, flexible in its whole length, while that of the sandpipers is flexible in the basal half only. The tip enlarged and smooth, channelled to the tip, and the nostrils pierced in the channels. In its character, and it is the organ from which we can best judge of the habits of the birds, it is intermediate between the bill of the sandpipers and that of the snipes—more sentient than the former, and less so than the latter. Their tarsi are of moderate length; and the feet have four toes, three to the front and one to the rear. The front toes are very slightly bordered with membrane; and the hind toe is small and articulated higher on the tarsus than the front toes. They are not such swift runners as the sandpipers, neither can they glide through tall herbage with the same adroitness as the snipes; but still they are rather clever birds upon their legs. They are also well-winged birds, and have much command of themselves in the air, either in forward flight or in whirling and doubling.

Over the temperate and the cold latitudes, the tringas are pretty generally distributed; and, though they are not so decidedly migrant for long distances in latitudes as many other birds, they seldom summer and winter in exactly the same locality. As is the case with many other birds which are conspicuous enough when not in the breeding season, the breeding places of many of the tringas have not been well ascertained. They are subject to considerable differences of colour too; and this has sometimes caused one species to be described as two. Our limits will permit of our noticing the mere outlines of the British species only.

The Purre or Dunlin (*T. variabilis*). This bird is well entitled to the epithet *variabilis*, from the great difference between its summer and its winter plumage. It is the "purre" in winter, and the "dunlin" in summer.

The winter dress is the one in which it is most frequently seen on the shores, and it continues there and in that dress for a very considerable portion of the year. In this winter dress, in which it appears on the coast, and especially on the south coast of Britain, for great part of the year, it has the top of the head, the back of the neck, the back, and the scapulars, ashen-grey clouded with brown, and the shafts of the feathers dusky black; the wing-coverts are blackish brown, with the margins grey, and the tips of the larger coverts whitish; the rump and upper coverts of the tail are brown, margined with a lighter shade of the same colour; the middle tail feathers brown, and the lateral ones grey with whitish shafts; the tail is slightly wedge-shaped, the middle feathers being the longest, but the external lateral ones have the broadest webs. The under parts are white, with the exception of the foreneck and breast, which are grey with brown shafts to the feathers. This plumage is, however, not the same at all times of the winter; and it is also paler in very severe winters than in mild and open ones.

In summer, or in that state in which it is the "dunlin," the upper parts are blackish or black, with red-brown margins to the feathers, and the rump and tail coverts are brownish black; the cheeks, foreneck, and breast, are black, with white margins to the feathers, and the rest of the under part of the body becomes wholly black; the chin is as white as in the winter, and the flanks are also white, but streaked with longitudinal lines of black; the quills and coverts are nearly the same at all seasons. The first plumage of the young birds is intermediate between the winter and the summer plumages of the adults; but it fades into the pale colour in the winter, and regains the dark against the next summer.

The length of these birds is from seven to eight inches, and the stretch of the wings is very nearly double the length; the bill is black, and the feet and toes are dusky green.

In winter they assemble in small parties, following the tide, on the oozy shores and banks of the lower estuaries near the sea. When undisturbed they run rather swiftly, and utter a sort of murmuring note; but when they are alarmed and forced to the wing, they utter a querulous and wailing scream. From the short time that they are absent from our shores, it is not probable that many of them leave the country in the breeding season; though some appear to move northward within the country, and others to the borders of the inland lakes. In the breeding time, however, they are solitary; that is, they are in single pairs, and they are comparatively silent. They have very rude nests, only a little scratch in the dry surface, in which a few vegetable fibres are placed.

Purple Tringa (*T. purpurea*). This is rather a larger bird, rather more than an inch larger in the body, but not larger in the wings, so that it is not quite so well adapted for flight as the other. The bill is longer, harder, and more pointed at the tip; its general colour is a dull dusky red, with the tip and the edges of the mandibles black. The tarsi are shorter in proportion than in the preceding species, and the toes are a little more free to their bases. They are the same dull red as the bill, but the claws, which are quite blunt, are dusky.

The plumage varies with the seasons; and as the winter plumage is that in which it is most commonly seen in Britain, we shall mention it, and notice the changes that take place in the summer. At that season, the head and neck are dusky black; the rest of the upper parts black, with reflections of purple; and the upper part of the back and the scapulars with ash-coloured margins to the feathers. Four feathers in the middle of the tail are of the same colour as the lower part of the back; but the remaining ones are ash colour. The wings are black, with a little white on the tips of the coverts, small white margins to the primary quills, and some of the secondaries nearly white. The under part white, with stripes of black on the breast, sides, and flanks. In summer, the upper part of the breast is grey, and the sides of the same black; the bill and feet also bloom to a bright reddish orange. This species is found on the shores of the Atlantic and the Mediterranean, and on the American side of the former as well as upon the European side. Its nest is rather rare in Britain; and the bird is by no means a very abundant one, even in the winter. It frequents more stony places of the shores than the variable tringa, and its chief food is understood to consist of the small crustacea and mollusca abounding on stony shores.

The Knot (*T. canutus*) is a larger bird than either of the preceding species. It is ten inches long, and more than a foot and a half in the expanse of the wings. These birds are fond of soft and fenny shores, and they are scattered over various parts of the coast, both toward the north and the south, but they are not abundant anywhere. They are birds of lonely places, the dreary shores from which the tide retires to a great distance, or the larger marshes near the sea. The upper parts are black in summer, with rust-coloured margins to the feathers; the coverts and quills dusky, the former tipt, and the latter margined, with white; the upper tail-coverts barred with white and dusky; the tail-feathers blackish ash, with very narrow margins of white. The under colours are, rust-red on the breast, and white on the rest, mottled with dusky. In winter, the upper plumage fades to dusky ash, and the under to white, with brown streaks on the sides and flanks.

Curlew Tringa (*T. subaquatica*). Bill and tarsi longer in proportion than in the other tringas, and black; the bill considerably arched; the legs bare for some distance above the tarsal joint. In summer the head is dusky ash, the breast reddish brown, the back deep black, with red margins to the feathers. In winter, the forehead, and most of the under part, white; the breast cream colour, and the back dusky. The size about the same as that of the purple tringa, but the habits more aquatic.

The Buff-breasted Tringa is very rare as a British bird, and its several changes of colour are not known. It is about the same size as the last mentioned species. The *Minute Tringa* and *Temminck's Tringa* are small species, about six inches long, and both of them are rare in Britain.

There is one other bird, which was once associated with the tringas, under the name of *Tringa pugnax*, and which, though it has very properly been separated from them, we shall notice in this place, as it was omitted under its proper name. That bird is,

The Ruff (*Machetes pugnax*). Its haunts are analogous to those of the different species of tringa, but in some of its habits it resembles the gallinaceous birds. In the pairing season the males fight desperate battles of gallantry. They are considerably larger than the females; and in the breeding season they have an accession of ornamental feathers, which, notwithstanding their seasonal changes of plumage, is not known among the tringas. This consists of a ruff or mantle of long glossy feathers, which, growing from the neck, fall down as far as the scapulars, something after the fashion of a Spanish mantle. At the same time they acquire tufts of feathers on the ear-coverts, and the face becomes covered with fleshy tubercles of a yellowish red colour. Thus, though the nuptial appendages are different in the details, they display the same exuberance of energy which the males of our common poultry display at the same season. In the form of their bodies they have a considerable resemblance to the tringas, but the bill and the feet are different. The bill is partially flexible only a little way at the base, and the terminal part of it is very compact and hard; the feet also are walking feet, without being particularly adapted to any kind of surfaces; the colours are very variable, not only with the season, but in different individuals. The male is nearly a foot in length, of which the bill occupies one inch. The female is a third less. In their walk, especially the males, they have a sort of strut, and have the head and neck more elevated than the other marsh birds.

In former times they were very abundant in the fen districts of England, and were among the birds reckoned first-rate dainties for the table. They were known by two names, "ruffs" and "reeves;" the former meaning the male with the ruff of produced feathers, and the latter either the female or the male when the ruff disappears. In those times they were captured in great numbers by the fowlers of the fen countries, and fattened in confinement for the London market, where they were in great demand by the curious in gastronomy. At present the numbers, as is the case with most of the fen birds, are greatly reduced, though those that do come still keep up "the customs of their ancestors."

They are migrants, and make their appearance in the spring, the males always before the females. At this time they are on the best terms possible with each other. They repose quietly in the herbage during the day, and come out to feed during the night, or rather early in the morning and late in the evening. This is the time at which they used to be taken by the fowlers; for, though not in high condition naturally, they feed readily. During this quiet time the ruffs, ear-tufts, and other "signs of the times," wax conspicuous apace, and soon after the natural cause of their warfare comes in the shape of the females.

The moment that these make their appearance, the doughty warriors prepare for deeds of bills—not by squabbling in a sort of private *duello*, where two happen to cross each other in their amorous courses, as is the case with the "ruffs" of mankind, who, like their kindred of the fens, have nothing to do or think of but "sleeping o' days, feasting o' nights, and wooing their dames." They carry on the war in a business-like manner, not for territory, but for glory,—as if they were the people of some happy isle of the sea, proud of being slain in any body's cause for any object, and at their own cost and charge. They are even superior to those self-devoted victims of glory; they fight for what would make the blood of the Pol-Œconomicus of "*the* University" curdle like cooling lead, and turn the fervid Lady of anti-matrimonial notoriety into an icicle, not to be thawed by the furnaces of seven thousand lovers: they fight in order that each may be—the father of a family! They do not come to the scene of battle as mercenaries, or any way in the train of a leader, as is the case in the *un*-gallant wars of the human race; each comes on, and for his own proper interest, to win the surrounding patch of marsh and the favourite, in like manner as barn-door cocks wage fierce battle for the dunghill and the dame. There is no herald to whet the stomachs of the combatants, as there was when whilom the bibliopoles of London are said to have contended at the may-pole in the Strand for the honour of polluting the public ear with the productions of Mrs. Centlivre—

> "His be yon Juno, of enormous size,
> With cow-like udders, and with ox-like eyes;"

neither is any of the present file likely to receive even the *vasa preciosa* for his private delectation—*Eheu! tempora mutantur.*

> "No heavy lord now hangs at every wet."

Still, the wars of the ruffs are faithful to the observances of the olden time, and admit not of the

slightest innovation. One ascends the "hill," and raises the cry of defiance, upon which forth rush the doughty birds, and the battle rages the live-long day, or till one has been conqueror, and leads off the dame to rushy bowers of sweetest love. The battle is renewed, with continuation of days, until they are paired and pacified; but the fate of the vanquished in the last and single combat is not known, whether he takes monastic vows, subject to fracture, *more monachi*, or goes off in purling streams, the learned have not decided. The wars of the ruffs are, however, very curious matters, and matters which cannot be explained upon any of our common theories of the conduct of animals, and the reasons which we affect to assign for that conduct.

The nests for which all this battling is carried on are but rude structures. They are formed of a few withered stalks, in the thick tufts of herbage, which stud the marshes. The eggs are four in number, pale olive brown in the ground colour, and spotted with darker brown. The young are produced about the longest day. It does not appear that the males give themselves any trouble about the females, the nests, or the young. During the incubation they bill as before, and battles are fought in the early parts of it; but as it proceeds these wear off, and by the time that the young break the shell the males merely show themselves. Soon after this they leave the females to provide for the young as they best can, and go into retirement for the purpose of changing their dress. The mantle, the ear-tufts, the caruncles on the face, and all the other insignia of the period of pugnacity, are thrown off, and the ere-while warriors come out of the places of their temporary retirement in plain apparel, and as gentle and peaceable as lambs. The produced feathers on the males of these birds do not belong to any particular moult; they come after the time of what may be considered the spring moult, and they are gone before the autumnal one, so that they are in an especial manner insignia of the breeding season. They are so varied in their colours, between nearly black and nearly white, that it is impossible to mention their tints. Their lustre is almost equally a puzzle; it is not metallic or vitreous, or any other that we could name; it is the bloom on the nuptial plumage of the ruff, and as such, it has no counterpart in nature by means of which it can be explained to those who have not seen it. After the moult the plumage of the birds is of a very sober character. Besides the capture of the males upon their appearance in the spring, there used to be a more extensive and indiscriminate capture in the month of September, at which males, females, and young birds of the year, were equally captured. It appears that the greater number migrate in the winter, but there are some stragglers that remain in the country.

TRIOPTERIS (Linnæus). A genus of twining shrubs, natives of the West Indies. The species belong to the tenth class of Linnæus, and to the order *Malpighiaceæ* of Jussieu. They are easily grown and increased in the stoves.

TRIPHASIA (Loureira). A genus of one species of plants found in China, and specifically called *Aurantiola*, the little orange. The flowers are pentandrous, and the plant belongs to the order it so much resembles, viz. *Aurantiaceæ*. It was called *Limonia trifoliata* by Willdenow. It does not thrive with much moisture, but with care may be increased by cuttings.

TRIPLARIS (Linnæus). A forest tree of South America, bearing dicœcious flowers, and belonging to the natural order *Polygoneæ*. Notwithstanding its natural bulk it may be kept in a dwarfed state and propagated in our hothouses, with the ordinary treatment of plants from the same quarter of the world.

TRIPLAX (Fabricius). A genus of coleopterous insects, belonging to the group of which *Erolytus* is the typical genus, and distinguished by the ovate form of the body, with the last joint of the maxillary palpi strongly securiform; the maxillæ have the internal lobe membranous, with a small tooth at the tip. These are insects of small size, found in boleti and fungi; they have the head and thorax generally of a red colour, with the elytra blue or black. The genus *Tritoma* (Fabricius) is closely allied to the preceding, differing chiefly in the rounded form of the body. The type is the *Tritoma bipustulatum* (Olivier), which is found in similar situations with Triplax. It is small, and of a shining black colour, with a large red humeral spot.

TRISTANIA (Dr. R. Brown). A genus of New Holland evergreen shrubs, bearing polyadelphous flowers, and belonging to the natural order *Myrtaceæ*. The species are desirable greenhouse plants, thrive in light loam and heath-mould, and may be propagated by cuttings.

TRITICUM (Linnæus). One of the most important of all the *Gramineæ* to European society, as well as to every other part of the world suitable to its culture. As a bread-corn wheat is superior to every other kind of grain. There are several species described and hundreds of varieties. A few only of the best varieties of winter and spring sorts are cultivated; the great majority are as suitable for the British climate, and even the favourite varieties are so much mixed that a pure sample of any one particular sort is not to be had. It is with wheat as with almost all other plants; the best varieties being accidental productions, are only for a longer or shorter time thrifty in any one locality. After a few years they degenerate, and then require to be succeeded by another kind, and, if convenient, from some distant quarter.

TRITOMA (Ker). A genus of herbaceous perennials, natives of the Cape of Good Hope. The flowers are hexandrous, and the genus is associated with the *Hemerocallideæ*. They are half-hardy plants, and bear our winters with a very slight covering. They flower early in the spring, if kept safe from frost.

TRITONIA (Ker). A genus of handsome flowering South African bulbs, belonging to the third class of Linnæus, and to the natural order *Tridaceæ*. The species, of which there are above twenty, require similar treatment and soil with other Cape bulbs, that is, potted in light soil in October, and when rooted fully, they may be removed to the greenhouse to bloom.

TRIUMFETTA (Linnæus). A genus of tropical undershrubs and annuals, bearing dodecandrous flowers, and belonging to the order *Tiliaceæ*. The species already in our collections are easily grown and increased by seed, which they yield plentifully.

TROCHILIUM (Scopoli). A genus of lepidopterous insects belonging to the family *Ægeriidæ*, having the body thick, with a small caudal tuft; the wings diaphanous, and the antennæ short and stout. There are two British species, namely, *T. apiforme*,

the hornet moth, and *T. bombiciforme*, Hb.; (*Crabroniforme*, Lewin, the lunar hornet moth), see ÆGERIIDÆ. These insects reside in the larva state in the stems of the broad-leaved willows (*Salix capræa*), which they longitudinally perforate in various directions. These larvæ are fleshy grubs with a scaly head, six short legs, and eight fleshy prolegs. An interesting account of the habits of this insect is published in the third volume of the Linnæan Transactions, and more recently by the Rev. W. T. Bree in the new and improved series of the Magazine of Natural History. These larvæ enter the stems near the roots, eating their way upwards for several inches, sometimes to the length of a foot or more. "Being an internal feeder, the caterpillar of course is only to be found by cutting into and opening the stems of the willow in which it is inclosed, finding there both food and lodging. *Salix capræa* abounds in our coppices near Allesley, Warwickshire, and forms a useful and rapid-growing underwood. When the periodical falls take place, I have observed that scarcely a single willow-wand is cut down that does not exhibit proofs of the ravages of this insect; sometimes three or four, or even five separate perforations occur in the same stem. To the woodmen our elegant sphinx must be regarded as in some degree an injurious insect. The wood of *Salix capræa* is with us usually either sold to the rake-maker, for the purpose of being worked up into rake-teeth, &c., or converted into what are here called flakes, *i. e.*, hurdles made of split stuff nailed together, in contradistinction to the common hurdle, which is formed of round wood twisted and plaited together without the help of nails. The lower, and consequently the thickest portion of each willow rod, to the length of five or six inches, or occasionally a foot or more, is spoiled by the perforations of the larva, and rendered unavailable to the above purposes." The writer hereof has met with this handsome species in the osier beds on the south side of the Hammersmith Suspension Bridge. (See Trans. Ent. Soc., Part III.)

TROGIDÆ (MacLeay). A family of coleopterous insects, of small extent and obscure colours, separated from the genus *Scarabæus* (see LAMELLICORNES), distinguished by having the antennæ ten-jointed, the basal joint large and hirsute; the palpi are short; the maxilla toothed; the body rugose and tuberculated, or fasciculated on the upper side; the thorax short and transverse, with the anterior angles advanced in front. There are only two British genera, *Ægialia* and *Trox*, the former globose and smooth, the latter more ovate and rugose. The type of the genus *Trox* (of which there are four British species) is the *Scarabæus sabulosus*, Linnæus. They are generally found in sand-pits and similar situations.

TROGOSITA (Fabricius). A genus of coleopterous insects, belonging to the family *Cucujidæ*, having the mandibles exposed and robust, but shorter than the head; the body narrow and depressed; the antennæ shorter than the thorax, and terminated by a compressed three or four-jointed mass; the labium is entire, and the maxilla have one lobe. The type is the *Tenebrio mauritanicus*, Linnæus, an insect about one-third of an inch long, of a pitchy black colour. It feeds upon bread, flour, &c., and is occasionally taken beneath the bark of trees. Its larva is very injurious in Provence, where it is known under the name of the *Cadelle*. This is the only British species. The exotic ones are rather numerous, and some of them very splendidly coloured.

TROLLIUS (Linnæus). A genus of showy flowering herbs, found in the north of Europe and America. The flowers are polyandrous, and belong to *Ranunculaceæ*. The *T. Europæus* is a native of Britain, and called the globe-flower division.

TROPÆOLEÆ. A natural order, containing only one genus, to which the well-known *Tropæolum majus*, or Indian cress of our gardens, belongs. This order comes near to *Geraniaceæ*, but differs in having separate stamens, and in the number of petals. There are eleven species described, all natives of Peru. *T. pentaphyllum* is used as an antiscorbutic; the flowers of both *T. majus* and *T. minus* are an ingredient in salads, and their fruit are used as capers, or as a pickle.

TROPHIS (Linnæus). A genus of two West Indian trees, called there Ramoon-trees. The flowers are dicœcious, and the genus belongs to *Thymeleæ*. The species are free-growing plants in our stoves, and are increased by cuttings.

TRUXALIS (Fabricius; GRYLLUS ACRIDA, Linnæus). A genus of exotic orthopterous insects, belonging to the family *Locustidæ*, distinguished at once by the elongated form of the head, having the eyes placed near the extremity of the long and slender pyramidal front, with the mouth very low, and appearing to be placed at the breast, and by the prismatic or ensiform antennæ. The species are of considerable size, and often elegantly varied with pink, green, purple, &c., especially on the wings. They are inhabitants of the warmer climates of the globe.

TRYPOXYLON (Latreille; APIUS, Jurine). A genus of hymenopterous insects, belonging to the family *Crabronidæ*, and distinguished by the very elongated form of the abdomen, which is gradually narrowed into a peduncle at the base. The mandibles are curved and without teeth; the upper wings have two submarginal cells, each receiving a recurrent nerve. The type is the *Sphex figulus*, Linnæus, a very common insect in gardens, &c., of a black colour, with the margins of the abdominal segments and the face silvery. The female makes use of the old burrows of other insects, which she discovers in stumps of wood, &c., and in which she buries small spiders as the food of her offspring, closing up the hole with moistened earth. (See Shuckard's Monograph of the British Fossores, and the Trans. Entomol. Soc., Vol. I., Part III., for a memoir upon the habits of this insect).

TUBEROSA is the *Polianthes tuberosa* of Linnæus, an East Indian genus, celebrated for the powerful fragrance of its flowers. The tubers are annually imported into this country from Italy. These are potted in sandy loam and peat-earth, placed in a hot-bed to bring them forward to flower in the autumn, and then are placed in the greenhouse, or entrance-halls of dwelling-houses, as grateful ornaments.

TULIPACEÆ. A natural order of beautiful flowering plants, natives of temperate climates, and containing eight genera, of which there are one hundred and twelve species already described. The genera are, *Yucca*, *Tulipa*, *Fritillaria*, *Cyclobothra*, *Calochortus*, *Lilium*, *Gloriosa*, and *Erythronium*, all of which, except the first, have been previously described under the proper generic names. But the

general character of *Tulipaceæ* is stated thus:—"Specious hexapetaloid hexandrous endogenæ, with introrse anthers, superior germen, connate styles, three-celled capsular fruit, with many albuminous seeds, having spongy testæ."

TULIP TREE is the *Liriodendron tulipifera* of Linnæus—ornamental trees, natives of North America, and long introduced into our ornamental plantations. They are raised from seeds imported from America. The seeds are generally two years in the ground before the seedlings appear.

TURNERIACEÆ. A natural order, comprising only one genus, unless *Piriqueta* be considered a distinct genus, which is doubtful. The species have alternate leaves, and yellow axillary flowers, resembling those of *Helianthemum*. The *Turnerias* are chiefly interesting for their relations to collateral groups.

TURNSTONE. See STREPSILAS.

TURRÆA (Linnæus). A genus of trees, found in India, having decandrous flowers, and belonging to the order *Meliaceæ*. These timber-trees submit to be cramped in pots of light loamy earth, thrive in the stove, and may be propagated by cuttings.

TURTLE. See CHELONIA and REPTILE.

TURTLE-DOVE. See PIGEON.

TUSSILAGO (Linnæus). A genus of broad-leaved herbaceous plants, mostly natives of northern Europe. Four of the species are British, and known by the name of colt's-foot. The flowers are composite, appearing before the leaves. Their properties, particularly *T. farfara*, are medicinal, but less in repute now than formerly. The same plant is a plague to farmers on clayey soils.

TYCHUS (Leach). A genus of coleopterous insects, belonging to the family *Pselaphidæ*, distinguished by having the fifth joint of the antennæ large and knot-like, especially in the males. Type, *Tychus niger*, Leach, an insect of minute size, found in damp moss in the winter.

TYLOPHORA (Dr. R. Brown). A genus of climbers from New Holland and India. They belong to the fifth class of Linnæan botany, and natural order *Asclepiadeæ*. The species are easily grown and propagated.

TYPHÆUS (Leach). A genus of coleopterous insects, belonging to the family *Geotrupidæ*, and chiefly distinguished by the males being furnished with horns upon the head and thorax. The only British species is the *Typhæus vulgaris* (*Scarabæus typhæus*, Linnæus), a very abundant species, found in and about the excrement of horses and cows in sandy places. It is known to collectors under the name of the bull-comber.

TYROPHAGA (Kirby). The cheese-maggot. See PIOPHILA and CHEESE-HOPPER.

TYPHINEÆ. A natural order of aquatic plants, containing only two genera, namely, *Typha* and *Sparganium*, both natives of European ponds, sluggish rivers, and ditches. The *Typhas* are conspicuous seed-like plants, and called in English cat's-tail.

ULEX (Linnæus). A genus, of four species, of one of our commonest plants on English wastes. Furze, though a wild vagrant, is not without beauty; its numerous flowers, appearing more or less at all seasons, compensate for the rigid character of the shrub itself. Nor is it wanting in usefulness. It is a wholesome fodder for cattle when duly prepared; and, as fuel for the brick-maker, rural brewers, and bakers, it is an excellent substitute for more costly fuel. In some countries furze is extensively cultivated, and yields as great a profit in a given term of years as if the land were cultivated for the growth of corn. Hedges are formed of it, and it is, moreover, an excellent cover for game. The flowers are monadelphous, and, as its fruit is a pod, it belongs to the order *Leguminosæ*. The Irish and double-blossomed furze are now admitted into the flower-garden.

ULMACEÆ. A natural order, containing three genera, namely, *Planera*, *Ulmus*, and *Celtis*. Of these there are nearly forty species described, most of which are also in cultivation. The common elm is the type of the order, and which, with its congeners, have the following generic character:—They are trees or shrubs, with knotless or jointless branches, alternate, simple, petiolate, scabrous, serrate leaves, the stipules free and often deciduous; the flowers are united, being collected into sub-amentiform clusters; the calyx is free, campanulate, and cleft at the edge, with an imbricate æstivation; the stamens are five in number, all fertile, and exserted from the base of the calyx; the anthers are free and two-celled; the ovary free, and also two-celled; stigmata two and distinct; the fruit is two-celled, membranous, or drupaceous; the seed solitary, pendulous, and without albumen.

The elms, it is well known, are large handsome trees, but their timber is of far less value than either oak, chestnut, or pine. Though tough and strong, it is too liable to warp and shrink. It is mostly used by wheelwrights and coffin-makers. Elm leaves formed a large proportion of the "British leaf," or "herb," intended to be sold as Chinese tea, but seized and burnt by the officers of excise.

The *Celtis*, or nettle-trees, though exotics, arrive at considerable bulk in our plantations, and may now be considered naturalised foresters.

The *Planeras* are North American deciduous shrubs, discovered and named by Michaux. They thrive in our shrubberies, and are propagated by layers.

UMBELLIFERÆ. One of the most important and most extensive natural orders; important, as embracing the carrot, parsnep, and celery, as dietetic plants in Europe; and the arracacha in South America; and containing, as useful medicinal plants, the galbanum, opopanax, and assafœtidæ. The order is divided by botanists into three sub-orders, namely, *Orthospermæ*, which is separated into eleven tribes; *Campylospermæ*, containing three tribes; and *Coilospermæ*, comprising one tribe. The generic character is expressed thus:—apopetalous, angiospermous, dichlamydeous dicotyledons, the petals narrow at the base, and involute; the stamens five, exserted from an epigynous disk; the carpels didymous and inferior, each one-celled; the ovules solitary, and the seeds albuminous; the leaves alternate, and the inflorescence umbellate. There are one hundred and one genera in this order, and above five hundred and seventy species already described; many of the species are inconspicuous worthless weeds, and often found in watery places.

UNAU—Two-toed Sloth (*Bradypus didactylus*). The general characters and habits of the sloths have been so fully noticed in the article AI and the article BRADYPUS, that it will be unnecessary to do any thing further here than simply to point out the cha-

racters of this species, or rather the sub-genus, for the animal differs sufficiently from the Ai to entitle it to that distinction. The unau has only two claws on the fore feet, though it has three on the hind ones. The tail is very short, consisting of only three vertebræ, and wholly concealed in the hair. The fore legs are not so long as in the ai, and they bear a proportion to the hind legs of six to five. The bones of the extremities are not so completely soldered together as in the ai, the first phalanges of the toes are free, though always soldered to the sesamoides. The claws are one-half shorter in proportion than those of the other. It is larger than the ai, its head is more elongated, its forehead less round and prominent, and its facial line more oblique. Its covering consists of rough hairs, thicker and coarser than those of the ai, but not quite so long and shaggy. They are partly brown and partly white, the former predominating on the back, and the latter on the under part. This mixture, which is not in spots but in single hairs, gives it a peculiar tint of grey, which appears deeper where the brown hairs predominate, which they especially do on the upper part of the neck, on the former of which the hairs are long, and produce a sort of mane. There are also very strong hairs on the thighs, and the hair on the fore arms is reversed. The canines are much larger and more conspicuous than in the ai, and they are separated from the cheek-teeth by a ridge of the jawbone. The proportions may be judged of from the statement that, in a specimen whose body is two feet, the head is about five inches long, the inner claw on the fore foot two inches, and that on the hind foot an inch and three quarters. The claws on the hind feet are longer than those on the fore ones, and the intermediate is the longest of three. The claws are in reality hoofs, embracing the whole extremities of the toes, as in the hoofed animals, and therefore are regular parts of the extremities as organs of locomotion.

Though this animal is not so utterly helpless upon the ground as the ai, it is yet but a very slow walker, and does not get on at a more rapid rate than a tortoise. It is much more at home in climbing, and can contrive to reach the top of a tall tree in a moderate length of time. Its favourable position, like that of the otter, is suspending itself by the feet with the back undermost; and it can thus suspend itself by three feet, and use the remaining one in feeding. It sleeps suspended.

All its senses, and indeed the whole of its vital energies, are of a very low and imperfect character. Of its hearing we know little, but it is not much startled by sounds. Its sense of smell is obtuse, and it sees badly in a strong light. Altogether it is much more a passive than an active animal. It can endure hunger for a long time, and is not much affected by blows, or even by wounds. All its qualities are in fact more of a passive than of an active nature, and it lives much more by its power of enduring whatever may be going on around it, than by its own activity, exertion, or resource of any kind.

It is by no means rare in the thick and close forests of South America; indeed it appears to be much more abundant, at least in some places, than the three-toed sloth; and, though it is not perhaps equal to that animal in power of perambulating the upper parts of the trees in the thick forest with the back undermost, it can more readily descend and again remount when it comes to an opening.

Of the duration of life, either in it or in its congener, we know nothing; but the numbers are considerable as compared with the productive powers, which consist of but one at a birth, which one attaches itself to the mother by means of its claws, and clings to her in all her climbings among the trees. This carrying the young attached to the body bears some resemblance to the marsupialia with a perfect pouch, only the mode of carrying is varied to suit the habit. The young, attached in any way to the belly, would be very inconvenient for the mother, and very unsafe for the young, in an animal which has the back undermost, and the belly in contact with those branches which form its pathway in the forest. The back, on the other hand, is equally safe for both. We must not wonder at this; for the unau still supports the young in that which is her own position of stability, namely, with the back undermost; and as the structure of the young one is the same, the back undermost is the position of stability for it also. The sloths of whatever species are reversed animals in their position of action as compared with ordinary animals; and therefore we must look upon all their performances the other way. In an upright animal, the young are most safe riding upon the upward back of the mother; but in those reversed animals, they are most safe in clinging to the downward back.

What may have been the state of South America at the time when the mighty animals of the sloth family were alive, or what may have been the precise scene and mode of their action, it is impossible for us to know; but we may with the greatest certainty and safety conclude that it must have then been a rough state of things. That there has been no great geological revolution in that part of the world, since the megatherium fed in some way upon some vegetable, we may be assured; for the remains of the animal have been found in the soft deposite of La Plata, without a single bone displaced or disjointed; and thus there must have been a common progress of nature in changing the country, from the time of the megatherium to that of the ai and the unau. Along with them, or with either of them, there could dwell no sprightly quadruped of large size feeding upon vegetables; for the remains of the forests are of such a character that they afford neither food nor footing for any such. This leads us to conclude that there must have been rather a rough state of things at that time, and that, on the part of the mammalia, the power of suffering must have far exceeded that of acting. The great bones of the megatherium are obviously formed for endurance, not for activity; and the probability is, that it may have been a still slower animal than the present sloths.

There is one curious point in the progressive zoology of South America; and that is the wonderful productiveness and prosperity of the horse and ox in that country. That there is not a vestige of either of them as having existed there before their introduction subsequent to the discovery of the country by Columbus and his followers, every body knows; and yet they have bred and multiplied there in wild nature, faster than they have done in the eastern continent, or in North America, by all the arts of the breeder. This is undeniable, and yet it seems somewhat strange. Experience has shown that the plains of South America, every where to the southward of the great tropical parts, where the sloths now inhabit, are the places of the earth's surface which are the

very best adapted for cattle. The cattle were not there until they were artificially introduced by man. Is this an anomaly in nature? Is it an instance of imperfection of the system, one where the state of the country was the very best adapted for certain animals, and yet nature did not provide these animals, and thus allowed her own bounty to run to waste?

This is a very important question, and one which involves far more than we would at first suppose. It will be most readily understood by propounding another question: was the discovery of America by Columbus, and the extension of that discovery by his followers, a work entirely originating with man, or was it part of that grand system of the economy of the earth's surface, of which man can understand and know only a very little? We cannot by possibility suppose that these things took place without the knowledge of the Omniscient Ruler of the system of things, or in opposition to the laws which He has ordained for the government of our planet; but the field which this question opens is much too wide for our investigation; and therefore we leave it to the consideration of the reader, for the stimulating of whose inquiry we have merely thrown it out as a hint.

UNICORN of the ancients. See the article ANTELOPE, species *Abu-harbe*.

URANOSCOPUS — Star-gazer. A genus of spinous-finned fishes which belong to the perch family, and to that division of them that lurk in the mud or lie at the bottom of the water, in order to seize their prey as it passes over them; they are in general armed with strong and sharp spines upon some part of their bodies, by means of which they can inflict severe wounds; but whether they employ these in the capture of their prey, or merely as defences against the predatory fishes, such as the rays and ground sharks, which have the mouth on the under side, has not been ascertained.

Of course the star-gazers, like all other bottom fishes, have the abdominal fins jugular or under the throat, in advance of the pectorals. They have the head of a cubical form, with the eyes on the top (hence the name); they have the mouth cleft vertically, the operculum toothed in the under side, a strong spine on each shoulder, and six rays in the gills. They have within the mouth a sort of filament which they are said to put out, as a lure to small fishes, as they lurk in the mud ready to receive the dupes into their capacious mouths. They are found in the warm seas. One, the *U. scaber* of the Mediterranean, is a shapeless fish, of a greyish-brown colour with white spots, and having the spinous part of the dorsal separated from the soft part. Others have them joined. These fishes, shapeless as they are, are eatable.

URANIA (Fabricius). A genus of very singular and beautiful exotic lepidopterous insects, placed by Latreille amongst the butterflies, but evidently forming a distinct family; the antennæ are filiform with the tips setaceous; the palpi are elongated, with the last joint naked; the hind wings are tailed. Mr. MacLeay has published an interesting memoir on the genus in the Zoological Society's Transactions, detailing the natural history and habits of a West Indian species. M. Sguanzin has also published some observations at variance with those of MacLeay, in the Transactions of the French Entomological Society. The genus seems most naturally to connect the butterflies with the *Hesperris plinges*, the habits of the perfect insects being diurnal, the flight being in the hottest sunshine.

URTICA (Linnæus). A well known genus of herbs and undershrubs, found in every inhabited part of the world, and in English lists known as nettles. The flowers are monœcious, and the genus belongs to the natural order to which it gives a title, namely,

URTICEÆ. A natural order containing twenty-four genera, of which there are above two hundred species. It contains plants of very different aspect, and of very different qualities. Worthless weeds and the most useful fruits, poisonous and sanative, ugly and graceful plants, are here united; and yet there is a similarity, especially in their fibrous constituents, which connect the whole. The opponents of the Jussieuan system have fixed on this order as a decisive proof of the incongruity of the whole natural system; but their opposition is gradually subsiding, though it cannot be expected that difference of opinion on Jussieu's scheme will entirely cease until the whole is re-arranged.

There are two circumstances belonging to the history of the common nettle (*U. dioica*) worthy of notice. The first is that of the pollen being discharged from the anthers in jets like the smoke from a pistol; and secondly, that the nettle is never seen far from the habitations of man.

VACCINIEÆ. A natural order including only two genera, namely, *Vaccinium* and *Oxycoccus*. Of these there are fifty-six species already described, and are natives of North America, Europe, and Asia. The *O. macrocarpus* furnishes the cranberries sent from North America, and the *O. palustris* those of Europe. *V. myrtillus* is the well known whortleberry. The order consists of shrubby plants, with aqueous juices, round or angled stems and branches; alternate simple leaves; the petioles short and without stipules; the inflorescence is solitary or racemose, the flowers regular and united; the tube of the calyx is adnate to the germen, from four to six toothed, or entire; the corolla epigynous; the stamens in one series, and borne on an epigynous disk; filaments free, anthers terminal and prolonged into horns; the germen is inferior, surmounted by a torus, which bears both the corolla and stamens; the fruit is a berry, four or five-celled, few or many seeded. This order is now merged in *Ericaceæ*.

VALERIANEÆ. Containing five genera, and of these above fifty species; the stems are somewhat jointed, the leaves opposite and variable in form; the inflorescence in terminal, and is cymose or corymbiform panicles; the flowers are united, and either white, pink, or blue, seldom yellow or purple; the tube of the calyx is close to the germen, the limb toothed or cleft; the corolla epigynous, and also cleft; stamens five or less, borne on the tube of the calyx, the filaments free, anthers ovate and incumbent; the germen is formed of three carpels, the style filiform, and the stigmas free or concrete; the fruit is capsular, dry, and indihiscent.

The valerians are mostly ornamental, the leaves generally esculent, and used as salad; instance, *V. olitoria*, the lamb's-lettuce; the roots of the perennial species are aromatic, and highly stimulating. The natives of India employ the roots of *V. jatamansi* as a perfume; it forming the spikenard of the ancients. The species are all easy of cultivation

in the open ground, and increased by division or seeds.

VALLISNERIA (Linnæus). A genus of Italian and New Holland aquatics, of very curious character. The flowers are dicœcious, and belong to *Hydrocharideæ*. The European species grow in Italian ditches of considerable depth. The female flowers are borne on long spiral foot-stalks, and which rise and float on the surface and there expand. The male flowers are produced on a separate, and often a distant plant, and on very short foot-stalks; but when these are nearly ready to bloom, they are detached from their mother plant, and, ascending to the surface, float about among the female flowers, where impregnation takes place. The females, so soon as this takes place, again shrink to the bottom to perfect the seed. The late Mr. Sweet was of opinion, that these plants might be grown in deep ponds in this country.

VANESSA (Fabricius). A very extensive genus of lepidopterous insects, belonging to the section *Diurna*, or butterflies, and family *Nymphalidæ*, having the antennæ terminated in a short abrupt club; the wings are angulated, the larvæ very spinose, and the chrysalis suspended by the tail without any girth round the middle of the body. In this genus are comprised some of our most splendid British butterflies; the red admiral (*V. Atalanta*); the Camberwell beauty (*V. antiopa*); the peacock (*V. io*); the large and small tortoise-shells (*V. polychloros* and *Urticæ*); and the comina (*V. C. album*), all belong to this genus. They are, for the most part, of such common occurrence, as to render minute description unnecessary.

VANILLA (Swartz). A genus of climbing orchideous plants, natives of tropical America. One of these is the old *Epidendron vanilla* of Linnæus, the roots of which are used for flavouring chocolate, and also for perfuming snuff. They are grown in damp moss in our stoves, and require a rough barked stump, or a tree, or other support to climb upon.

VELIA (Latreille). A genus of water bugs (*Hydrometridæ*), having the legs formed for skimming along the surface of water, of moderate length, and placed at equal distances from each other. See article Insect, vol. ii., p. 842, figures 44, 45, for representations of these insects.

VERATRUM (Linnæus). A remarkable genus of hardy herbaceous plants, bearing polygamous flowers, and belonging to the natural order *Melanthaceæ*. From the beauty of their foliage, and stately spike of flowers, the species are worthy a place in every flower-garden. They are increased by division or by seeds, which must be sown as soon as they are ripe.

VERBASCUM (Linnæus). A numerous genus of biennial and perennial herbs, mostly natives of Europe. The flowers are pentandrous, and the genus belongs to *Solaneæ*. The mulleins are well known British hedge plants, though some of them are admitted into the garden.

VERBENA (Linnæus). A genus of annual, biennial, and perennial herbs, chiefly natives of America; and their character is so peculiar, as to be taken as the type of the order

VERBENACEÆ. Containing twenty-nine genera, and two hundred and seventeen species already described in books. It is an order composed of plants of very various habits, lofty trees, and diminutive herbs, bearing conspicuous or colourless flowers, and with ample or attenuated foliage. The inflorescence is solitary or aggregate, spicate, capitulate, or corymbiform, and both irregular and united; the calyx is free, tubular, with a divided limb, and persistent; the corolla is hypogynous, tubular, with a five-lobed limb, more or less irregular, and deciduous; the stamens four or five, didynamous, sometimes only two exserted from the tube of the corolla, and alternate with its lobes; filaments are free, the anthers adnate, two-celled, and bursting lengthwise by chinks; the germen is free, and formed of two connate carpels; the style one, and the stigma scarcely divided. The vervain was a sacred plant, and in the Druidical superstitions, was regarded with reverence. To ancient superstitions is still owing its repute as a medicine, as it was long esteemed as a potent ingredient in love philtres. It is slightly bitter and astringent; but its influence over disease or passion is merely imaginary. *V. Lamberti*, and *V. aubletia*, are ornamental plants; but the most useful in the order is the famous *Tectona Indica*, or teak-tree of the oriental forests. Its trunk is sometimes seen above two hundred feet high, especially about Malacca and the neighbouring islands; and for ship-building is almost equal to the oak.

VERBESINA (Linnæus). A genus of shrubs and herbaceous perennials, mostly natives of central America. Their flowers are mostly yellow, and belong to *Compositæ*. Different species of *Verbesina*, according to the country they come from, require the stove or greenhouse, and some of them are hardy, grow tall, and take their place in the shrubbery.

VESPA (Linnæus); Vespidæ, (Leach). The wasp family. See Wasp. The hornet is also one of the large species of this genus, being systematically under the name of *Vespa crabro*.

VIBURNUM (Linnæus). A genus of evergreen and deciduous shrubs, natives of both North America and Europe. They belong to the fifth class of Linnæan botany, and to the natural order *Caprifoliaceæ*. The species are almost all ornamental shrubs, some of them decidedly so, as the *V. tinus*, *laurustine*, and the *V. opulus*, the guelder-rose. The *V. rugosum*, and the *V. odoratissimum*, are greenhouse species, and handsome plants. The hardy sorts are chiefly propagated by layers, the more tender sorts by cuttings.

VICIA (Tournefort). A numerous genus of climbing annual and perennial herbs, mostly natives of Europe. The flowers are diadelphous, and the genus belongs to *Leguminosæ*. Vetch is the common name of this genus of plants. Several of them are useful agricultural objects, being in most seasons the earliest green forage that can be cut for cattle.

VIOLA (Tournefort). This favourite genus gives a title to Jussieu's natural order of

VIOLARICEÆ, and which comprises twelve genera, and one hundred and thirty-five species. The greater part are hardy herbaceous plants, some of which are attractive for their perfume, others for their varied colours, and all for their neatness. The generic character of *Violaricæ* is expressed briefly thus: apopetalous, angiospermous, dicotyledous, with the sepals imbricate, and the petals obliquely convolute in æstivation; the stamens equalling the petals in number (five); the filaments elongated beyond the anthers, style one and undivided; ovarium one-celled, with narrow placenta, opening laterally; the seeds albuminous, the embryo erect, and the leaves furnished with stipules.

It is said that there are some suffrutescent violets in intertropical countries which have not yet been introduced into this country; but all the hardy sorts have been long admitted in the flower-garden for placing on rock-work and shady borders. The *V. tricolor* is now cultivated under the name of pansies, or heartsease, most extensively by professional florists, who have originated numerous varieties, excelling in size, colour, and variety, all that were before known. They are all readily increased by parting the root, or by seed.

VIPER (*Vipera*). A genus or rather family of poisonous serpents, having poison fangs unaccompanied by other teeth. They occupy the same place in the eastern continent that the *Crotali* (rattlesnakes and triangular-headed snakes) occupy in America, and with them include the whole of the land *Ophidi* which have poison fangs; the other poisonous serpents have common teeth along with their poison fangs, and are all aquatic in their habits, constituting what is called the *Hydra* family.

The vipers of the eastern continent are more numerous and varied in their species than the *Crotali* of the western; but taking them on the whole, they are not so formidable in their appearance or so deadly in their venom. There are, however, exceptions to this, depending partly on the species and partly on the warmth of the climate and the season; and in those extreme cases wounds inflicted by any small ones are attended with the most fatal consequences.

The vipers occupy the same place, both in the system and on the globe, among the poisonous serpents, which is occupied by the colubers, among the true serpents which are not poisonous; and as they have the plates under the tail double as well as the colubers, they have been confounded together, and the poison of the vipers has been imputed to the others which are certainly not poisonous. This confusion of two sections of animals so very different, as those are in the character which gives them their chief interest with mankind, has often been productive of double mistakes. The harmless colubers have been persecuted as if in possession of deadly venom, and people have been terrified at them; on the other hand, some have, from experience of the harmless nature of the colubers, been led to tamper with the adders, and have paid dearly for their temerity. The true criterion as to whether a serpent is or is not poisonous, is the presence or the absence of the poison fangs.

The poisonous ones are also less lively in their motions, as the few serpents which are harmless are less lively than the snakes; the principal distinctions are, however, to be sought in the appearance of the species. There is one character which prevents the vipers from being confounded with those poisonous representatives in the west, the crotali. The last have second or posterior lappets to the nostrils, and the vipers have not. Practically this distinction is of very little consequence, as the two are never found in the same places, and as, though they were, they are equally to be avoided.

The viper family, or rather tribe, admits of subdivision into four sections; the first having the scales on the head of nearly the same size and character as those on the upper part of the body, and this is a distinction between them and the non-venomous colubers. The second have large plates on the top of the head, resembling those of the colubers, but they have the poison fangs apart like the former; the third, the tail flattened like an oar for swimming, or otherwise different from the typical vipers; the fourth have the poison fangs in the same row with other maxillary teeth, only larger in size, and the scales on the belly and tail like those of the *boa* and *crotalus*, but as they do not inhabit the same part of the world as either of these, there is no danger of confounding them in wild nature. They make in all ten genera, or subgenera, in Cuvier's arrangement.

VIPERA—Vipers, properly so called, or those which have the scales on the head similar to those on the back; but some even of these have differences in this respect.

Common Viper (*V. berus*). This is the only poisonous serpent which occurs in Britain, and it is not very common or very dangerous, except in very dry and warm parts of the country, and during the hot season. Being the only British reptile whose bite is in the least to be dreaded, we shall be more particular in our notice of it, but it seems subject to some varieties of colour. Its length is from a foot and a half to two feet, and it greatest diameter in the latter case about one inch. The general colour on the upper part is brown or russet, but in some instances it is ash-grey. It is marked with an irregular zig-zag black line along the back, and with a row of black spots upon each flank; the belly is generally slate-grey, and covered with plates, varying in number from one hundred and forty-four to one hundred and seventy-seven; the plates on the tail are still more variable in number, being sometimes not more than twenty-nine, and in other instances as many as sixty-eight; the head is blunt and truncated in front, broader posteriorly than the neck and anterior part of the body, depressed on the tip, and a little heart-shaped; the top of the head is covered by small granulated scales, and there are six plates on the muzzle, two of which are perforated for the openings of the nostrils, and form black spots; on the upper part of the head there are two divergent black lines in the form of the letter V; the upper jaw is whitish, with small spots of black, and the under jaw is yellowish; the eyes, which are surrounded by black borders, are very small, but very clear and brilliant; the tongue is soft, very extensile and retractile, divided into two points at its extremity, and of a blackish or greyish colour. The old story of vipers being capable of poisoning with the tongue, and all the metaphorical allusions to the poisonous tongues of serpents which are founded upon it, must be placed in the category of idle stories.

The varieties of the common viper may be ranged according as one or another of the tints which enter into the general colour is the more predominant. They are accordingly red, brown, grey, blue, and black, but still these are only shades of difference, the causes of which are not known, and which occur at the same places, and even in the same family; the brown and grey, as being the intermediate tints, are the most common.

When let alone, vipers are very quiet and inoffensive animals, never in the least interfering with man or his operations, but is rather serviceable to him, by eating insects, worms, mollusca, field-mice and moles. They are active only for a portion of the year, always the shorter the more northerly the climate; and when they hybernate, a number of them are often rolled up in a bundle in the same retreat.

The females are ovoviviparous. The eggs vary from a dozen to about two dozen in number; the gestation lasts about eight months; the eggs, when matured, are about the size of those of the wren; and when the young at first burst the membrane, and come out of the oviduct of the parent, they remain some time "on the egg," as is the case with the young of the ovoviviparous fishes; but they do not, according to the vulgar statement, take refuge in the body of the mother after they have been produced. This species, and not any of the non-venomous snakes, is the *Adder* of common language, the *Neidr* of the Welsh, and the *Nathair* of the Scotch Highlanders; though the common snake often gets the name and comes in for a share of the persecution, and of all the superstitious beliefs connected with the adder. It is eagerly eaten by the wild boar, and also by various species of birds; these, however, take the precaution of bumping it on the head, or beating its head against the ground, until it is incapable of using its fangs.

It is doubtful whether the *æsprig* of Scandinavia, and some other places of the north and the east of Europe, is any thing else than the common viper.

Horned-muzzle Viper (*V. ammodytis*), is not uncommon in the valley of the Danube, and in countries further to the south. It has a soft bone covered with small scales in advance of the muzzle; but, in other respects, it differs but little from *Lucus*, though in proportion as it is a more southerly inhabitant, its venom may be presumed to be more active.

Horned Viper (*V. cerastis*). This one has a small projecting horn over each eye; it is of a greyish colour, inhabits the hot and dry parts of Africa, especially the borders of the valley of the Nile, and conceals itself in the sand.

The tufted Viper (*V. lophophris*), is an analogous species found in Southern Africa, but instead of the two projecting bones over the eyes it has two tufts of filaments.

The short-tailed Viper (*V. brachyura*), is a foreign species, with the scales on the head keeled and imbricated like those on the back; it inhabits warm regions, and is represented as being very poisonous.

The brown and white Viper (*V. hæmachates*), is a South African species, of a reddish-brown colour marbled with white; it has plates on the head very similar to those on the colubers, and the lower part of the muzzle is bevelled off.

Naia. These are, generally speaking, of small size, but they are remarkable for the virulence of their poison. They are found in very warm countries, such as India and Egypt, and lurk about ruins and among stones and rubbish. They have plates on the head, and they have the power of inflating the body immediately in the rear of the head by advancing and expanding the anterior ribs.

Naia tripudians is the most notorious species. It abounds in the warmer parts of India, where it is called *cabro capello*, hooded snake, by the Portuguese; and it is also called the *spectacled serpent*, from a black mark, something in the form of a pair of spectacles, which appears on its inflated disc. There are one or two coloured varieties, as in the common viper, but they are all equally poisonous. They are animals of some speculation; for the Indian jugglers teach them to dance and play a number of tricks, pretending to charm them; but the safest part of the charming is the extraction of the poisonous fangs.

Naia Haje. This is an Egyptian species, which has been celebrated from the remotest antiquity. The inflated neck, and often the erect attitude, which we observe in the serpent of the ancient paintings and sculptures of Egypt, is proof that this is the serpent which they made the emblem of the protecting divinity of the world, and, as such, placed it as a guard, at each side of the globe, upon the portals of all their temples. There is little doubt that, if Cleopatra did poison herself by the bite of a serpent, the haje was the *aspic* which she employed for the purpose—only it could not have been procured from the mud of the Nile, as it is not aquatic. Its markings are greenish and brown, not yellowish and bluish-brown, as in the preceding; and it cannot inflate the anterior part of the body to such a degree. It has been taken advantage of by the jugglers as well as its congener, who, by pressing its occiput, can make it as stiff as a stick, so as alternately to seem a rod and a serpent. The power that it has of erecting itself when alarmed, or otherwise excited, is probably the reason why the office of a guardian was conferred upon it.

Elaps. These have the head furnished with plates; but the bones of the anterior part of the body are very different from those of *Naia*; for, instead of the ribs being dilatable, the jaws can hardly be separated from each other in consequence of the shortness of the tympanal bones; their head, in consequence, seems one continuation with the body. They form an exception to the general geography of the vipers, in being found in the tropical parts of the American continent as well as in the East. Perhaps they ought to be formed into a distinct section. They are the *labarra* or *libarri* snakes of Guiana, and neither so large nor so formidable as the *crotali* of that part of the world. The one best known is *E. lemniscatus*, of which the ground colour is white, marked with rings of black, approaching each other in species, and one of the black rays forming the point of the muzzle. The poison of this one is much dreaded; and, as is the case with the viper of Britain, it brings part of its bad name upon some of the harmless serpents, which have the misfortune of bearing some resemblance to it in their general appearance.

There are many species of *Elaps* in different parts of the warm latitudes which resemble each other in the marking of their colours, and some of them, from the stoutness of the tail, have been called *Micruri*.

Platuri have plates on the head, and a double row on the tail, with the tail flattened for swimming. They are found in the Indian seas.

Trimeresuri have some of the plates on the tail single and others double.

Oplocephali have very large plates on the head, and all those on the tail single.

Acanthapleis will be found noticed in its place in the alphabet.

Echis, or Scytali, have the scales on the head small, and large single plates on the under side of the tail.

Langaga are but little known. They are said to be of Madagascar, to have plates on the head, the muzzle narrow and projecting, the anterior part of the tail furnished with rays which invest it all round, and the terminal part with small imbricated scales on the under side as well as the upper.

Bungari, called also Pseudoboa, or false boa, have large entire plates on the under side of the tail,

like the boa, *crotalus*, and *echis*. They have the head short, and covered with large plates, and the occiput broad; they have also a keel of enlarged longitudinal scales along the back. Their most remarkable character, however, is the compound structure of the mouth, which has the maxillary teeth of the swallowing serpents and the fangs of the poisonous ones in the same row upon the same bones. These fangs are of course not worked in the same way as those which have the poison fangs apart. Serpents of this description are natives of the East, where they are sometimes called rock serpents. Some of them grow to the length of six or seven feet.

VIRGIN'S BOWER, is the *Clematis flammula* of Linnæus, a common ornamental climbing shrub in gardens.

VISCUM (Linnæus). The *V. album*, the white misseltoe, is one of the most remarkable English vegetable productions, and often noticed in the Druidical history of the country. It is a perfect parasite, fixing itself on the stem or branches of other trees, and subsisting on their sap. The unisexual flowers are on different plants, and where these are accidentally intermixed, the female plants bear abundance of white viscid berries, forming the principal winter food of the missel thrush. When a misseltoe is found on an oak, the whole tree was formerly considered sacred by the superstitious votaries of other days, and solemn rites were performed in the shade of the tree. The seed, stuck upon the smooth bark of any tree suitable to its growth, strike root readily. The whitethorn, crab apple, lime, and several others, are frequently seen garnished with misseltoe. The plant belongs to the small order *Loranthæ*, which receives its title from the *Loranthe* of the tropics, a plant of similar character with the *Viscums*.

VOLUCELLA (Geoffroy). A genus of large dipterous insects, belonging to the family *Syrphidæ*, having the body short, robust, often hairy, and much resembling humble-bees; the antennal seta is plumose, the third joint oblong; the larvæ of several of the species reside in the nests of *Bombi* (humble bees), being parasites; and hence it is that we find them clothed in a garb very much resembling the insects upon which they are parasitic, so as, in fact, to deceive their fosterers, and permit them to enter their nests unmolested. The type is the *Musca inanis* of Linnæus. There are four other British species.

VOMIT NUT is the fruit of the *Strychnos nux-vomica*, a plant having pentandrous flowers, and belonging to the natural order *Apocyneæ*, a native of the East Indies. In our collections it is a stove plant, and propagated without difficulty.

VULTURE (*Vultur*). A genus, or more correctly, *Vulturidæ*, a family, of diurnal birds of prey, differing from the *Falconidæ*, or hawks, eagles, &c., in being not so much regulators of the numbers of living birds and small quadrupeds, as cleansers of the earth from the dead bodies of such as have perished by other means. They are the winged scavengers of the land, *par excellence*, just as the storks are the scavengers of the inland waters, the gulls on the shores of the sea, and the petrels upon the broad waters.

They are in some measure geographically reversed upon the other grand division of the *Accipitres*. The head-quarters of that division are in the north; and though they are not absolutely wanting in any one latitude, the species in the tropical countries are comparatively few and feeble; and those of the higher latitudes of the south are not very many in comparison with what are found in the north.

The vultures, on the other hand, have their head-quarters under the equator; they are, latitude for latitude, more numerous in the southern hemisphere than in the northern; and in the very high latitudes of the latter there are none. It must not here be inferred, however, that the vultures are birds of delicate constitution, capable of living only in the warm regions of the world. They are the very reverse of this; their office in nature is a rough one, and they are organised and tempered for "roughing it" through life. In their highest latitudes they are birds of the cold and wild mountains, neighbours to the perennial snow; and they very rarely descend to the plains, and when they do it is only as stragglers, or rather as strays, wholly out of their proper place.

Regions, where the weather is in extremes, not the extremes of summer heat and winter cold, as we find them in the polar countries, but the shorter and more violent changes of the weather, and the conflicts of rain and drought, occasion that kind of devastation which finds food for the vultures, and calls them in to clear the surface of corrupting matter which cannot be removed by animals of any other kind. Hyænas and jackalls may do the work very well in the plains, or in those tropical woods where the violence of the changes of weather causes a frequent destruction of animal life; but no animal having only feet as organs of motion could travel over the Alps or the Andes, or any other lofty ridge of mountains, where the food that is for them might be encircled by precipices thousands of feet in height. Nor is it much better in some of the more tangled forests, where the openings in which the dead bodies of animals are most likely to be found, are parted from each other by trees of mountain height, and fairly barricaded against the passage of an animal on foot, except at so slow a rate, as that it would inevitably perish in toiling from the place of one meal to that of another. The food is there, and the general principle of "no waste," which is so easily traceable through the whole of Nature, demands that as there is food there should also be feeders regulated to its quantity, and adapted for reaching it with the least possible exertion. Did our limits admit, we could very easily show that the vultures are the very animals who can perform this duty in Nature in the very best manner. They are birds of immense wing in proportion to the weight of their bodies; their flesh is tough and rigid; their plumage is so little liable to be injured by the weather, that nothing appears to agree better with them than thorough soakings and alternate exposures to wet and dry, as even in confinement they frequently wash themselves thoroughly, and hang out their wings to the sun and air to be dried. They can also endure hunger for very long periods of time; and when they do meet with a prize in the way of food, they can gorge to an extent equal to that of the great crushing serpents; in fact, till they lie benumbed on the ground for a considerable time. But these surfeits, as they would not fail to be in the case of an animal that fed frequent and moderately, do not appear to injure the species which naturally practise them. The time of inactivity after the full meal appears to be a time of great renovation of the system; and the matter thus obtained appears to be capable of performing the functions of life for a long time without a fresh renewal.

The general characters of the vultures are: the eyes flush with the head, and not enfonced under a brow, or standing prominent to command a horizon; the tarsi are not covered by protecting plates, but reticulated, covered with small scales let into a sort of network, as they generally are in the wading birds; the beak is long, nearly straight in the greater part of the length of its cutting edges, and hooked only in a portion toward the tip; a greater or smaller portion of the head, and even of the neck, is bare of feathers, and if not absolutely naked skin, covered only with thin short and soft down; the power of their talons is by no means in proportion to the size of the birds, and they are not much used as weapons; the bill is the member upon which they chiefly depend, and it has more the character of a cutting than of a killing instrument; their wings are so very long, that they are obliged to carry them partially expanded when they walk; they are loosely made and cowardly birds, and feed chiefly upon carrion, and rarely upon living prey. After they have gorged themselves with food, their craw forms a large protuberance beneath the furcal bone, a flow of fœtid humour distils from the nostrils, and they are often in such a state of stupidity and inaction, that they are incapable of escape or defence, and one may catch them or knock them down with a stick. Their office in Nature is a foul one, and when they have performed it, they are foul and offensive birds—but not upon that account the less in character.

Cuvier divides them into four sections, which gradually approach a little more to the *Falconidæ*, though the best formed of the vultures are very inferior to the worst-formed of that grand division of the *Accipitres*. These sections are *Vultur*, *Cathartus*, *Percropterus*, and *Gypaëtus*.

Vultur. Has the beak thick and strong, with the nostrils placed transversely at its base; the head and neck without feathers, and the skin smooth, without caruncles or warty protuberances. They have also the neck surrounded by a collar of produced feathers or down on the lower part, between the naked portion and that which is covered by the regular plumage of the body. Those which have three climacters are found in the eastern continent only; and the difference in the American ones which range in this section or subgenus will be noticed. The species have been much confounded by authors, and many ridiculous stories have been told concerning them.

The Tawny Vulture (*V. fulvus*), is a large bird, and has been long known to natural history. It is pretty generally distributed over the warmer parts of the eastern continent, occurring in the mountains. The general colour of the mature bird before it is affected by old age, is grey or brown, and fawn on the upper part; the down on the head and neck ash-colour; the collar white, or white mixed with brown; the quills and tail-feathers brown; the bill and feet leadcolour; and the belly in general white. The total length of the bird is about three feet and a half, and the extent of the wings not less than eight feet. The down on the head is very short, but it forms a sort of tuft on the occiput; the skin of the upper part of the breast over the craw is furnished with a tuft of hair, and when the craw is empty it falls in and forms a pit; but after a full meal it swells out and becomes a protuberance. It is subject to considerable varieties of colour at different ages; and additional diversities have been produced by confounding it with others. Buffon, for instance, has given the figure of it along with the description of another species.

In summer it appears in numbers on the Alps, the Pyrenees, and other mountains of the south of Europe, but it retires into Africa in the winter, over which continent it is pretty generally distributed; but it is everywhere of a roving disposition. It is not a very handsome bird under any circumstances; and when it is in a state of repose, it retracts the neck between the bones of the shoulders, and nearly conceals the head in the feathers.

The Brown Vulture (*V. cinereus*) is a more daring bird, and often larger in size than the preceding. It is more apt to attack live animals, especially such as are wounded, or in a weakly condition. It is blackish brown on the upper part, with the collar of long and bristling feathers advancing obliquely toward the nape, where there is a tuft of feathers. The feet and the naked skin at the base of the bill are bluish violet. The feathers on the tibiæ are long, and hang down considerably beyond the tarsal joints; but the tarsi themselves are not feathered, as alleged by some. Its colour changes much with age, and it is generally distributed over the wilds of the south, and also discursive.

The Eared Vulture (*V. auricularis*) is an African species of a blackish colour, with a fleshy crest on each side of the head under the openings of the ears. There is no down on the head and neck of this species; the naked skin on these is reddish and violet, that on the front of the neck black; the under part of the body is brown; the bill yellow at the base, and horn-colour toward the tip. It is a large bird, and remarkable for the stretch of its wings, which are said to be at least three times the length of the body, and that, in the full-grown bird, is not less than three feet. It is abundant in the wild and elevated districts of Southern Africa. Some of the vultures of India have a considerable resemblance to this one, only the fleshy appendages to the sides of the head and the upper part of the neck are not so prominent. It is by no means improbable that there are many varieties differing a little from these in the wild parts of central Africa and of Southern Asia.

The American vultures which have the nearest resemblance to those now described have the membrane, at the base of the bill, covered with fleshy tubercles; and in some of the species the naked parts are very fine in their tints of colour, and exhibit a brilliant play of prismatic colours; but these go off when the birds are dead.

The King of the Vultures (*V. papa*). This bird is about the size of a goose; and remarkable for its changes of colour, both at different ages and in different individuals, so that it is not easy to form any one description so as to apply to it. In its first plumage it is blackish, then it becomes variegated with yellow, next the feathers on the body are fawn colour, and the quills and collar black. The naked parts of the head are of various brilliant colours, the predominating ones being coral red and yellowish with purple; but they vary so much that they cannot be accurately described. The caruncles are toothed something like the comb of a cock. This is a bird of the low grounds rather than of the naked mountains, and it is said to nestle in holes of trees, and to have two eggs in a hatch.

The Condor (*V. condor*) is the celebrated vulture

Condor

Bearded Vulture

Egyptian Vulture

of America, of whose size, strength, and daring, so many marvellous tales have been told, that had there been any such animals as elephants in South America, it is highly probable that we should have had an account, "by eye-witnesses," of the condor flying clear over Chimberazo with an elephant in its claws. We have no room to go into its history, and it is not necessary, as it may be found any where, since Humboldt brought it within reason and reasonable dimensions. It is only a little larger than the mountain vulture of the Alps, and its habits are nearly the same; but the appendages to the naked part of the bird bring it more within the present section. The colour is blackish, with great part of the wings ash, and the collar on the neck silky and white. The male has one large carunculated membrane above the bill, and another below; but these are wanting in the female. The female is nearly of a uniform greyish brown; and the young in their first plumage are ash brown, and without the collar of feathers upon the neck. Even after all the exaggerations are discounted, the condor is a bird of no small interest. It is the most lofty-dwelling bird of the whole class; and the regions of storm and earthquake which it inhabits are of themselves well calculated to give it a very peculiar importance.

Cathartus are the vultures of North America, some of which have occasionally been confounded with the condor; and, though none of them are equal to that bird in story, they rival, if not exceed it, in size and in power. We cannot go into the details of all the species, of which there are several; and therefore we shall give a few particulars of one as a specimen.

Californian Vulture (*C. vulturinus*). This is a very large bird, about four feet and a half in length, and nearly ten feet in the stretch of the wings. It inhabits North America to the westward of the Stony Mountains, and is particularly abundant in the lower valley of the Columbia. It is a woodland bird, and does not appear to inhabit very high latitudes, though, like the vultures of the eastern hemisphere, it is more northerly in the summer than in the winter. Their general colour is brown, without any very decided markings; they nestle in the thick woods, choosing the tallest pines in the wildest and most inaccessible parts of the mountain valleys. The nest is composed of sticks and coarse grass, and the pair occupy it for many years in succession. The eggs are two, of a jet black colour, nearly round, and about the size of those of a goose. The hatching time is about the first of June, and the incubation lasts about thirty days. The young are at first covered with whitish down, and five or six weeks elapse before they are able to quit the nest.

Where these birds inhabit is truly a vulture's country, as the turns of the seasons are particularly violent both on land and at sea. Many land animals are beaten down by the rains, or overtaken by the swelling rivers; and when the storm abates, the wreck both of the land and the water is great. This is indiscriminately eaten by the vultures, which make common prize both of fishes and of land animals, and heed not much how far they may be gone in putrefaction. Their senses are keen, especially their sense of sight, and we shall not enter upon the disputed keenness of the sense of smell in vultures, which, to say the best, appears to have been most gratuitously exaggerated. When on the reconnoitre, or tracking the progress of a wounded animal, they fly very high; and, though there may not be one in sight when it falls, the carcase of a large animal speedily attracts a number of vultures; and they come to a recent carcase just as readily as to a tainted one, to that which does not smell with the same readiness as to that which does, and this is against the common notion of the acuteness of their scent. Indeed the fœtid distillation from their own nostrils is a pretty strong argument against their smelling power; a man with his nose constantly bathed in assafœtida would not be in the best condition for finding roses by the scent. "Their voracity," says the lamented David Douglas, "is almost insatiable, and they are extremely ungenerous, suffering no other animal to approach them while feeding. After eating they become so sluggish and indolent as to remain in the same place, until urged by hunger to go in quest of another repast. At such times they perch on decayed trees, with their heads so much retracted as to be with difficulty observed through the long, loose, lanceolate feathers of the collar; the wings at the same time hang down over the feet. This position they invariably preserve in dewy mornings, or after rains. Except after eating, or while guarding their nest, they are so excessively wary that the hunter can scarcely ever approach sufficiently near for even buck-shot to take effect on them, the fulness of the plumage affording them a double chance of escaping uninjured. Their flight is slow, steady, and particularly graceful, gliding along with scarcely any apparent motion of the wings, the tips of which are curved upward in flying. They are seen in greatest numbers, and soar highest, before hurricanes and thunder-storms. Their quills are used by the hunters as tubes for tobacco-pipes."

The Turkey Vulture (*C. aura*) is another American species of smaller size, and more generally distributed. It is about two feet and a half in length, and six feet in the expanse of the wings. The upper parts are nearly black, with some white markings, and the lower parts sooty brown. They are common in the United States, but leave the northern ones in the winter.

The Black Vulture (*C. atratus*) is a darker and smaller species; and so familiar that it frequents the towns, and plies as a scavenger in the streets, in which office it is protected by the inhabitants. It is about two feet two inches in length, and four feet four inches in the stretch of the wings. The general colour is dull black, with some white on the insides of the primary quills. It is a dull and sluggish bird, and the smell of it is peculiarly offensive.

Percnopterus—Black wings. These have the beak long, slender, a little bulged out of the middle of the lower mandible; the nostrils oval, longitudinal; the head only, and no part of the neck, bare of feathers. These are birds of moderate size, not nearly equalling the vultures properly so called: but still they very greedily devour carrion and all sorts of garbage, and rather than want they gorge the most foul and offensive substances. They are found in both continents.

Egyptian Vulture (*P. leucocephalus*). This is also, from its abundance in Egypt, called "Pharaoh's chicken." It is about the size of a raven. The cheeks and throat are naked; the general plumage of the male bird white, with the quills black. The female and the young are brown. This species ranges pretty discursively over the eastern continent; and it is the

only species of vulture which is recorded as having occurred in Britain, even as a rare straggler. They follow the caravans in the deserts in large flocks, in order to feed upon the camels and other animals which perish on those hazardous marches, which are fatal to the lives of so many, not only from the heat and drought, which one could readily understand, but from the piercing cold of the night which, at some seasons, follows a burning hot day. The ancient Egyptians paid divine honours to these birds, and we find them often represented in their sculptures and paintings; and, though the Mussulmans of the present day do not actually worship them, they treat them with much respect, as very important birds in a country where cleanliness is so essential, but so much neglected. It is probable that in so wide and varied a country as these vultures are scattered over, there are many varieties, some of which have been named and described as species.

Urubu Vulture (*P. jota*). This is an American species, common in the warm and temperate parts of that continent, and often confounded with the black vulture, though it is a much smaller and quite a different bird. Its habits are similar to those of the Egyptian vulture; and it renders similar services to the people. It is also about the same size, but the beak is shorter, and the plumage entirely bright black. It is this one, and not the *Atratus*, which is called the "carrion crow" in the United States. Its smaller size, more slender beak, and blacker colour, readily distinguish it from the other. There seem to be some smaller species, or at all events varieties, of this one in America.

Gypætos—Griffons. These are the most bold and powerful of all the vultures, and approach the *Falconidæ*, with which they have been associated by some describers; but still they are vultures in their essential characters. They have the eyes level with the head, and the talons feeble; their wings are half spread in repose, and their craw sticks out when full, as in the more typical vultures; but their head is entirely covered with feathers, and in the following respects they make an approach to the eagles: the bill is very strong, straight in the greater part of its length, and much hooked at the tip of the upper mandible, where it is enlarged; the nostrils are covered by rough hairs, and there are tufts of hair projecting obliquely at the gape; their tarsi are short and feathered to the toes; their wings are long, and the third quill the longest. These characters show that they have more hardship to endure than the other vultures.

The Læmmer-geyer or Lamb Vulture (*G. barbatos*) is the typical bird. This is a sturdy mountaineer, inhabiting, but not abundantly, the summits of the most wild and elevated ridges, and nestling in the inaccessible cliffs in a manner similar to the eagles. It has been perhaps more exaggerated than any other bird, except perhaps the condor. It is in all probability the *roc* of the Arabian tale; and some describers have assigned it an extent of eighteen feet in the wings, which appears to be about double the real quantity; and the length is about four feet, the tail being long and strong. The upper plumage is black, with a white line on the middle of each feather; the neck and all the under part of the body a clear fawn colour; a black band across the head; and the band or tuft of hair, which projects from the gape, black. It stands accused of carrying off lambs, goats, chamois, and even the hunters, when they are benighted and sleep on the mountains. It is also accused of hovering over the villages and carrying off children. It is further said to drive animals over the precipices, in order to feast on their mangled remains;—all of which must be taken *cum grano salis*. Still it is a formidable bird, as well on the mountains of Africa and Asia as on those of Europe.

WAGTAIL (*Motacilla*). A genus of dentirostral bird, belonging to the fine-billed section, and having some characters in common with the warblers, the greater part of which were in the older arrangements included in this genus. See Bird, Curruca, Sylvia. It has been reduced to comparatively few species.

The generic characters of the wagtails are: the bill still more slender than that of the warblers; the tail very long, and in continual motion upward and downward; the tarsi long; and the scapular-feathers so long as to hang over the turn of the wings, as in the stilt-birds, which run by the margins of the waters. In fact, the more characteristic wagtails are aquatic birds in their habits; and though they capture great part of their insect prey on the wing, they also capture a good deal while they are running, or in the shallow waters, where they perch upon stones, waiting what may come. As they are exclusively insectivorous, they do not remain during the winter in the colder latitudes, or in places where the water is apt to be frozen. Limited as the genus is in the modern system, it is, in Cuvier's arrangement, divided into two subgenera, *Motacilla*, wagtails properly so called; and *Budytes* (shepherdess).

Motacilla. These have the hind claw short and crooked, as in the rest of the fine-billed section; and they are found only near waters. There are two British species.

Pied Wagtail (*M. alba*). This species is very much distributed over the country in the summer, always near the pools and streams, to enjoy which it advances to a very considerable height up the mountains; and, though it disappears from those places as the cold weather sets in, and food for it is not to be had, it is probable that many remain during the winter. They are handsome birds, and their action in the summer is very amusing. They follow their prey in the air by leaps and jerks, accompanying them by the motion of the tail; and they leap from the ground and catch prey in the same manner. They are very familiar birds, resorting to the close vicinity of houses, and carrying on their labours about the horse-pond quite undisturbed by the cattle or the servants. They also attend the ploughs in the spring, and take their part in clearing the fields of noxious insects; and from their familiarity and their strut, one would be half tempted to believe that the little lively fellows are aware that they are performing a service. At all events, they are in their element; for the plough turns up numbers of larvæ, and also of insects, which have been hybernating in the earth. The male sings early in the season, and sweetly, though his song is neither loud nor of much compass or variety; but it sings from a low perch, at a time and in places where we do not expect to hear a song, and this adds to the effect which it produces. The nest is constructed in a hole of the bank under a stone, or in a hole of the wall, and sometimes in thick foliage near the ground. It is constructed with vegetable fibres, feathers, and wool, and lined with hair. The eggs are very small, four or

five in number, of a greyish-white colour, with light bright brown speckles; and the bird is said to have often the ungracious task of raising a young cuckoo at the expense of its own brood, though, in very many of the places where the wagtail breeds, the cuckoo could not possibly get the egg into the nest unless they sent it in a letter. The weight of this bird is about three quarters of an ounce; and the length, of which the tail forms a considerable part, seven inches and a half; the front cheeks and sides of the neck are white; the nape, the hind neck, the chin, and the throat black; the back bluish-black, more or less tinged with ash-colour; two or three of the quills next the body black; and the rest dusky, with broad white margins on the outer webs; the coverts black, the lesser tinged like the beak, and the greater with white tips; the tail-feathers black, with the exception of the distal parts of two lateral ones on each side, which are white. The female is dusky where the other has black, and much more tinged with ash-colour; in winter the black on the anterior part fades off, and is replaced by white, with the exception of a crescent on the breast. In winter many of them resort to the lower estuaries and marshes flooded at high-water, remaining in the withered herbage when the tide is full, and ranging the ground as it ebbs away.

Grey Wagtail (*M. baurala*). This species is not quite so common as the pied one, and its colours are not nearly so conspicuous. It is also more migratory. In summer the male has the principal portion of the upper part grey, and the rump and tail-coverts yellow; two white lines diverge from the gape, one over and the other under the eye, and one across the eye, joining them above and below; the throat under the white lines is black, and running with a curve downwards to the breast; the whole of the under part is yellow, bright where it joins the black on the breast, but fading as it recedes upon the belly; the wings are greyish-black, with white tips to the coverts; the tail is black, with some white on two or three of the lateral feathers; the bill and also the inside of the gape are black; and the feet are brown, marked with a yellowish garter on the tarsal joint. The female has the yellow paler, and the grey with a blackish or tarnished shade; but the male fades to the same tints in the winter. Besides being less abundant than the pied wagtails, these birds are more retiring in their habits; and thus they are much less frequently seen. They collect in the southern parts of Britain in the winter, and are then known only, or chiefly, as winter wagtails; and they quit these places in February or in March, according to the season, and spread themselves over the heights, without, however, reaching so far to the north as the other species. They breed by the streams in the upland moors of the south, but not in the low and rich places to which they resort in the winter. The nest is usually placed in the rocky banks, and seldom in a cover of vegetation. The nest is much the same as that of the pied one; but the eggs are large, of a yellowish colour, and brighter in the spots. In their more southerly haunts they have often one brood early in June, and another about the middle of July; but in less genial places they have only one about midsummer. Their food at all seasons consists chiefly of water insects and their larvæ, and very small and soft crustacea and shelled mollusca.

There is more propriety in the separating of these birds from the warblers than appears at first sight. While they were associated with these in the system, they were also associated with them in manners; whereas they are birds of a quite different habit; birds of the open air, not of the grove, altering their plumage with the seasons more than their place; and having several points of resemblance with the pipits.

Budytes. These birds are also with propriety separated from the wagtails, on account both of their structure and their haunts and habits, and their general form and action, but the claw on their hind toe is nearly straight, and lengthened as in those pipits which most nearly resemble the larks. The structure of the foot is adapted for walking upon grassy surfaces; and, accordingly, the birds are chiefly found upon them. They are insectivorous as well as the others; but they seek for insects in the fields and meadows, and follow the flocks and herds, about which there are usually numbers of insects. It is for this reason that they are called little shepherds or shepherdesses by the French, which is also the meaning of their Greek generic name *Budytes*. There is only one European species.

The Yellow Shepherdess (*B. flava*). While this bird stand in the list of the wagtails, the epithet yellow was by no means a happy one, inasmuch as there is less yellow upon it than upon the grey wagtail. The green wagtail would have been more appropriate if the generic wagtail had been retained; but as there is a difference of habit along with the difference of colour, the bird is much better in a separate genus.

It is a much rarer bird, at least much more local in its distribution, than any of the wagtails; and it is more of a migrant, and probably leaves Britain entirely in the winter. It appears in March, rears its brood about midsummer, and migrates in September, although a few appear to remain in the marine pastures near the Channel. It is but seen on its coming in the spring; and thus it has been called the "oat-seed bird" in England, and the "spring wagtail" in France. The male is olive-green above in the summer, darker on the back; the wings and tail are dusky with but little white, and the under part is yellow, bright anteriorly, and very pale backwards; The female is almost white on the under part; the nest is in a tuft or under a bush upon the ground, and never in holes of banks, or under stones; neither is the bird found hawking for insects over the water, or running on the sludgy shores, as is the case with the wagtails properly so called.

WALRUS. See Morse.

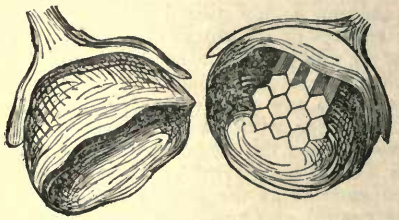
WAPITI. See Deer.

WARBLER. See Curruca and Sylvia.

WASP. The name of a well-known hymenopterous insect, belonging to the section *Aculeata*, subsection *Diploptera*, family *Vespidæ*, and genus *Vespa*. In the articles Diploptera and Odynerus we have already noticed the distribution of these insects and the habits of the solitary species of wasps. We shall therefore here confine our remarks to the social species, which constitute the genera Poilstes (which see), and *Vespa*, which, in its present restricted state, comprises only six British social species of the Linnæan *Vespæ*, the largest of which is the Hornet (which see). The five other species are of smaller size, the common wasp (*Vespa vulgaris* of Linnæus) being the type of the genus, which is distinguished by the existence of three kinds of individuals in the community, namely, males, females, and neuters, by

having the upper part of the inner margin of the mandibles as long or longer than the other part; the front of the clypeus is broadly truncate in the middle, with a tooth on each side; the abdomen is always oval or conical. Early in the spring a few large wasps may occasionally be observed flying about, and actively engaged in obtaining materials; these specimens are females which have survived the winter, harbouring in suitable places, without having deposited their eggs, which the returning warmth of the ensuing spring induces them to do; first, however, constructing a nest in some hole in the ground. Here the insect not only forms an outer covering, but constructs a layer of cells of an hexagonal form, in each of which she deposits an egg; the larva is hatched in a few days. Wasp grubs are well-known baits for anglers: they are destitute of legs, and remain within the cell in which they are born, being fed by the parent wasp; as soon as they are full grown the larva closes the mouth of the cell and becomes a pupa. In a week or ten days more this first brood appears in the winged state; but here commence the wonders of the wasp nest; all these first-born specimens are destitute of sexual instinct, being neuters, created only for the purpose of assisting their common parent in enlarging the nest, constructing fresh cells, and feeding their younger brethren, which are still in the larva state, the egg-depositing process still being continued by the old foundress wasp. It is not until the latter part of the summer that the development of the male and female wasps takes place, the latter are not, however, driven from the nest as soon as produced, as in the case of the hive-bees, and consequently there is no swarming of wasps analogous to the swarming of bees; they remain in fact for some time in the interior of the nest, only quitting it at the beginning of the autumn; they now pair, the males soon dying; but scarcely more than a dozen out of the three hundred females, of which the nest is composed, survive the winter, to become the foundresses of fresh colonies in the ensuing year. After this dispersion, the great object of the construction of the nest having been accomplished, the community is at an end, the neuters soon disperse and die, and the nest is rendered a desolate ruin. A full-sized wasp-nest is nearly a foot in diameter, of a globular form, the outer covering composed of numerous layers of a very thin substance like paper, which the wasps construct of comminuted bits of wood: this covering is more than half an inch thick. There are several (eight in a large nest before the writer at the present time) layers of cells: each of these layers is about two-thirds of an inch deep, separated from the next upper and under layers by a space of about half an inch, the layers being supported by numerous strong pillars. There are about 16,000 cells in a nest, differing in size according to the three orders of individuals composing the community; it is generally in holes in banks, &c. that the wasps construct their nests. Wasps are very ferocious creatures when disturbed, and their stings are to be dreaded. They feed upon sweets of various kinds as well as upon flesh, and other insects; they seize the common house flies with avidity, and are very fond of honey. The nests of the other British species are not to be compared in point of size with that described above. *Vespa media* of Latreille, and *Britannica*, Leach, which are probably identical, make their nests on trees, attaching them at the extremity of the branch, where they resemble, in size and colour, a Welsh wig hung out to dry. According to the author of the Insect Architecture they are more common in the northern parts of the country, being seldom met with in the south; the tree which this species prefers is the silver fir, whose broad flat branch serves as a protection to the suspended nest, both from the sun and the rain. The materials of the construction are nearly the same as those of the common wasp.

Vespa holsatica constructs its nest of a singular form; it is nearly globular, and enclosed beneath in a saucer-like covering, and is placed in the interior of granaries, or attached to the beams of unfrequented apartments. Another species attaches its nest to various low shrubs. We have been favoured with the two following sketches of a nest of this kind, of small size, found in Oxfordshire, and which consisted of about a dozen cells only. It is somewhat like the



nest figured by Rösel, which Kirby and Spence gave as that of *Vespa parietum;* but that species is solitary, and belongs to the genus *Odynerus*.

Another nest is described by Reaumur, of a depressed globular figure, composed of numerous envelopes, so as to assume a considerable resemblance to a half-expanded Provence rose. In Reaumur's specimen there were two layers of cells, and a large open space in the centre, which would most probably, in due time, have been occupied by other layers of cells.

WEEVIL. The ordinary name given to various species of coleopterous insects belonging to the family *Curculionidæ*, or the Linnæan genus *Curculio*, and more especially applied to the different species of the genus *Calandra*. See CURCULIONIDÆ and CALANDRA.

WHIRLWIG. The common English name of the *Gyrinus natator*. See GYRINIDÆ.

WHITE ANT. See TERMITIDÆ.

WILLOUGHBEIA (Scopoli). An East Indian tree, having pentandrous flowers, and belonging to the natural order *Apocyncæ*. This plant yields caoutchouc, which is extracted from it in the East, where the trees grow naturally. The plant is easily kept and propagated in the stove.

WIREWORM. This name is applied to the cylindric wire-like horny larvæ of the species of insects belonging to the coleopterous family ELATERIDÆ (which see), some of which are very destructive to young wheat and various vegetables.

WISTARIA (Nuttal). A highly ornamental genus of plants, chiefly natives of China, belonging to *Leguminosæ*. This beautiful genus has borne different names, namely, *Glycine*, *Apios*, *Dolichus*, &c. They may be increased by layers or cuttings, and are the most suitable of all other climbing plants for covering arbours, naked walls, &c.

XANTHOXYLUM (Linnæus). A genus of

shrubs and trees found in the East and West Indies, as well as in North America. The latter do well in the common garden soil, and are increased by cuttings, or by pieces of the roots. They are known as the toothache tree, and belong to *Rutaceæ*.

XEROPHYLLUM (Michaux). A genus of North American herbaceous perennials bearing hexandrous flowers, and ranking among the *Melanthaceæ*. The genus was called *Helonicus* by Nuttal. As ornamental plants they deserve notice, and require a peaty soil, where they ripen seeds, by which they may be increased.

XIPHYDRIA (Latreille; Urocerus, Jurine; Hybonotus, Klug). A genus of hymenopterous insects, placed by Latreille in the family *Tenthredinidæ*, and formed by Dr. Leach into a distinct family, *Xiphydriidæ*, but belonging to that of *Siricidæ*, having the body cylindrical, the antennæ inserted close to the mouth, slender at the tips; the ovipositor exserted. These are insects of moderate size, which live in the larva state in the stumps of trees, seeming to prefer those of willow grounds. The type is the *X. dromedarius* (*Sirex* of Linnæus), so named from the elongated neck. The other reputed British species is *S. camelus*.

XYELA (Latreille). A genus of minute but very remarkable hymenopterous insects, arranged by Latreille, but improperly, amongst the sawflies (*Tenthredinidæ*), but having the ovipositor nearly as long as the abdomen, and naked; the antennæ are elbowed, the third joint being very long; the maxillary palpi are also very long, and the wings large. Two species are only yet described, but the writer has seen several others, and possesses both sexes of a very large new species, presented to him by Dr. Klug of Berlin, with the manuscript name of *Xyela Dahlii*. Very excellent figures of the genus are given by Mr. Curtis in his British Entomology. Latreille states that the larvæ reside in the interior of vegetables, or in old wood. Brebisson named the genus *Pinicola*, in consequence of the species being found in the neighbourhood of fir plantations. There is only one British species, *X. pusilla*.

XYLOCOPA (Latreille). A very numerous genus of large exotic hymenopterous insects, belonging to the family of the bees, having the body and legs very hairy, the mandibles in the females spoon-shaped, obtuse, and guttered, with two teeth at the tips; the upper lip is horny, and ciliated above; the antennæ are very much elbowed and filiform; the fore wings have three complete sub-marginal cells, the first of which is divided by a small transparent line; the third is the largest, receiving two recurrent nerves. These bees resemble large humble-bees, and have been called carpenter bees, from their habit of constructing their nests in posts and other wooden erections. The body is generally of a black colour, often partially covered with pale-coloured hairs; the wings often stained with violet, copper, or green, and very shining. The male, in many of the species, differs considerably from the female. In a few species the eyes of the male are large and approximating, and the anterior legs are greatly dilated and ciliated. These insects are chiefly inhabitants of tropical countries, to which they give a peculiar entomological character. The type of the genus is the *Xylocopa violacea*, a species which occurs in the central and southern parts of Europe, of a black colour, with fine violet wings, the female of which constructs her cells in dry upright palings, &c., into which she first bores obliquely for an inch, then changing the direction, she burrows perpendicularly for a foot or more, her burrow being about half an inch in diameter. Having completed this burrow, she commences the construction of her cells, forming them of the gnawed wood which she has collected at a short distance from the nest. Having formed a cell at the bottom of the burrow, and filled it with a supply of pollen paste sufficient for the entire subsistence of one of her progeny (the egg of which she introduces into the pollen), she stops up the mouth of the cell with a lid of sawdust kneaded together, which serves as a floor to the superincumbent cell, proceeding in this manner until the burrow is filled. As she is several weeks in completing these operations, it is evident that the egg deposited in the lowest cell will produce the perfect insect before the rest; and in order to prevent it from disturbing the upper individuals, the parent bee has the instinct to construct a lateral opening at the bottom of the cells, which prevents the egress of the young bees as they successively arrive at perfection. None of the species of this interesting genus are inhabitants of this country.

XYLOPHYLLA (Linnæus). A genus of curious evergreen shrubs, chiefly natives of the West Indies. Their flowers are monœcious, and belong to *Euphorbiaceæ*. These plants are remarkable for bearing their flowers on the edges of the leaves. The species are easily increased by cuttings rooted in sand, under a glass, on moist peat.

YEW TREE. This common and well-known tree has been already noticed under Texas; and it may be only necessary to add here that, though placed in *Diœcia* by Linnæus, individual trees are found with both male and female flowers upon them.

YPONOMENTIDÆ (Stephens). A family of small lepidopterous insects, belonging to the section *Nocturna*, distinguished by having generally two, rarely four, palpi; the wings entire, the anterior pair mostly long and narrow, with shortish ciliæ; the posterior generally large, folded on the inner edge with long ciliæ; the body slender, elongated, and often depressed, acute in the females, and tufted at the tip in the males. These insects are of small size, but of considerable diversity in their appearance. From the *Tortricidæ* they differ in having the palpi long and slender, and from the *Tineidæ* in having only two palpi. Some of these insects reside in their larva state on flowers, upon which they subsist; others are found within the surfaces of leaves, devouring only the parenchyma; some form extensive webs, and live in society; others are solitary. Among the subcutaneous species are some of the most brilliant of the lepidoptera, their wings being adorned with highly polished scales, and some of them being extremely varied in the number of tints; others, again, are very plain; the former set have generally drooping palpi, the latter ascending recurved ones. The species, and even genera, are very numerous, including the japanned, or long-horned moths (*Adela*, Latreille), which are to be found in the early summer months hovering over bushes in great swarms, and distinguished by the great length of their antennæ; *Yponomenta*, comprising, *Y. evonymella*, *Y. padella*, &c., the larvæ of which reside in webs, and often entirely strip the white thorn hedges of their foliage; the moths being white, with numerous black spots,

whence the names of the little ermine moths, *Anacampsis, Argyromiges*, &c.

YUCCA (Linnæus). A conspicuous genus of herbaceous and half-shrubby ornamental plants, chiefly natives of America. The flowers are hexandrous, and the genus belongs to *Tulipaceæ*. The most tender sorts are kept in the greenhouse or conservatory, and the hardy species do well in the open air. They are all magnificent flowering plants, and increased by suckers.

YUNX—Wryneck. A genus of zygodactylic, or climbing birds, belonging to that portion of the order which run upon the bark of trees, and perch lengthwise upon the branches, and not to those which climb by grasping the twigs, as is done by the parrots and the allied tribes. In Cuvier's arrangement they are placed between the woodpeckers and the cuckoos, but they have most resemblance to the former. The term "wryneck" is given not because the necks of these birds are "a-wry" more than those of any other birds, but because they have a wonderful power of twisting the neck with great facility, and in all directions. It can not only be bent in any plane, but it has so much twisting motion, that the bird can turn the bill and forehead fairly round in the direction of the back; and thus, while the axis of the body remains perfectly still, the bird can, in proportion to the length of its bill, command more space, and command it with more freedom and celerity, than any known bird. This at once leads us to conclude that the bird subsists upon very small food.

The generic characters are: the bill short, straight, in the form of a depressed cone, slender at the tip, rounded on the culmen, and with the cutting-edges entire; the nostrils pierced in the grooves at the sides of the ridge of the culmen, naked of plumage, and in part covered by membrane; the tongue extensile, as in the woodpeckers, and with a horny or hard cartilaginous point, but without any barbs; the two front toes united at their bases, the two hind ones entirely free; the wings of mean length, the second quill the largest. There is only one characteristic species, which was known to the Greeks, who called it *Yunx*, and the Romans called it *Torquilla*.

Common Wryneck (*Yunx torquilla*). This bird appears in the south of England as a summer visitant, and frequents the warm and dry soils—the very opposite ones from the woodpeckers. Its chief food is ants and other little insects, which it collects with wonderful rapidity from the bark of trees, and also from the ground. Sunny days are those upon which it is especially active. It is about the size of a lark, and nearly of the same colours, only they are much richer in the tints and more beautifully mottled. The ground colour of the upper part is yellowish brown, variegated with spots of darker brown, and arrow-head lines of black; and there is a very distinct mesial line of black along the back, and especially on the neck; the under parts are greyish-white, with arrow-head spots of black, forming bars; the quills are brown, with black margins; the tail-feathers mottled brown, also margined with black; the tail-feathers are long, but they have not the stiffness of those of the woodpeckers. The bird does not require this, either in the preparation of its nest or in the finding of its food. It prefers a hole of a tree for its nest; and if it does not find one quite suitable for its purpose, it can make improvement, but it never actually digs a hole. Neither does it dig into the wood for any part of its subsistence, though it picks it fast enough from the bark. In the spring these birds are partially social; and the bird-catchers to the south of London decoy them into their snares by imitating their call-note, which has some resemblance to the cry of a small hawk, only it is more subdued and feeble. The eggs are as many as nine or ten, and they are hatched on the wood-dust in the hollow tree, without any materials placed as a formal nest. When the wryneck meets with a plentiful supply of ants, and keeps picking them up right and left, the flexures of the mesial line change so rapidly, that it appears to glide onward like a snake.

Cuvier makes the genus *Picumurus* a section of this one. See Picumnus.

ZABRUS (Clairville). A genus of coleopterous insects, belonging to the family *Carabidæ* and subfamily *Harpalides*, having the body very thick and robust; the external maxillary palpi filiform, the last joint being shorter than the preceding, the mandibles shorter than the head, &c. These are insects of moderate size, and generally black colours, which are often found in the neighbourhood of corn-fields, to which, as we learn from a memoir by Germar, the *Zabri* are often very injurious, by feeding upon the young plants in company with one of the *Melolonthidæ*. Mr. Stephens considered, however, that it was for the purpose of feeding upon the larvæ of the latter that the insects were found in company together; but Mr. Rudd has clearly proved the contrary in a memoir published in a recent number of the Entomological Magazine. The type of the genus is the *Carabus gibbus* of Fabricius.

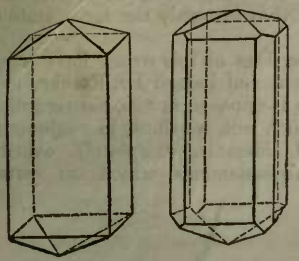
ZAMIA (Linnæus). A very remarkable genus of rigid herbaceous plants, natives of South Africa and the West Indies. The flowers are diœcious, and belong to the natural order *Cycadeæ*. This genus has somewhat the habit and character of palms, having short thick stems, crowned with a tuft of harsh much-divided fronds, from among which the florescence is produced. The *Z. Caffra* is the bread-tree of the Hottentots, its pith being extracted and manufactured into a kind of flour.

ZEA (Linnæus). An important genus in those countries suited to its growth. It is an annual belonging to *Gramineæ*, and is the famous maize or Indian corn so much extolled by the late Mr. Cobbett, as suitable for English cultivation. It has been fairly tried in this country, and in many instances with considerable success; but comparing the expense of cultivation, and the risk of the crop being injured by frost, and as food for either man or cattle, it is not to be compared with common wheat for bread, or common beans for feeding cattle; it may be superior for feeding poultry, perhaps, but poultry can scarcely be called a necessary of life to British society.

ZEOLITE, or Mesotype as it is sometimes called, is a mineral, of which there are several varieties; the acicular zeolite is of a grey or reddish-white colour. It occurs in massive, and in distinct concretions, which are both massive and granular. Its two ordinary forms are exhibited in the next page.

There is a very curious peculiarity in this mineral, which it shares with some others, but which phenomenon it is singularly well fitted to exhibit. If the zeolite be heated it shows very distinct electrical symptoms, and retains this property for some time after it has cooled; thus one extremity of the crystal

exhibits an excess of electricity, whilst the opposite end is in a negative state. Fine specimens are found



in Dunbartonshire, and some other parts of Scotland; it is also brought from America. The other forms of zeolite are more rare, and excite but little interest.

ZEUZERA (Latreille). A genus of moths, belonging to the family *Hepialidæ*, and comprising a single British species, *Z. Æsculi*, known to collectors under the name of the Wood Leopard, being of a beautiful white colour, with numerous small black spots; the male is distinguished by the antennæ, which are pectinated only half their length, the extremity being simple; the female has the abdomen terminated by a very long and retractile telescopic ovipositor, fitted for introducing her eggs in the crevices of trees. It feeds on the wood of the pear, apple, service, quince, and probably of all the *Rosaceæ*, as it is known to do on the horse-chestnut, lime, walnut, beech, birch, and oak, into which the larva bores, forming burrows half an inch in diameter, and so greatly injuring the timber. This larva is of a deep fleshy yellow colour, with black spots and a black head. It remains two years in this state and about a month in that of the chrysalis, the abdominal segments of which are furnished with reflexed hooks, enabling the chrysalis to push itself to the orifice of its burrow, so as to effect its escape without difficulty on arriving at the perfect state.

ZIMB (*Tsaltsalyia*). An insect first described by Bruce, the African traveller, but of which no subsequent information has been obtained by travellers in the deserts of Africa; so that, notwithstanding the confirmation of many of Bruce's most marvellous-seeming statements, the account of the zimb is becoming a matter of doubt. We mention it, however, in this place because we perceive that at the last meeting of the Zoological Society Mr. MacLeay called the attention of the members to this subject. "This insect," says Bruce, "is a proof how fallacious it is to judge from appearances. If we consider his small size, his weakness, want of variety or beauty, nothing in the creation is more contemptible and insignificant; yet, passing from these to his history, and to the account of his powers, we must confess the very great injustice we do him from want of consideration. We are obliged with the greatest surprise to acknowledge that those huge animals, the elephant, the rhinoceros, the lion, and the tiger, inhabiting the same woods, are still vastly his inferiors; and that the appearance of this small insect, *nay his very sound*, though he is not seen, occasions more trepidation, movement, and disorder, both in the human and brute creation, than would whole herds of those monstrous animals collected together, though their number was in a tenfold proportion greater than it really is. It is in size very little larger than a bee, and its wings, which are broader than those of a bee, placed *separate, like those of a fly*. As soon as this plague appears, and their buzzing is heard, all the cattle forsake their food, and run wildly about the plain till they die worn out with fatigue, fright, and hunger. No remedy remains for the residents on such spots but to leave the black earth, and hasten down to the sands of Atbara, where they remain while *the rains last, this cruel enemy never daring* to pursue them further. What enables the shepherd to perform the long and toilsome journey across Africa is the camel, emphatically called the ship of the Desert. Though his size is immense, as is his strength, and his body covered with a thick skin defended with strong hair, yet still he is not capable to sustain the violent punctures this fly makes with his proboscis. He must lose no time in removing to the sands of Atbara, for when once attacked by this fly, his body, head, and legs break out *into large bosses*, which swell, break, and putrify, to the certain destruction of the creature. Even the elephant and rhinoceros, who, by reason of their enormous bulk, and the vast quantity of food and water they daily need, cannot shift to desert and dry places as the season requires, are obliged to roll themselves in sand and mire, which, when dry, coats them over like armour, and enables them to stand their ground against this winged assassin; yet have I found some of these tubercles upon almost every elephant and rhinoceros that I have seen, and attribute them to this cause."

On reading this account, we are most forcibly struck with many of the circumstances connected with the habits and appearances of the *Œstridæ* (see Bot and Œstrus). We have marked in italics those passages which seem to prove that the zimb is perfectly analogous to some of the *Œstridæ*. Latreille also (Règne Anim. v. 500) expressly mentions the camel as being subject to the attacks of the *Œstridæ*; and Mr. Hope has recently read, before the Entomological Society, an account of a larva of one of the same insects which attacks the rhinoceros. It is true that each species of *Œstridæ* is peculiar to a particular quadruped; but we think by attributing part of Bruce's statement to the confusion prevailing in a desert by the maddened fury of a troop of rhinoceroses, for instance, on the appearance of *Œstrus rhinocerontes*, we shall not be very far wrong in considering the statement as a but slightly exaggerated account of circumstances seen by an eye-witness.

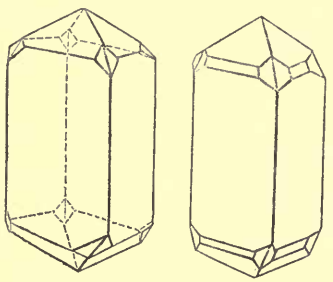
ZINC. This mineral occurs in a variety of forms, and is mostly found in collections of the metals under the name of calamine. Here it assumes the most beautiful forms, and when coloured by carbonate of copper presents a display of tints which are almost unrivalled in nature. It abounds in Somersetshire, Flintshire, and Derbyshire.

Both prismatic and rhomboidal calamine, when purified and roasted, are used in the fabrication of brass, which is a compound of zinc and copper, and the pure metal is also employed for a variety of purposes, the most important of which are comparatively new. Thus we find zinc, which was usually considered one of the hardest and most frangible of metals, rolled into thin plates, as a covering for houses and a variety of domestic utensils; and if its surface be kept bright it is especially fitted for the latter purpose, but the oxyde is injurious when allowed to corrode.

ZINGIBER (Gærtner). A useful genus of tuber-

ous-rooted herbs, having monandrous flowers, and belonging to *Scitamineæ*. This is the well-known ginger, so useful to the inhabitants of the countries where it grows wild, and also to every other part of the known world, as a wholesome spice. It is cultivated everywhere in India, and forms an important article in commerce. In Britain it is raised in very great perfection on hotbeds, for the purpose of making a preserve in its green and soft state.

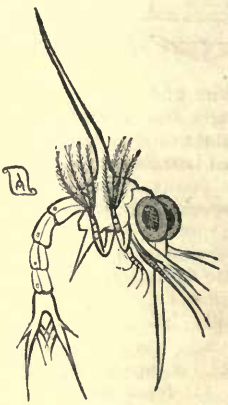
ZIRCON. This rare and beautiful mineral derives its name from the French word *jargon*, which was originally applied to all those gems, which, on being cut and polished, had somewhat the appearance of the diamond. The common *Zircon* approaches to a grey colour, and is mostly procured from the island of Ceylon. The primitive form of *Zircon*, according to Haüy, is composed of two four-sided pyramids, applied base to base. The accompanying figures furnish good views of its ordinary crystallised forms.



Zircon is found in company with the hyacinth, with which it is frequently confounded, but from which it materially differs in its colour and crystallised form. From the diamond it is distinguished by its crystallisation, greater weight, and conchoidal fracture; and from most other gems by its peculiar power of refraction. These characteristics can only be easily indicated by absolute comparison; and this points out the great advantage of cabinet collections of specimens in mineralogical pursuits. Indeed, the great increase of knowledge in this branch of science, may be mainly traced to the increase of "natural history collectors," as the practical students in the great Book of Nature are usually called. Another circumstance, and one that should never be lost sight of in tracing the progress of mineralogy, is the facility for investigation on a large scale furnished by the vast gallery now opened to the public in the British Museum. We have there spread out before us many hundred thousands of specimens procured from every quarter of the globe; and if the descriptive accounts prefixed were but a little fuller, it would still more facilitate the researches of the student.

ZOEA (Bosc). A very curious genus of small crustaceous animals, respecting which great diversity of opinion has been entertained amongst crustaceologists: the carapax is large and nearly globose, armed with remarkably long spines in front and behind, as well as at the sides; the eyes are very large; and placed on footstalks; the apparent organs of locomotion are two pairs of large bifid articulated members; but a very careful examination discovers ten other rudimental legs (the anterior pair being cheliferous) within the shells; the antennæ are four in number; and the abdomen long and furnished with a terminal apparatus for swimming. Latreille has placed these insects, which are of very small size, amongst the branchiopodous *Entromostaca*; but Mr. J. V. Thompson has, in several memoirs, asserted that they are only the larvæ state of some of the crabs.

The assertions of this writer have need of much confirmation, and indeed Dr. Rathke, to whom Mr. Thompson is opposed *in toto*, has recently published a note, which will, we think, in conjunction with his announced Memoir, completely overthrow Mr. Thompson's statements, which are certainly made



without any of that precision which is so obviously requisite in such a matter. The species here figured is from Mr. Thompson's work; it is exceedingly minute (the size being indicated in the scroll), and was discovered in the sea near Cork, and is asserted by him to be the larva of the common edible crab.

ZYGODACTYLI. Birds which habitually have two toes to the front and two to the rear, without any reversing. They are the same with the *Grimperes*, *Sconsores*, or climbers of different authors. See the article Bird, and the references therefrom, which are well worthy of attending to, as these are among the most peculiar, and therefore the most interesting, of all the birds.

ZYGŒNIDÆ (Stephens). A family of beautiful lepidopterous insects, placed by Linnæus with the *Sphinges*, on account of the similarity in the structure of the antennæ, but having a much nearer relation to some of the moths. The antennæ are generally thickened in the middle, and slightly pectinated, especially in the males. The wings, when at rest, are deflexed at the sides of the body, and very much varied in their colours, often offering glass-like spots; the abdomen is not tufted at the tip. The caterpillars are pilose, without any caudal appendage; they are not enclosed in a case, and feed on different leguminose plants. When full-grown, they form a silken cocoon, which they attach to the stern of different grasses, of a spindle-shaped appearance. They fly in the hot sunshine. Many of the species are exotic, few only being found in this country; these compose the two genera, *Zygæna* of Fabricius and *Procris* of Fabricius (*Ino*, Leach); the former comprises the Burnet moths (which are of a fine blue-black colour with scarlet spots), and the latter is composed of a single species known to collectors under the name of the green forester (*Ino statices*, Leach). They are to be found in the summer months sporting on the wing, in the hottest sunshine, over grass, &c.

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Plover, iii. 477; dotterel, 479; ring, 480; Kentish, 481; crowned, 481; black-headed, 481; spur-winged, 482; hooded, 482; Cayenne, 482; wattled, 482; double-collared, 482; red capped, 482; Wilson's, 482; kildeer, 483; black-bellied, 484
Poa pratensis, *meadow-grass*, iii. 228
Pochard, red-headed, *duck*, ii. 341; canvass-back, 342; white-eyed, 343; tufted, 343; red crested, 343
Podiceps, *grebe*, ii. 668
Podophyllum peltatum, *May-apple*, iii. 228
Podoa, *grebe-coot*, ii. 672
Pœonia suffruticosa, *moutan*, iii. 290
Pogonophorus, *leistus*, iii. 36
Pollack, *gadoidæ*, ii. 563
Polecat, common *marten*, iii. 215; Polish, 216; Siberian, 217; Javanese, 220; African, 220; Madagascar, 220; Cape, 220
Polygala vulgaris, *milkwort*, iii. 239
Polygonatum vulgare, *Solomon's seal*, iii. 699
Polygonum fagopyrum, *buck-wheat*, i. 639
Pomme de prairie, *psoralea*, iii. 501
Pond-weed, *potamogeton*, iii. 497
Poplar, *populus*, iii. 497
Poppy, *papaveraceæ*, iii. 386
Populus alba, *abele tree*, i. 2
Porbeagle, *shark*, iii. 655
Porpoise, *cetacea*, i. 790
Potentilla fruticosa, *cinquefoil*, ii. 54
Poterium sanguisorba, *burnet*, i. 646
Pouched badger, *perameles*, iii. 421
Poultry, and birds resembling poultry, *gallinidæ*, ii. 568
Pout, *gadoidæ*, ii. 561
Poyou, *armadillo*, i. 202
Pratincole, *glareola*, ii. 634
Pride, *ammocœtes*, i. 92
Primula elatior, *oxlip*, iii. 380
Primula veris, vulgaris, *cowslip*, ii. 162
Procellaria, *petrel*, iii. 427
Procyon, *racoon*, iii. 508
Proteles cristata, *aard-wolf*, i. 1
Proteus Mexicanus, *axolati*, i. 262
Prunus domestica, *plum*, iii. 484
Prunus insititia, *bullace tree*, i. 643
Prunus myrobalana, *myrobalan plum*, i. 308
Psittacus, psittacidæ, *parrot*, iii. 387
Psychotria, *cinchonaceæ*, ii. 57
Ptarmigan, *gallinidæ*, ii. 607
Pteris aquilina, brake, i. 624
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Pterophorites, *pterophoridæ*, iii. 504
Puffin, ash-coloured, *petrel*, iii. 429; sooty, 430
Puffin, *fratercula*, ii. 534
Pulicidæ, *pulex*, iii. 504
Pulmonaria officinalis, *lungwort*, iii. 65
Puma, *cat*, i. 737
Pumpkin, *cucurbituceæ*, ii. 202
Punicea granatum, *pomegranate*, iii. 496
Purre, *tringa*, iii. 813
Puss-moth, *cerura*, i. 778
Pyrus aucuparia, *mountain ash*, iii. 290
Pyrus malus, *apple*, i. 175
Pyrus sativa, *pear*, iii. 417

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Quagga, *horse*, ii. 783
Quail, Virginian, *gallinidæ*, ii. 600; californian, 601; common, 601; Chinese, 602; New Holland, 602
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Quince, *cydonia*, ii. 229
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Rabbit, *hare*, ii. 705; Siberian, 707
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Ramoon trees, *trophis*, iii. 316
Rana, *frog*, ii. 547
Ranunculus bulbosus, *butter cup*, i. 651
Ranunculus acris, *crowfoot*, ii. 181
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Rattan-seed, *calamus*, i. 664
Rattlesnake, *crotalus*, ii. 177
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Raven, *corvus*, ii. 143
Ray, *raia*, iii. 510; starry, 517; bordered, 518; small-eyed, 518; sting, 519
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Recurvirostra, *avocet*, i. 258
Redbreast, *sylvia*, iii. 750
Red Jamaica dogwood, *piscidia*, iii. 474
Redbreasted merganser, *mergus*, iii. 237
Red mullet, *mullus*, iii. 292
Redstart, *sylvia*, iii. 751; black, 752
Redwing, *thrush*, iii. 767
Reed bunting, *tringillidæ*, ii. 538
Reed pheasant, *bearded reed-bird*, i. 339
Rein-deer, *deer*, ii. 249
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Remora, *echeneis*, ii. 377
Reptilia, *reptile*, iii. 543
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Rhamnus, *buckthorn*, i. 639
Rhamphostos, *toucan*, iii. 809
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Rhipitera, *strepsiptera*, iii. 727
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Rhododendron, *ericeæ*, ii. 441
Rhubarb, *rheum*, iii. 565
Rhus toxicodendron, *poison-oak*, iii. 485
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Ribes, *currant*, ii. 214
Ribes grossularia, *gooseberry*, ii. 663
Rice, *oryza*, iii. 359
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Robinia, *halimodendron*, ii. 698
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Rodebok, *antelopes*, i. 151
Roebuck, *deer*, ii. 258
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Rose-chaffer, *cetoniidæ*, ii. 1
Rotche, *guillemot*, ii. 678
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Rubus cæsius, *dewberry*, ii. 273
Rubus chamæmorus, *cloudberry*, ii. 65
Rubus idæus, *raspberry*, iii. 526
Rubus fruticosus, *bramble*, i. 624
Ruff, *tringa*, iii. 314
Rumex nemolapathum, *grove dock*, ii. 673
Rupture-wort, *herniaria*, ii. 726
Rusa, *deer*, ii. 260, 262
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Sable, *marten*, iii. 223
Sabre-wing, *humming-bird*, ii. 805
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Safflower, *compositæ*, ii. 98
Sage palm, *salvia*, iii. 603
Sagittaria, *arrow-head*, i. 204
Sago palm, *sagus*, iii. 580
Sagonius, *monkey*, iii. 273
Saiga, *antelopes*, i. 137
Salamandra, *salamander*, iii. 580
Salicoques, *palæmonidæ*, iii. 384
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Salmo, Salmonidæ, *salmon*, iii. 587
Salsify, *tragopogon*, iii. 811
Salsola soda, *chenopodeæ*, ii. 20
Saltwort, *salsola*, iii. 603
Salvia sclarea, *clary*, ii. 60
Sambucus nigra, *elder*, ii. 397
Samolus, *brook-weed*, i. 632
Samphire, *crithmum*, ii. 174
Samver, *deer*, ii. 260
Sandal-tree, *sandoricum*, iii. 604
Sand-eel, *ammodytes*, i. 92
Sandwort, *caryophylleæ*, i. 709
Sanguinarea Canadensis, *bloodwort*, i. 530
Santolina, *latiospermum*, iii. 33
Sapajou, *monkey*, iii. 271
Sapajous, *ateles*, i. 229; *cebus*, i. 757
Sarcophalus esculentus, *Guinea peach*, ii. 679
Sasin, *antelopes*, i. 137
Saturnia, *attacus*, i. 245
Satyrium viride, *frog orchis*, ii. 553
Satyrus, *hipparchia*, ii. 746
Savine, *coniferæ*, ii. 130
Savory, *satureja*, iii. 607
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Saw-wort, *serratula*, iii. 647
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Saxifraga umbrosa, *London pride*, iii. 58
Scabious, *dipsaceæ*, ii. 287
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Scarabæus, *dynastes*, ii. 346
Scarabæus melolontha, *cockchafer*, ii. 73
Scarlet-feathered Indian bird, *cassicus*, i. 712
Scarlet-flowering chestnut, *hippocastaneæ*, ii. 748
Schubertia disticha, *deciduous cypress*, ii. 246
Schænus, *bog-rush*, i. 540
Scilla non scripta, *hare-bells*, ii. 709
Scaritides, *scaritidæ*, iii. 612
Sciurus, *squirrel*, iii. 710
Scolopax, *snipe*, iii. 694
Scolopendrium officinarum, *hart's-tongue*, ii. 710
Scolytus, *omophron*, iii. 347
Scorpionidæ, *scorpion*, iii. 630
Scorpiurus, *caterpillar*, i. 747
Scorzonera, *compositæ*, ii. 100
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Sea anemone, *actinia*, i. 28
Sea bear, *seal*, iii. 643; steller, 644; Forster's, 645
Sea-bream family, *sparus*, iii. 700
Sea cabbage, *cruciferæ*, ii. 182
Sea cow, *cetacea*, i. 793
Sea horse, *syngnathus*, iii. 767
Sea kale, *crambe*, ii. 163; *cruciferæ*, ii. 183
Sea lavender, *statice*, iii. 721
Sea lion, *seal*, iii. 644
Sea louse, *cymothoidæ*, ii. 229
Sea mouse, *cyclopterus*, ii. 228
Sea parsnip, *echinophora*, ii. 384
Sea pie, *centriscus*, i. 767
Sea rocket, *cakile*, i. 663
Sea scorpion, *cottus*, ii. 157
Sea snipe, *centriscus*, i. 767
Sea sword, *cetacea*, i. 791
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Sea wolf, *anarrhicas*, i. 101
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Sempervivum tectorum, *house-leek*, ii. 785
Sepecio vulgaris, *groundsel*, ii. 673
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Seps, *scincus*, iii. 615
Serin, *fringillidæ*, ii. 540
Serpula anguina, *siliquaria*, iii. 683
Serpula polythalamia, *septaria*, iii. 647
Serrifera, *sawfly*, iii. 608
Serropalpides, *melandryidæ*, iii. 229
Serval, *cat*, i. 743
Seseli, *meadow saxifrage*, iii. 228
Shad, *alosa*, i. 79
Shaddock, *auruntiaceæ*, i. 248
Shaddock, *citrus*, ii. 56
Shag, *cormorant*, ii. 139
Shale, *slate*, iii. 694
Shark family, iii. 648; small spotted dog-fish, 651; large spotted, 651; black mouthed, 651; white, 652; blue, 653; fox, 654; porbeagle, 655; Beaumaris, 655; grey, 657; pear grey, 657; basking, 657; picked dog-fish, 658; Greenland, 659; hammer-headed, 659; angel or monk-fish, 659; shark ray, 600; saw fish, 601
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Shearwater, *petrel*, iii. 429
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Shoveller, *duck*, ii. 336
Shrike, *lanius*, iii. 25
Sialia, *blue bird or blue robin*, i. 530
Siaming, *ape*, i. 167
Siberian polecat, *marten*, iii. 216
Siluridæ, *silurus*, iii. 687
Silvery gade, *gadoidæ*, ii. 565
Simia, *ape*, i. 161
Sinapis arvensis, *charlock*, i. 8
Sinapis nigra, *mustard*, iii. 299
Siskin, *aberdevine*, i. 2; *carduelis*, 700; black-headed or olivares, 703; aberdevine, 703; venturon, 703; Chinese, 703; pine, 703; Arkansan, 703
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Sitta, *nuthatch*, iii. 325
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Skirret, *sium*, iii. 694
Skua, *gull*, ii. 685; common, 686; polar marine, 687; Richardson's, 688; arctic, 688
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Sloth, *ai*, i. 52; *bradypus*, 624
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Snakefly, *raphidiidæ*, iii. 526
Sneezewort, *compositæ*, ii. 101
Snow-drop, *galanthus*, ii. 565
Snow-drop tree, *halesia*, ii. 697; *styracineæ*, iii. 731
Snow-flake, *leucojum*, iii. 45
Soapwort, *caryophilleæ*, i. 709
Sœmmering's antelope, *antelopes*, i. 143
Solanum dulcamara, *nightshade*, iii. 322
Sole, *flat-fish*, ii. 503
Solidago virgaurea, *golden rod*, ii. 652
Solpuga, *galeodes*, ii. 566
Sorex, *shrew*, iii. 680
Sound, *air-bag*, i. 57
Southernwood, *compositæ*, ii. 101
Sow-thistle, *compositæ*, ii. 100
Spanish broom, *spartium*, iii. 700
Spanish chestnut, *cupuliferæ*, ii. 209
Sparganium simplex, *bur-reed*, i. 646
Spartium, *broom*, i. 632
Spermaceti whale, *cetacea*, i. 788
Sphangum vulgare, *bog-moss*, i. 540
Spider-wort, *Tradescantia*, iii. 811
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Spinach, *chenopodeæ*, ii. 20
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Spine-snake, *acanthopis*, i. 12
Spinous rats, *echimys*, ii. 380
Spikenard, *valerianeæ*, iii. 819
Spike-rush, *cyperaceæ*, ii. 233
Spiræa filipendula, *dropwort*, ii 330
Spiræa ulmaria, *meadow-sweet*, iii. 228
Spiza montana, *brambling*, i. 624
Spondylus, *plicatula*, iii. 477
Spotted crow, *corvus*, ii. 151
Sprat, *herring*, ii. 741
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Springbok, *antelopes*, i. 146
Spring-grass, *anthoxanthum*, i. 160
Spuney, *caryophilleæ*, i. 709
Spurry, *spergula*, iii. 703
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Star-gazer, *uranoscopus*, iii. 819
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Stuartia malachodendron, *malachodendron*, iii. 75
Sturgeon, *accipenser*, i. 18
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Sucker, *discobolus*, ii. 291
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Sula, *gannet*, ii. 611
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Sundew family, *droceraceæ*, ii. 330
Sunflower, *compositæ*, ii. 101; *helianthus*, 719
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Sweet basil, *ocymum*, iii. 341
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Sweet leaf, *symplocineæ*, iii. 761
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Sword-fish, *scomberoidæ*, iii. 622
Sylviadæ, *sylvia*, iii. 747
Symphytum officinale, *comfrey*, ii. 96
Syngnatha, *chilopoda*, ii. 25
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Taira, *gulo*, ii. 691
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Thalictrum flavum, *meadow rue*, iii. 228
Thapsia villosa, *deadly carrot*, ii. 243
Thar, *antelopes*, i. 138
Thea, tea, *camellieæ*, i. 682
Theobroma, *byttneriaceæ*, i. 658
Theophrasta, *clavija*, ii. 62
Thesium linophyllum, *bastard toad flax*, i. 307
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Thistle, *compositæ*, ii. 98
Thrush, iii. 794; missel, 794; song, 795; ring, 797; solitary, 797; mocking, 798; rust coloured, 801; solitary, 801; Wilson's, 801
Thuja, *arbor vitæ*, i. 187
Thyme, *thymus*, iii. 802
Tiger, *cat*, i. 727.
Tigridia pavonia, *Mexican tiger flower*, iii. 238
Tilia microphylla, *lime-tree*, iii. 48
Tillandsia, *bromeliaceæ*, i. 631
Tillidæ, *cleridæ*, ii. 63
Tinamon, *gallinidæ*, ii. 590
Tipulariæ, *tipulidæ*, iii. 804
Titan, *cytineæ*, ii. 235
Tithys, redstart, *black breasted redstart*, i. 505
Todus, *tody*, iii. 807
Tomtit, *blue cap*, i. 534
Tomogerus, *anostoma*, i. 124
Top-knot, *flat-fish*, ii. 503
Tope, *shark*, iii. 656
Torpedo, *raia*, iii. 512
Torsk, *gadoidæ*, ii. 561
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Tortoise beetles, *cassida*, i. 713
Totanus, *sandpiper*, iii. 604
Toton verdadeiro, *armadillo*, i. 202
Trachilus, *humming-bird*, ii. 789
Tragium anisum, *anise*, i. 116
Tragopogon porrifolium, *salsify*, iii. 603
Trapogon, *gallinidæ*, ii. 582
Tree-creepers, *certhia*, i. 776
Trefoil, *trifolium*, iii. 811
Trefolium, *clover*, ii. 66
Tribulus, *caltrops*, i. 670
Trichecus, *morse*, iii. 286
Triglochin, *arrow-grass*, i. 204
Trochilium, *ægeriedæ*, i. 41
Trochilus, *humming-bird*, ii. 787
Trochus, *monodonta*, iii. 284
Trochus perspectivus, *solarium*, iii. 699
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Tropæolum majus, *Indian cress*, ii. 825
Trout, *salmon*, iii. 596; salmon, 594; bull, 595
Trumpeter, *agami*, i. 46
Trumpet flower family, *bignoniaceæ*, i. 378
Truncati pennes, *brachinidæ*, i. 620
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Turbot, *flat-fish*, ii. 502
Turc, *bostrichidæ*, i. 570
Turdus, *thrush*, iii. 794
Turkey, *gallinidæ*, ii. 591
Turnip, *cruciferæ*, ii. 183
Turnip-fly, *haltica*, ii. 699
Turtle, *chelonia*, ii. 11; sea, 13; green, 13; hawk's-bill, or tortoise-shell, 15; logger-head, 15; soft, of the Nile, 16
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Tusk, *brosmius*, i. 632; *gadoidæ*, ii. 565
Tussilago farfara, *colt's-foot*, ii. 88
Tussilago petasites, *butter bur*, i. 651
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Two-toed sloth, *unau*, iii. 817
Typha angustifolia, *cat's-tail*, i. 749
Typographer beetle, *bostrichidæ*, i. 569
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Uleoiota, *brontes*, i. 632
Ulex Europæa, *furze*, ii. 556
Ulmus, *elm tree*, ii. 413
Upas tree, *apocyneæ*, i. 174
Upupa, *hoopoe*, ii. 767
Uria, *guillemot*, ii. 677
Urocerus, *xephydria*, iii. 829
Ursus, *bear*, i. 321
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THE END.

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