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ARTS AND SCIENCES

In India.

CONDUCTED BY

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THE GOVERNMENT OF BENGAL.

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PREFACE TO THE SIXTH VOLUME.

The heavy loss which the scientific world in general, more particularly the Indian portion of it, and in an especial manner the supporters of this Journal, experienced since our last annual preface was written, so paralysed our efforts, that at first we saw no alternative but to discontinue the work.

The very prompt and kind assistance, particularly of Dr. Wight and Mr. Gardner, in the department in which the death of Mr. Griffith had left so great a blank, ultimately determined us, with the aid of other friends, to continue the work, at least for the present.

It was announced in a notice prefixed to the 23rd number, that the Government had permitted the appearance of our late friend's papers in our pages, preparatory to their being transmitted to England, and authorised, in the most liberal manner, the necessary assistance for the execution of the plates connected with the Botanical portion of his labours.

The Government however on becoming further acquainted with the nature and extent of the papers in question, the difficulty of transcribing them accurately, as a precaution against accidents by sea, such as befell the similar papers and collections of the late Dr. Jack, will probably be disposed to sanction a preliminary publication of the whole in a separate form, which will have the effect of securing these invaluable records from all risk, and of rendering them at once available to the scientific interests of the country. The question as to how they are to appear being at present undecided, (though the work is progressing) we only allude to it in this place with reference to the notice above adverted to.

The discontinuance of the "Indian Journal of Medical Science," may be expected in some degree to direct towards our pages, communications of a professional character connected with Medicine. To these they have always been open, particularly such as relate to improvements in anatomy, physiology, chemistry, and materia medica. The only difference now contemplated is, that such subjects will be conducted by a distinct Editor, as far as possible, without interfering with the original character and objects of the work, except in the shape of a very marked improvement to its general interest and utility.

NOTICE.

On receipt of the melancholy intelligence of the death of our late lamented colleague, Mr. Griffith, on the 8th of March, one month after the sad event took place, the first thing decided on was to relinquish the present work, in the object and support of which he had so large a share. Since then, the generous and kind encouragement received from Dr. R. Wight, Superintending Surgeon, Madras Service, (distinguished no less by the extent and value of his botanical works, than the independent means and exertions with which they have been accomplished) Mr. Gardner Superintendent of the Royal Botanical Garden Ceylon, and Mr. Jameson Superintendent of the Botanic Gardens, N. W. Provinces, Capt. Hutton, and other scientific friends interested in the progress of the work, particularly Dr. J. Macpherson of Howrah, and Mr. A. Robertson of the Medical College, induces the editor to venture on its continuance. Engagements however trifling, directed with a view to improved knowledge, should be conducted without regard to friendships; and the loss sustained by the premature death of an ardent genius, and eminent votary of science, however paralysing and painful, should rather induce us to redouble our exertions, if not with the hope of repairing the loss, at least with the view of lessening its effects, as far as the circumstances of the case may admit of.

Extract of a letter from Dr. Wight, *dated Coimbatore 6th March,* 1845.

"I send along with this a little paper the joint production of Mr. Gardner and myself as commencement of a quarterly series of Botanical Papers from one or both of us. The modest labours of Mr. Griffith has placed your Journal in the first ranks of Botanical Periodicals. I do not anticipate that we shall be able to maintain that high tone but still, we are anxious to do what we can towards placing Indian Botany as nearly as we are able on a par with English, as exhibited in the only purely Botanical Journal published at home. Should we fail in this, I trust we will still be able to satisfy European Botanists that the Calcutta Journal of Natural History is the proper source to which all must apply who wish to be informed regarding the progress of Botanical Science in India.

Calcutta,
15*th April,* 1845.

NOTICE.

We have the pleasure to announce to our Readers, that we have received permission to print, in connection with this Journal, such portions of the Griffith MSS. as may be thought necessary to secure the priority of the Author in his Botanical researches.

To facilitate this object, the Government of Bengal has afforded the aid of the Lithographic Press, together with a portion of the establishment of native painters, &c. at the Botanic Garden, for the execution of the plates. This act of liberality has removed every obstacle to the proper appearance in due course of Mr. G.'s researches in the state in which they were left by him at the period of his death.

They will appear as supplementary numbers, as nearly as possible, at quarterly intervals, until the whole be published. The plates, an important portion of the work, will be printed in a separate quarto form to appear in fasciculi with the letter press.

Those Subscribers to the Journal who do not desire to receive such supplementary numbers, are requested to intimate the same to the Editors.

THE CALCUTTA JOURNAL OF NATURAL HISTORY.

The Natural History, the Diseases, the Medical Practice, and the Materia Medica of the Aborigines of Brazil, by DR. VON MARTIUS. *Translated by* JOHN MACPHERSON, ESQ., *Assistant Surgeon.*

Part I.—*Natural History of the Aborigines of Brazil.*

INTRODUCTION.

Although many travellers have written accounts of the physical constitution of the aboriginal American, and of the diseases dependent on it, yet the subject does not appear by any means to be exhausted. Indeed, it requires the critical attention of philosophical enquirers on that very account, for many erroneous views have been given forth, and been handed down traditionally from the time of the first discovery of the new world. It was in the spirit of that century, and it was the interest of those discoverers, to represent many things in the physical constitution of the inhabitants of the newly-found continent as strange and wonderful, and differing from the type of mankind previously known.

To this we may add, that the earliest describers of the new world, chiefly Spaniards and Portuguese, wrote according to the prejudices and prevailing opinions of their own country, and that they entertained no enlightened anthropological views regarding even the white races. The literature of the rest of Europe, being equally under the dominion of the doctrines of the middle ages, readily and without any critical examination adopted their representations, which were either one-sided, or inaccurate in details, and in consequence, they pretty generally maintain their ground up to the present day. We may quote as a striking example of the strange accounts of many points in the Natural History of the American man, the book of DePauw,* whose views, proceeding from his love of every thing strange and unusual, are not even yet quite exploded, although many other equally false pictures have, by this time, had their exaggerations detected.

As the spirit in which such enquiries are in these times conducted, is very different, it may be of some importance to give a true anthropological sketch of the Brazilian aborigines, especially as other nations of the American family have been described by Von Humboldt, Rush, Morton, D'Orbigny and others, with enlightened and unprejudiced views. Such an investigation also acquires additional interest from the fact, that the aborigines are being gradually drawn more and more into the vortex of social and civil movement, out of which an altered and new population of the Brazilian kingdom must arise; that in this movement they lose more and more their original peculiarities, and at last,—such appears to be the law of the world,—will cease to exist at all, as an independent member of the family of mankind. Every sketch, therefore, which represents the physical condition of the aborigines of Brazil at a particular epoch, must be regarded as an attempt to fix historically for that period, a race fast hastening to dissolution.

* Philosophische untersuchungen uber die Americaner. Berlin, 1769.

The Indian population of the large Brazilian empire displays a distinct individual character in all its physical peculiarities. To examine how far this marked character of the Brazilian aborigines recurs or varies in the other parts of the American continent, in short, in how far it is to be considered a more or less extensive type of the human family, is foreign to my present purpose to enquire; yet unprejudiced observation leads to the impression, that the red man, as he is found, here in the aborginal forests, there in the boundless plains of Brazil, is in all essential respects the same, and appears every where as part of one and the same race. Although I have seen him over a great extent of country, from the tropic of Capricorn to the line, from the eastern sea-coast to the boundaries of Peru and Popayan, under very various circumstances and in many different stages of social development, yet I everywhere recognised the most striking characteristics in stature, proportion of limbs, countenance, color, and hair. I must not, however, be understood to say, that the variety in the lineaments of the face, which we are accustomed to observe among civilized nations, was in any degree wanting in him. True it is, that my companion Von Spix and myself, when we found ourselves among the Indians, thought at first that we could not recognise these marked differences; but this solely arose from our not being accustomed to the striking novelty of their whole appearance, and has been the case with many other travellers in the commencement of their journies. After we had got over our first impressions, and were able to observe details, we satisfied ourselves, *that the individual physiognomies of the Indians are as varied and as distinctly marked*, as those of any other people equally low in moral, social, and intellectual development. It is but natural, that the want of varied occupations, and the absence of the different emotions and feelings, which influence civilized man, should tell on the mirror of the soul, the countenance, and deprive it of the nicer shades of expression. But this is also the case with the negro, who has had an unvarying and unindividualised countenance erroneously attributed to him by some authors.

The same is equally true of their stature, of the colour of their skin, and of their beard; those characteristics appear in great variety, and are by no means bestowed so uniformly on all, that one could say that nature had formed them strictly after one model. We see Indians in Brazil, large and small, slender and broad, copper-red, pale-yellow, nay almost white, with very weak, or, if they do not constantly extirpate them, tolerably strong beards, so that of all the physical peculiarities attributed to this race, the hair of the head smooth, straight, black and shining, growing down low on the forehead, and the beard rare and always soft, alone remain constant. (I have never observed hair frizzly, brown, red, or blonde, nor a frizzly beard.) This circumstance must convince us, that the characteristics of the Brazilian are not to be found in any exclusive mark, any more than are those of other branches of the human family. The races of men are indeed in the same condition in this respect as the so-named natural families in the vegetable world, which modern science endeavours to describe and to fix, not by a few exclusive marks, but by a union of several characteristics, a collective character.

While, however, it is not any one prominent characteristic, while it is the aggregate of all physical peculiarities, that impresses us with the idea, that the aborigines of Brazil, and of America in general, are a peculiar and independent race, yet his first glance satisfies the mind of the traveller on the subject, when he beholds the son of the wilderness in a state of freedom standing naked in his wastes. The impressions of so novel an apparition are then presented so immediately to our observation, that our awakened attention quickly embraces all its characteristics, and unites them into a picture, the colouring of which no space of time can effface in the mind of the observer. Thus, even to this day, after the lapse of many years, the picture of my fisrt meeting with the Brazilian savage remains fresh in my imagination, and I find, that the sketches, which my deceased companion Von Spix and myself drew, under the influence of our first impressions, are the best calculated to give a correct view of his physical constitution.* I mean, therefore, to insert here the most important parts of our description of them, but must remark, that the Coroados, whom we first met, are, comparatively speaking, a weak persecuted race, and that the description of the Indians given in that part of our travels (vol. i. p. 375), cannot be regarded as a favourable one.

General View of the Physical Constitution of the Brazilian Aborigines.

The Brazilian savages are on the whole, as compared with Europeans, of smaller or more middling stature. The men are four feet ten inches to five feet five inches, the women four feet three inches to four feet ten inches in height. They are all of a strong, broad, and compact make. This stature is generally pretty uniform in a tribe; we rarely observe one or two individuals more than half a head taller than their comrades. On the whole, they appear to the eye of an European taller than they really are, owing to their going naked. The head is proportionally large, the trunk muscular. The neck short and strong, the chest arched and fleshy. The women's breasts firm and not so pendulous as those of negresses, the belly well arched and prominent,

* It is now, we believe, more than 20 years since Von Martius left Brazil. Some rather vague and general description in this paper may be fairly attributed to the length of time that has elapsed since his visit. Still, besides the interest which it possesses of its own, this sketch may furnish many useful hints to parties having the opportunity or the inclination to describe any of the tribes of India, for instance, the Hill, (may we say the aboriginal ?) races. The translator has here and there added a few notes, chiefly on points of obvious analogy.—*Tr.*

with a large navel: the male organs much smaller than in any other race, and not like those of the negro in a state of persistent turgescence. The extremities short, and the lower ones, especially, any thing but full, for the calves and the buttocks are flat, while the shoulders and arms are round and muscular. Hands and feet small. The former almost always cold, with comparatively thin fingers and very short nails, which they generally pare close. The foot narrow behind, very broad in front, the great toe standing wide apart from the others;* corresponding to the width of chest, the middle of the face and the prominent cheek-bones are distinguished for their breadth. The forehead low, rough on its surface from the prominence of the frontal sinuses, above narrow and retiring, with the hair growing down very low. The back of the head does not hang nearly so far back as in the negro,† whose skull is altogether narrower and more oblong. Countenance broad and angular, not so prominent as that of the negro, but more so than that of Kalmucks and Europeans. Ears small, neat, slightly turned outwards. Eyes small, black or blackish-brown, placed sideways, with the inner corner directed towards the nose, protected by eye-brows highly arched in their centre; nose short, very slightly depressed above, flattish below; nostrils wide, turned a little outwards; the lips not nearly so large as in a negro, if either, the upper one projecting a little, or both alike; mouth small, and more closed than in the negro. Teeth very white; the incisors broad and regular, the eye teeth prominent. Chin short and

* This is always the case with people who go bare-footed: savages never turn their toes out in the degree in which civilized nations do. Catlin records, that in taking a long journey over the prairies on foot, he got over the ground much better by imitating the Indians, and turning his feet in.—Catlin, vol. i., p. 219.—*Tr.*

† It is only the prominence of the upper jaws that gives this appearance to the negro skull.—*Tr.*

rounded off.* The colour of the skin is more or less reddish like burnished copper,† varying according to the age, the occupation, state of health, and race of the individual. New-born children are almost white, or yellowish-white, like Mulattos; people when they are sick, have a brownish yellow colour. On the whole they are darker, the stronger and more active they are. The sun and the smoke of their huts may also contribute to make the skin a little darker. But such shades, depending on transient causes, are not permanent. On the inside of the flexures of the joints, the skin is lighter. The wild Indian can hardly be said to blush from shame, though he blushes from indignation. In fine, his skin is delicate, soft, shining, and, when exposed to the sun, much disposed to sweat; the sweat has a peculiar urino-scabiose smell,‡ but is not so rank as that of the negro.§

* The following remarks on the skin apply pretty generally to the natives of India, save as to the shade of colour.—*Tr.*

† I can give no better designation for the colour of the American than this, yet it varies in shade from a brownish-yellow even to a light-white, almost equalling the tint of the European. The young cells and cell-granules of the inner layer of the epidermis lying on the cutis, according as they contain more or less pigment, determine the colour of the skin. This layer is known by the name of the rete Malpighii. In the white races of men, this granular coloured layer is only to be plainly observed in particular spots, for instance the nipples, but it is more clearly recognisable in all parts of the body in Americans and negroes. Yet even the existence of this layer in Europeans is still a matter of dispute among anatomists. Flourens maintains that the skin of the American, as well as that of the negro and Mulatto, is differently constituted from that of the European; for he attributes to those races a fine pigmentary apparatus of two layers between the cutis and the two layers of the epidermis (which is wanting in the European.) German anatomists do not assume any such complexity, and consider the pigment-layers, the product of the papillæ of the cutis, as only a part of the inner, younger, and not yet firm layer of the epidermis, distinguished by a greater deposit of pigment. [General reasons are against M. Flourens' doctrine: for in the infinite variety of shade in the gradation from a coloured man to a white one, it is impossible to draw any line, which should define where these two layers cease to exist.—*Tr.*]

‡ *Urinös-scabiös:* if such a combination be more intelligible to German than to English readers, they must be a-head of us in the science of osphresiology, to use another hard word.—*Tr.*

§ Von Martius is silent on the subject of albinism, which is described as being very rare in Brazil, though so common among the Indians of the Isthmus of Darien. It is common enough in Bengal. The writer has casually observed three albinoes, all in different families, and residing in his immediate neighbourhood.—*Tr.*

His hair long, hard, tense, black, and shining, hangs down in thick disorder from his head. It is never curly, though often cherished with care, and indeed in many tribes shaved in a peculiar way, or pulled out as a national distinction. His hair is very late in getting grey, and very rarely becomes white: baldness is hardly to be found in one among a thousand. No hairs are in general observed in the axillæ or on the chest; and the hair on the male organs and chins of the men is very weak and scanty. Yet sometimes one sees an Indian with a tolerably strong black beard, but never with a curly one.

Doubts regarding D'Orbigny's Sub-divisions.

Such do the aborigines of Brazil appear in their *collective* physical characteristics, and this picture recurs in different parts of the country, from one spot to another, in such a way, that it is hardly possible to ascribe to any one or other race of this varied population individual and absolute characteristics, sufficiently strong to distinguish them from the rest. It is here just as it is in Europe, where no physiognomist would venture, from his knowledge of the physical characteristics which mark the Roman, the Celtic, the German or the Jewish races, to pronounce authoritatively on the race of any given individual. I must also expressly remark, that I recognised their collective physical peculiarities, without any material variation, in Brazilian Indians in all the provinces of the empire, and found that prominent differences depended solely on the degree of civilization of particular tribes, or on the development of individual intelligence. This makes me doubt whether we are entitled, with D'Orbigny, to distinguish three sub-divisions, or as he calls them races, of the aborigines of South America. This writer, who certainly had ample opportunities of observing many aboriginal tribes on the continent of South America, distinguishes an Ando-Peruvian race, a Pampas-Indian, and one which he calls the Brazilio-Guarani. The race of the Ando-Peruvians subdivided again into Peruvians and Antisians, east of the Bolivia Andes chain, and Araucanians, is supposed to be distinguished by olive-brown complexion, small stature, forehead little elevated and retiring, eyes horizontal, never turned upwards at the outer angle. The race of Pampas-Indians (subdivided into the Pampas Chiquitos and Moxos), is on the other hand characterised by olive-brown complexion, stature often very tall, well arched forehead, eyes placed horizontally, sometimes slightly turned upwards at the outer angle. The Brazilio-Guarani race, by yellow complexion, middling stature, slightly arched forehead, eyes oblique and raised at the outer angle.

My own observations, though made among races scattered over the space of twenty degrees or more, do not sanction any such subdivision. While in different localities, I have seen individuals removed from the characteristics ascribed to the Brazilian race by D'Orbigny, and coming nearer at one time to those of the Ando-Peruvian, at another to those of the Pampas race, yet I could not resist the conviction that the physical peculiarities common to any one race or tribe, were chiefly dependent on climatic influences, its mode of life, and whole state of development, in short, that there were *no exclusive physical marks of distinction*, for the members of a population, which, as proved by many circumstances, is now excessively mixed, and has given up the character of an independent race along with the loss of its history and national independence.*

After these more general observations, which however appeared to be necessary, in order to define the ground from which I meant to sketch my portrait, I now proceed to give

* It may be remarked that the basis of D'Orbigny's classification is chiefly geographical. The little that is known of the South American languages, scarcely aids in classifying the native races, and as far as it goes, does not seem to bear him out.—*Tr.*

an account of the most important physiological relations of the Brazilian aborigines.

Strong development of the Muscular System.

Our first glance at the American savage convinces us, that he possesses a predominant development of the muscular system. The broad compact figure, fleshy on the trunk and upper extremities, the swelling muscles, of his proportionately short arms, on his broad and arched chest, and on his short and thick neck, his light elastic regular movements, which bring him forward with surprising quickness, even while he takes short steps, his wonderful power of carrying burdens, and of continuing for hours the use of the same set of muscles,—all these are peculiarities which at once struck the first discoverers of America, and which we recognise in the Brazilian savage, whether he lives in deep aborginal forests or in open plains. Nevertheless the variety in his mode of life produces a distinct difference in the mould of his body. The inhabitants of the forests are almost always fleshier, broader and more muscular. Those of the plains again are slender and smaller-limbed, their motions are more free and supple, and they seem to set a great value on the development of muscular power in their legs, for on this account they adorn them with cotton lacing and bird's feathers, and often try to promote the development of their calves by applying round the ankles of their youths tight bands, which are never afterwards taken off. I do not, however, remember ever to have seen an Indian with calves as muscular as those which we frequently find among European mountaineers. The freer use of the legs is also accompanied by a diminution of size in the pelvic region. The savage on the other hand who lives in dense forests, where he can only take comparatively short steps, and can seldom go quickly forwards in a straight line, is almost always distinguished by a striking development of the sinews of his thorax and arms, and astonishes the European by the strength which he displays in his neck and arms in bearing immense burdens, and felling gigantic trees. An Indian willingly undertakes to carry a weight of 110 pounds on his back for ten or twelve hours, if he is attracted by the prospect of getting for his pains a bottle of brandy, or any thing else that he values. Even the strongest negro would not undertake to ply the axe for ten hours against hard tough timber, and after his work was done, dance and feast the whole night, under the intoxicating influence of the drink *caohy* (afterwards described.)

Thickness of Skin.

Along with this great muscular power, the Indian is also endowed with a special thickness and strength of skin. He is subject to a uniform insensible transpiration, but he perspires much less than the negro or the white man. When in motion, or when occupied in any active labour, the whole surface of his skin shines. Although the determination of blood to the surface is very moderate—yet he attains that shade of colour which resembles burnished copper, and, when Indians are seen dancing in this state, the colour and polish of their skin give them the appearance of living bronze figures, which the European eye views with considerable pleasure, particularly if their black shining hair flying about their shoulders, or their party-coloured ornaments of bird-feathers aid in increasing the strange novelty of the scene. In dancing, however, the Brazilian savage does not produce the immense quantity of perspiration, which in hot countries runs from the forehead and chest of other races of men, and which causes a degree of exhaustion, from which they, especially the white races, are sometime in recovering.

This comparatively small secretion of perspiration, indeed, in many cases total absence of it, even under considerable corporal exertions, gives the Indian an expression of apathetic strength. I have, however, on other occasions observed, that he often breaks out into profuse perspiration, when under the influence of any strong mental emotions. When he is frightened or startled, large drops of sweat stand on the forehead of the savage, who is otherwise so immoveable. It is as if he were suddenly attacked with a *colliquation.* And this peculiarity, which no traveller has remarked, so far as I know, harmonises with a mental trait, which especially characterises the American, I mean that sudden prostration of mind, that helpless despair, as soon as the one-sided tension of his mind, which is only maintained under a few conditions, is relaxed. For similar reasons he is often covered with a profusion of perspiration, when employed in work to which he is not accustomed, or which he dislikes, and then he ascribes the little progress he makes in it, to sudden illness or to witchcraft.

Small excitability of the Circulation.

The deficiency of perspiration in the Indian is obviously connected with the proportionately small excitability of the heart and large vessels, and perhaps even with a relatively smaller mass of blood. I cannot bring forward any direct experiments on this subject, but I may mention what many physicians in Brazil have assured me of, that the aborigines of that country possess less blood than the negro or the white man, and that they are more weakened by a comparatively small loss of blood.* One of the best observers of the habits of the North American Indians, Dr. Rush, remarks, that as compared with Europeans, their women have but a slight menstruation. Azara has given the same out regarding the women of the Charruas and Guaranis, and I can, from the accounts given me, say it of the women of Brazil. The catamenia seldom last longer than three

* This is notoriously the case with natives of Hindostan.—*Tr.*

days, are very seldom copious, and occur commonly with great regularity from month to month, at times however, along with various hysterical affections. The catamenia appear to vary little in quantity according to the season of the year. We may assume that they continue in a few cases up to the 50th year, but commonly cease between the ages of 42 and 47.* Whatever, however, may be the case as to the actual quantity of blood in the American Indian, it may be safely assumed, that from his coarse and commonly very unnutritious diet, he is often in a condition to produce only a little blood.

On the whole we may say, that the Indian, although commonly the inhabitant of warm localities, has but cold blood in his veins. For this reason, his cutaneous transpiration is scanty and cold. This strikes a European most, when he extends his hand to a red man. He then always receives a damp cold pressure, quite different from that of the Ethiopian, who has warm blood in his hand. There is perhaps some similarity in this respect with the Malays, whose hands generally feel damp and cold.†

* All this is vague and unsatisfactory, and given merely on hearsay evidence: it is probable, that the date of the appearance and of the disappearance of the catamenia is tolerably uniform in all races, especially under similar sexual relations. Even allowing for the premature marriages of this country, we find that of 127 natives of Bengal, the date of whose first menstruation has been recorded by Dwarkanath Das Bosu, the majority began to menstruate at the age of 14, the same age as that at which the majority of 1,100 women in London (Med. Gazette, vol. xxxi. p. 162,) commenced menstruating. The old belief of the very late appearance of the catamenia in women of northern latitudes, and their very early appearance in those of warmer countries, has been gradually giving way, as accurate collections of facts have been made, and must be greatly modified. The opinions of authors as brought together by Prichard, vol. i. are very confused. It might be inferred from the analogy of the vegetable world, that removal from one climate to another would influence the date of the appearance of the catamenia, and this is probably the case, but we want facts on the subject.—*Tr.*

† The cold clammy feel of the hands of the natives of India is a common subject of remark. The usual reasons assigned for it, poorness of blood, and languor of circulation, are hardly sufficient to explain it, when we remember, that according to the most trustworthy observations, the temperature of the body of man in a state of health is the same in all climates and under all circumstances.—*Tr.*

Corresponding with this coldness of the extremities, the Brazilian savage has also a small slow pulse, which has no elasticity, and yields under the pressure of the finger. In healthy men I often counted only from 55 to 68 beats in the minute; in the women, who on the whole excelled the men in liveliness, the beats were 76, 80, and more.

Inactivity of Vital Functions—Nutrition.

All that I have hitherto said regarding the physical peculiarities of the Brazilian savage, points to a want of sensibility, to an inactivity and langour of the vital functions. More close examination confirms us in this impression. The Indian has, comparatively speaking, only weak powers of assimilation. He can digest with ease only the kinds of food to which he is accustomed. He digests more easily a raw diet of over-ripe roots and fruits, or of ill-prepared flesh, than food which has been cooked and seasoned. He eats slowly, while he tears with his fingers the pieces of flesh along the course of its fibres, and chews them long. He eats at one time a large quantity of food, but digests it slowly.* He never disturbs his digestion by a second meal, as he seldom has any superfluity of food for another repast. His chief meals are usually at intervals of four and twenty hours. His feeding is slow, but regular and uniform. He keeps himself in health and strength only by a uniform course of life, and by the stimulus of the employments to which he is accustomed, and of which he is fond. When placed in an altered position, or in one that is repugnant to his habits, he immediately experiences dissatisfaction, dislike of every occupation to which his former life did not accustom him, and becomes a prey to deep depression and despondency, the process of nutrition fails, he fleshy elasticity of his limbs wastes away, and his

* American Indians are supposed to eat very large quantities of food, but Catlin says, that under ordinary circumstances, a North America Indian does not eat more than a European.—*Tr.*

constitution breaks up with visible quickness, generally along with colliquative diarrhœa. Colonists, who are in the habit of carrying off Indians in hostile expeditions, and of making use of them as servants or slaves about their farms, can amply testify as to this great liability to fall away, as to this want of all energy in the nutritive functions, especially when their accustomed stimuli to exertion are gone, or when they have to submit to a change in their mode of life; a few weeks are often sufficient to convert the strongest Indian into a bare skeleton, and to render death certain, unless his own resolution, or the assistance of his comrades, or what is a rare case indeed, the sympathy of his master restores him to his original freedom. This sudden failing of the powers of nutrition always depends on depression of spirits, and has been justly brought forward as a proof of the great power of mental influences over the Indian. For our purpose, we may consider it a proof of the weakness of the plastic system in this race of men. We shall see this more plainly, if we compare with it the analogous condition of the negro, which is too well known among slave-holders in the Brazils under the name of Banzo. This nostalgia of the black man also manifests itself in a deep melancholy, which in most cases leads to death. But while the exterior of the Indian scarcely betrays what he is suffering internally, and he seems reduced to the condition of an automatic machine, which can produce only one idea, that of flight, the negro displays an unusual elevation in all the feelings connected with his state. He broods with incessant fondness over his own melancholy thoughts, lives in an exstatic remembrance of the past, which his fancy unceasingly paints in the fairest colours, refuses to take nourishment, and appears busied with suicidal zeal and resolution in putting an end, as soon as possible, to his miserable condition by death. Nevertheless, the negro is much slower than the Indian in becoming the victim of such destructive emotions, and he often wastes away for months, until he is seized with universal dropsy, or with a galloping consumption, and is removed from a state of dependence and misery, which he seems to have felt much more deeply, than the other.*

Several other facts might be adduced to prove the especial weakness and inactivity of the nutritive system of the Indian. One instance of it is, the indolence of wounds and ulcers, which he often carries about for a long time, in a torpid state, especially ulcers of the legs, without any evident influence on his general health.

Passiveness of Nervous System.

Such a condition of the nutritive is only compatible with an unexcitable indolent one of the nervous system, and we must therefore set down as the second physical characteristic of the Indian, *a remarkable passiveness and dullness of the nervous system.* That intimate union of all organic actions among themselves, and with the higher intellectual life, which is one of the most important peculiarities of the more finely-organised man, is not found here in the same degree as in the negro, not to mention the Caucasian. All the individual powers of mind and body lie in a state of separate passiveness, unconnected with each other. All acts take place more slowly; all sympathies are more one-sided and weaker; all antagonisms less strongly marked.

Longevity.

The foregoing peculiarities naturally prepare us for the same longevity of the Brazilian Indians, that is ascribed to Americans in general. It is usually difficult to get any accurate account of the age of an Indian who is in a state of freedom. A few rare events only can be taken, as fixed points in their accounts of the length of certain periods;

* Nostalgia is common enough among natives of Hindostan.—*Tr.*

for in counting the number of years that have passed since any particular event, these people (who may be considered in some degree to be living without any time,) are never consistent with themselves. They mark the change of years, chiefly by the ripeness of particular fruits, for instance, of the chesnut (Bertholletia excelsa) along the course of the Amazon; but their accounts of the changes are almost always very imperfect and indefinite. During my travels in the neighbourhood of the Amazon, I made use as points for fixing my dates, of various expeditions made by the Portuguese, the journey of Governor Mendonça Furtado, (from 1753 to 1755,) the circuit of the judge Ribeiro de Sampayo, (from 1774 to 1775,) that of Bishop Brandao (in the years 1784-87 and 88,) and the last expedition for settling the boundary (from 1781 to 1791). The appearance among them at those periods of numerous Europeans, was a circumstance never to be forgotten by the Indians, and I have often had cause to wonder at the accuracy with which they remember many individuals and occurrences of those times. The first of those expeditions, which had been made 65 years before, was described to me by an aged Indian in Ega, who had served as guide to it, and who told me, that even at that time he had grandchildren. He must have been certainly 105 years old, yet all his senses were unimpaired, he had still many teeth, his hair was not white, but only grey, and his walk was firm and upright. This Indian was the only instance of so advanced an age that I fell in with.* Among hundreds of Indians, whom I have often seen collected on the Rio Jupurá, very few were distinguished by completely grey hair, and I may say, that comparatively few men exceeded their sixtieth year. The cause of this is not to be found in any early failure of the

* Von Humboldt mentions the death of an Indian at Lima aged 143 years, who had been married for 90 years to a woman aged 117 at the time of his death. The story however will, like many of the sort, be regarded by most people, as apocryphal.—*Tr.*

vital powers, but in the inconsiderate way in which the elders join in the chase, and in the wars, thereby subjecting themselves to sudden attacks of violent illness, which from the want of all proper medical aid, most frequently prove fatal. Women, however, are often to be seen of great age, between the years of 70 and 90. These aged creatures attain in the filth and ashes of their hearths, among which they always live, a state of decrepitude, which one cannot behold without sorrow and disgust.

Development of the Senses.

The senses of the Brazilian Indian are certainly sharp, lively, and of long endurance: but they are so developed only in certain matters, and in varied degrees. They are almost solely confined to the requirements of a life of poverty. They do not go beyond this, and they do not embrace abstract ideas: they are occupied only with the life of the next moment, are without past or future, and without the subtleties and the refinements of love, or the foresight of prudence. The savage smells with distended nostrils, whether a friend or an enemy has entered the forest, he discovers a long way off among the thickets the animal that he is in chase of, and can distinguish man or beast on the very horizon of a boundless plain; his vision of minute objects when near, is also very acute;* he hears, lying on the ground, with his ear pressed to it, the lightest footstep of the approaching foe; he wanders with instinctive certainty in the darkest night through the forest, and with his dark eyes, makes discoveries even in the thickest gloom, in which a European can see nothing; and yet the Indian is half-deaf, half-blind, half without feeling or smell. That higher degree of intelligence, the *concentrated* not the *extended*, which sports and plays with

* Dobrizhofer tells of an Abipora, who, while sitting on horseback observed a flea on the coat of a priest riding along side, dismounted, caught the flea and presented it with comic gravity to its proprietor.

nature, is wanting in him, because he never has occasion for its use. His senses in the struggle with nature only help him far enough to enable him to call out " Who's there?" when he is in danger or in difficulty. They are accustomed to work only in one direction with the instinct of an animal. They are the senses of the rude man of nature with few wants, who has not accustomed himself to connect together even the lowest mental operations, and to educate them by the power of a combining intellect. Thus his senses are not instruments for higher observations. That development of the senses, in which they act in unconscious harmony with the mind, has not been reached by him. I have often made Indians look through a microscope, to try their power of vision, and how they would take up objects; but I never found that they had actually seen anything; on the contrary, they always turned away impatient and dissatisfied.* A European does not need to be long among the Indians, before he learns to value the intellectual refinement of his own senses, and to know that those servants and messengers of his organism, are only of high value to him, when they are employed in supplying his intellectual wants, in dependence on, and in mutual union with his higher powers. Even the degree of development of the senses which Africans and Malays have attained, is far ahead of that of the red man, in spite of the cleverness and sharpness which he displays in things which are necessary to him, and within his own immediate sphere.

Narrowness of Intellect, Apathy.

The one-sidedness, I may say the simplicity, of the nervous system of the Brazilian aborigines, prepares us for the monotony of action to which their minds are subject. The

* Would not V. Martius find it the same, if he made the experiment with an ordinary peasant? This and the few following sections, from being translated literally wear a very German look.—*Tr.*

great and varied emotions, the deep-seated and mixed feelings which regulate and influence the life and action of the European, are in great measure unknown to the savage. He lives an uniform life, varied by but a few emotions. Hate and jealousy are the feelings, which when they gain the mastery of his soul, cause violent perturbations, and cloud to the very night of animalism, his dark or only partially-lit conscience. The Indian, it is true, knows that higher impulse of civilized man the love of glory, and often acts under its influence; but it would almost appear that he can only manifest negatively this natural love for distinction and praise. The Indian rests his claim to glory on stoical indifference to bodily sufferings, and on savage contempt of death. His finer and nobler feelings are often purely instinctive. Thus numberless acts of maternal love, which come under this head, are chiefly the result of direct instinctive emotions.* I cannot deny to this degraded race conjugal love and fidelity, as among their higher qualities; but the Brazilians, who live near them, do not give them credit even for this, any more than for a delicate and powerful sense of right, which the Indians may display perhaps in their intercourse with each other, but not with men of other races. Modesty is undoubtedly a trait of the Indian, but, strangely enough, it is not confined to the sexual relations, but also embraces certain physical necessities, which he endeavours with the greatest care to conceal from the eye of a second party.† If then we take a general view of all the feelings and emotions which occur in an Indian's life, we come to the conclusion, that they are few and uniform, descending unaltered from race to race, along with the rude unvarying occupations of the Nomadic warrior and huntsman, in one vitious circle, in which he ever turns round,

* Why should they not get as much credit for their maternal love as civilized nations do?—*Tr.*

† He covers up his excrement like a cat.

and finds no inducement to develop his natural powers to a state of greater variety and freedom.*

Language.

Their language, as being the most intellectual expression of the soul, that can take place through the medium of the body, deserves at least a few words of remark. I do not profess to ascribe to the dialects, which I have observed among the Brazilian aborigines, the same character that Duponceau gives to the North American languages, when he calls them *polysynthetic* and *polysyntactic.* Many different ideas are expressed at once in the shortest possible manner by the union of single verbal symbols, inasmuch as those individual symbols are connected with each other, not only in their general connexion *(totalität,)* but often as it were interwoven in their roots. Thus the condition of the *subject* is indicated not solely by its *predicate,* but by an accent according to its *connexion, state, number, place, time, &c.,* as the verb experiences certain peculiar inflexions, augments, and alterations of vowels, and sharpenings of accent. Thus long words are formed from a few broken syllables;† and are equivalent to whole sentences in those languages, which are by some grammarians termed *analytic,* as the German, or *synthetic,* as the Greek and Latin. The best marked character of the languages of the Brazilians, appears to me to consist in this, that they make the most varied use of the organs of speech‡, while they not only

* If a good deal of this account be not founded on the prejudices of the early authors, against which we were cautioned in the introduction, the South American Indian must be indeed a degenerate type of the human family.—*Tr.*

† For instance, Schoolcraft says, that the word *kuligatschis,* means "give your pretty little paw." The word is as it were agglutinated, or made up of *k,* the second personal pronoun : *uli* part of the word *wulet,* pretty : *gat,* part of the word *wichgat* signifying a paw : *schis* conveying the idea of littleness.—*Tr.*

‡ I am told, that among the Khonds of Goomsur, certain words bear opposite significations according as they are *expired* or *inspired*; a very singular fact! Is it known to occur in other languages?—*Tr.*

represent in their numerous syllables the richest change of vowels, and the quickest transition of one vowel into another, but also bring forth consonants of the most different natures, by the application of all organic means, such as hissing, smacking the lips, speaking through the nose, rattling in the throat, blowing, and whistling, and by their long-drawn-out tone give their language a sing-song sound, which is very strange to the ear of an European. I may say, that these languages bear the same relation to those of Europe, as an *enharmonic* scale does to the *chromatic* and *diatonic*, in which we perform. They make use of many more organic elements of speech than we do, but owing to their peculiar combinations, and extensive modulations, they do not attain in individual sounds, that appreciable distinctness and strength, which we are accustomed to in our languages, which are formed on a wider basis. On this account their expressions appear to us void of all harmony, and we find it so difficult to imitate them. According to the ideas of a European, there is a childish helplessness in the peculiar syntax of the Indian, but in his own mouth it gains a freedom and strength, (which the grammarian cannot fail to admire,) by means of its great richness in short, seemingly broken, but easily combining elements of speech; by its sharpness of intonation, by the changes in the modulation of the voice, and by the sudden elevations and depressions of its intensity and rhythm. The ease with which, in a language so constituted, transpositions and transmutations and running together of vowels and syllables, take place, is no doubt the main cause of the mutability and incompleteness when standing alone, of particular words, and of the enormous number of dialects into which the languages of America have become divided.*

* The variety of languages among the hill-tribes of India is very great. Thus, the languages of the Goands, the Bheels, the Coles, the Khonds and the Sourahs, are said to be quite different from each other, and to have no roots in common with those of the plains.—*Tr.*

Lymphatic Temperament, Phlegma.

From all the natural and acquired endowments of mind and body which I have described, it follows, that the Indian's temperament is lymphatic. Poor in blood, in animal heat and vitality, cramped in all those intellectual actions, which might awaken his system, supporting himself from year to year with recurring monotony on a coarse, heavy, ill-prepared, unseasoned diet, the Indian has his naturally weak system as it were steeped in crude fluids. He is an indolent, cold, heavy nature, an amphibious man. The inexcitability of his blood vessels, which, but few emotions can awaken into activity, the cold creeping circulation of his blood, the slow assimilation of scanty nourishment from a vast quantity of coarse food, and the clouded, obstinate, grovelling, sunkenness of his soul, may be fairly regarded as the elements of a specially lymphatic temperament. It shews the predominance of a phlegmatic and a melancholic disposition.*

II.—*The Diseases of the Aborigines of Brazil.*

INTRODUCTION.

We have already said enough to enable us to divine, what must be the nature of the diseases to which this race of men is subject. They are such as originate especially in the system of assimilation and nutrition: diseases of the lymphatic system.

In accordance with the slight excitability of the Indian, they run their course slowly, involve few other organs, assume a very acute character but seldom, have rarely a marked periodicity, and often terminate, without the nervous system

* Catlin's accounts of the North American Indians, though perhaps too highly coloured, paint them, *when not in contact with civilized man*, in a far more favorable light physically and intellectually, than that in which the learned Munich Professor exhibits the Brazilian Indian.—*Tr.*

suffering at all till just before death. A Portuguese physician, who had lived thirty years among the Indians, assured me "that death overtakes the dying Indian very slowly and gradually. Unconsciousness from serous effusions on the brain occurs very late, and is unusual. The patient in most cases feels a general sinking of all his powers, and if an easy death (euthanasia) consists in awaiting its approach quietly, then the Indian may be said to enjoy it in the fullest degree. He meets this change with an apathetic quiet, which is only equalled by the cool indifference of the spectators. No where is death slower in its approaches; no where is it met with greater indifference, and no where is less grief or wailing to be observed than around the death-bed of the Indian. Only at the close of the scene, when the last breath has been yielded up, when the body has become stiffened, do they reveal, in a burst of shrieks and wailing, their sense of the fearful change, which, in a sort of childish inexperience, they do not seem to have anticipated."

The dangerous diseases of the Brazilian savage are then especially *chronic*, and such as are connected with the assimilative process: obstruction, inflammation and suppuration of the mesenteric glands, of the ometum, the liver and of the spleen, dropsy, and slow fever.

Before the introduction of Europeans into the new world, the Indians died most commonly of these diseases. But since then, small-pox, and according to Indian accounts measles (sarampo) have been added. At present these acute exanthemata make the most fearful ravages among them. But in a description of the endemic diseases, the introduced ones fall into the secondary class.

The above indicated chronic affections of the assimilative organs have for their predisposing cause the natural constitution of the Indian; but they have also their more immediate causes, and among them their diet is especially influential.

Diet.

Their diet consists of game, fish, and raw or coarsely cooked vegetables. These are yams, (Dioscorea), carás (Caladium) batatas, (Convolvulus,)* the wholesome aypi root (Manihot aypi); and the poisonous mandiocca root (Manihot utilissima), the injurious properties of which are removed by the use of fire. Among their more delicate vegetable food, we find Indian corn, the only one of the Cerealia known to the Indians of Brazil. Several vegetables, for instance species of Amarantus (Carurú) and of Portulaca are cooked, sometimes alone, sometimes with powdered seeds of Sapucaya trees (Lecythis, Bertholletia.) Plantains are, like other fruits of the country, eaten raw, or boiled with water into a kind of soup. All these vegetables are used without any kind of seasoning. Flesh is either roasted on a spit or boiled with water, but is almost always eaten without any condiment. Common salt is utterly unknown to many Indian tribes.† Only the comparatively highly civilized ones in Mato Grosso, where it effloresces from the soil, are familiar with its use. A few tribes along the Amazon stream receive from their neighbours in Maynas, Peruvian rock salt, but most of the races which have not yet begun to barter with the Brazilians, make use instead of common salt, of an impure potash, which they extract from the lye of the ashes of the bark of certain trees, (Lecythis, Eschweilera, and species of Couratari, and Licania.) The continued use of this salt weakens the digestion. The only vegetable condiment employed by the Indian is the fruit of the Spanish pepper. Many species of it, for instance the Capsicum frutescens, the C. cerasiforme, and the C. pendulum, are cultivated

* Convolvulus batatas, is the common sweet potato; cassava and tapioca are both procured from the root of the poisonous Mandiocca.—*Tr.*

† Catlin says, that even in districts which have their whole surface encrusted with salt, and in which brine springs exist, the wild Indian makes no use of salt. Are the cattle that resort to the Canadian salt-licks, to be considered more civilized? —*Tr.*

in the neighbourhood of dwellings, and their berries used both ripe and unripe along with meat. The use of these condiments among the Indians is excessive. The poisonous juice of the root of the Mandiocca, when boiled down to the consistency of a fluid extract, loses its noxious properties. In it the Indian steeps a great quantity of dried berries of pepper, especially the C. cerasiforme, and makes of it a sauce, which he uses in great quantities with his food. This sauce is very heating, and often produces in persons not accustomed to its use, all the symptoms of acute poisoning. There is no doubt, that the excessive use of it is injurious to the Indians, and must favour that langour and plethora in the abdominal system to which they are naturally disposed.* On the other hand, the unseasoned flesh is also injurious, as it is often in the first stage of putrefaction before it is eaten. The nose of the Indian, it is true, is sensitive enough to the smell of tainted meat, and he will not taste it as long as he can get fresh, but he is often reduced to starvation, and then he is compelled to eat it in whatever state it may be.

At other times however, he eats besides these, many kinds of flesh, which we reckon unwholesome, such as toads and several kinds of worms. The ants which he eats dried in mandiocca flour,† are probably not unwholesome, indeed may be useful from the free Formic acid which they contain; but the like can hardly be assumed of many other insects, for instance the larvæ of the palm Chafer, (Calandra Palmarum) and of others which he preserves, for the purpose of stewing them, or of sucking out their fluids after he has bitten their heads off.‡

* According to German notions, *Plethora abdominalis* has to answer for half of the diseases to which man is subject, perhaps even for more than *sudor pedum suppressus.*—*Tr.*

† Mandiocca starch prepared in a peculiar way, when it is called *Cassaribo*, is said to possess antiseptic powers, quite equal to those of salt.—*Tr.*

‡ Ants are a favorite condiment with the Burmese and Chinese; shrimps eaten after the manner described in the text, are believed by most European school boys to have a peculiar relish.—*Tr.*

The flesh, which the Indian stores up, is either carelessly dried on some open wood-work by means of fire, or in the sun, and then rolled up in leaves of palm-trees or of a large species of plantain, and kept in the roof of his hut, which is always filled with smoke. The animal most frequently hunted for this purpose is the ape, whose flesh resembles in taste that of rabbit, but by the mode of preparation is rendered very dry and tough. These animals, after having been skinned and disembowelled, are dried, but never salted.* Of birds, the Indian collects chiefly storks, ducks, divers, herons, and lapwings. Small fishes are simply dried in the sun, packed in baskets, and placed in the smoke of the hut: large fishes, such as the Pirarucú (Sudis Gigas) are gutted and hung up in pieces to dry. The Indians are very irregular in all their domestic processes. The apes are hunted during the dry season, and remain stored up for months until the rains. In this time the flesh becomes so tough and dry, that no stomach, save that of the Indian could digest it. This is also the case with their birds. The Indian watches chiefly for the birds of passage, when they visit his settlements. The quantity of them that he kills at some seasons is so immense, that he disregards every rule of prudence and foresight in preserving them. It thus happens that he stores up a kind of food that is very indigestible, and from the quantity of oil which it contains particularly ill-suited to a warm climate. The Indian is just as careless with his fish, which being dried in the sun without any salt, is such as none but an Indian palate could tolerate. From the use of this bad oily food, diarrhœas and cæliac fluxes are common in the rainy season. Add to this the eating of unripe fruits, and we need not wonder that whole villages are attacked with dysentery, which from want

* The North American Indians have a great advantage in the plentiful supply of buffalo flesh, which they dry in the sun, without the aid of salt or smoke, and at times pound into a powder called pemican.—*Tr.*

of care, and from their bad practice of always in acute and painful diseases rushing into a running stream, takes on the worst character, and causes very great mortality.

Drinks.

The water has an equally unfavorable effect in increasing the tendency to gastric disorders. The Indian seldom settles near a spring, but generally beside a brook, or if he can, by a river. The advantage of being able to fish in it daily, the facilities of intercourse which it offers, and the increased means of attacking enemies, or of meeting their attacks which it affords, always lead the Indian to the bank of a river, or of a lake communicating with one. Thus it is along the great river streams of the Amazon, the Tocantin, the Madeira and the Paraguay. It is only in districts where there are no large sized rivers, that the Indian thinks of building his hut in more remote and elevated positions. The consequence of this is, that most of them drink river water, and that too at every season of the year, whether it may be pure or muddy. We do now and then find in the hut of a savage a large earthen vessel to let the water stand in; but he commonly drinks it fresh from the stream, from which his wife or his child fetches it in a bowl of Cuieté wood, (Crescentia Cajeti.) It is often warm, muddy, and impure in the highest degree. The Indian oarsman on the Amazon does not leave his seat to help himself from the supply of clearer and cooler water kept for the use of the master of the boat. He draws up the river water, and drinks it freely, without considering that it contains the collective impurities of the greater part of S. America. The immediate result is the production of quantities of worms which are exceedingly common in every boat's crew, and indeed in every village on the course of a river.

At the commencement of the warm rainy season, these parasites often increase in prodigious numbers, and generate worm fevers in whole districts, which being totally neglected or ill-treated, quickly carry off the affected, and especially children, and girls near the age of puberty.* I myself have had to suffer for months from a *verminose dyscrasy*, and have seen in my companions all kinds of diseases complicated with worms. It is no unusual thing to be disturbed for nights in succession by the rattling in the throats of patients, out of whose stomachs the worms creep, and cause a constant sense of choking, till they are vomited up.

The habit of drinking impure river water also causes other serious affections. The waters of the Tocantin, which in several places flow over large layers of gypsum, carry many grains of it in their stream, and cause such a disposition to stone as is hardly to be found in any other part of the world. The Rio Guamá also and the Moju tributaries are said to develop this disposition. There can be little doubt that the prevalence of calculous and nephritic diseases in Brazil may be fairly ascribed to the use of impure drinking water. In some localities in the middle and in the Northeast of Brazil, as in the provinces of Goyaz, Bahia, Pernambuco, Rio Grande do Norte and Ceara, in which the limestone formations that most dispose to calculus occur, running water is wanting, as the smaller streams get quite dried up during the long droughts. In those districts the Indians usually dig for water in the deepest parts of the bed of the river, and procure a much better and more wholesome water than their neighbours the Brazilians, who commonly make

* Worms are as frequent among the negroes as among the Indians in Guiana. In this country they are common, and especially in seamen, and in children come off long voyages. Troops proceeding on the river in country boats, [that sure mode of sacrificing life] frequently have dysentery complicated with worms. In all these cases the use of impure water is probably the main cause of their production. All kinds of parasites are most common among those whose diet is poor. Thus maggots, so often met with in the sores of natives, are rare among Europeans, and worms are more common in the former than in the latter. It is curious that Rush states he could find no accounts of worms occurring in grown-up Indians.—*Tr.*

use of cistern water, which produces various morbid affections, especially worms and diarrhœas.

No where does man set a higher value on pure, cold, pleasant water, than in those hot latitudes in which the simple element is the favourite means of quenching thirst. The settlers are on this account in the habit of selecting and tasting their drinking water, with as much care as a connoisseur among us selects wine for his table. The Indians, however, are very indifferent in the matter, and use the most impure water, satisfying themselves with at most dropping in a little of the expressed sap of fleshy leaves (such as those of the Bromeliaceæ) or the juice of fruits (for instance of the Puruma or Cactus) to clarify it.*

The water of many rivers is mild and of a pleasant taste, and may be drank without fear, especially when it is drawn from the middle of the stream, where the current is strongest. The season of the year has also to be borne in mind. The water of the Madeira and of the St. Francisco, is clear and wholesome while the river is low, but when it is full, is said to produce fever. The Jupurá in the upper parts of its course flows over beds of clay containing iron pyrites. In such places the water is unwholesome, and the Indians attribute to it the prevalence of dysentery and of dysenteric diarrhœas.†

The prepared drinks of the Indians are of various sorts, either fermented or unfermented. Of the latter, the most important one, whether we consider its intoxicating qualities, or agreeable taste, which resembles that of beer made from wheat, is the Chicha, which is prepared from the boiled seeds of Indian corn. The preparation of this drink is

* We recently noticed in a European Journal the common Indian mode of clarifying water mechanically by alum, mentioned as a novelty.—*Tr.*

† As iron pyrites is not under ordinary circumstances decomposed by running water, the unwholesomeness of the Jupurá water is probably dependent on some other cause ; we have heard well-educated medical men talk gravely of fishes becoming poisonous from feeding on beds of *copperas.* Lately the fish of the river Edin, have been poisoned wholesale, by peroxide of iron and sulphate of lime to the extent of 3½ grs. to the pint of water, introduced from a coal pit.—*Tr.*

known, and has been practised from time immemorial on the whole American continent and its islands, wherever Indian corn is grown. To set up fermentation in the decoction, we ourselves saw old women chew the seeds of corn, and then spit them into it. In like manner they produce vinous fermentation in a decoction of other fruits and roots containing sugar, for instance plaintains, Acajû (Anacardium occidentale) Batatas, and the sweet Mandiocca, root (Macajera.) Many of these kinds of wine, when kept in cool places, remain for several days, without getting sour. They are in the Tupi language commonly called Caohy or Cauim. The decoctions which they make from several of the various fruits of the forest, and which they drink when fresh made, are called Caxiri. They are oftenest made from the berries of the Assai, and the Patouá-palms (Euterpe, Œnocarpus) and from the fruit of the Bubunha palm (Gulielma speciosa.) That made from the fruit of the Œnocarpus family resembles in taste a light chocolate, and is so nutritious, that Indians get fat from its continued use. The preparation of what is called Pajuarú is more complicated. To make it, cakes of Mandiocca flour lightly baked on the hearth, are either boiled or infused in water, and then left to the vinous fermentation. The Indians also are acquainted with the means of preparing a kind of vinegar (tupi or Caui sai, that is, sour wine) from the juices and decoctions of fruits. These decoctions, as well as their fermented drinks, are drank at their evening dances and other festivals, in great excess, and to intoxication.

Influence of the Weather on the Skin.

There is another predisposing cause to disease, to which I must here particularly allude, I mean, the imperfect protection and the little care, which the Indian bestows on his skin. He goes about naked.* The light aprons

* Imperfect clothing is the main cause of most of the diseases of the cold season in the natives of Bengal, especially of rheumatism which is so prevalent.—*Tr.*

made of the inner bark of trees, of cotton, or of lace, which the women wear in some of the more civilized races, can not be regarded as articles of clothing. They are only meant for ornament, or to satisfy the requirements of modesty. Their heads too are without covering. Only such Indians as have experienced the influence of European civilization, wear shirts and short trowsers, while their women wear shifts and light gowns, with a hat or a cap, the latter generally woollen. Now although the climate of Brazil is very mild, yet it is subject to great variations, especially in mountainous parts and in the neighbourhood of the sea and of large rivers. The savage is in such places often exposed within 24 hours to a change in the temperature of 8 or 9 degrees.* It is clear that this circumstance must have a powerful effect on his health and disposition to disease. The skin of the red man, is, as already observed, uncommonly thick, and of stronger and closer texture than that of the European, it has beneath it a thick layer of fat, and besides is rendered hardy by usage from youth upwards. From this we may assume that it is but little calculated to act as an organ of reaction in the healing processes of nature, or to favour *critical* action, and by its means produce favourable secretions. The skin of the Indian is in fact unexcitable and coarse, and has not the firmness or vital energy, which might be assumed from its constant exposure.† For this reason he often catches cold. The red man is particularly susceptible of the injurious action of night dew and of moon-light: and he needs to guard himself against them with a degree of care not at all corresponding with his indifference in other matters. He is very unwilling to leave his warm hut in a damp evening:

* We found the mean temperature of the air in the neighbourhood of the Amazon to be about 81½° or 82½°, that of the surface of the river water 79¼°. In these localities the greater changes of temperature do not take place, as in the more elevated parts of southern districts.

† Many will regard all this as too theoretical.—*Tr.*

and he always protects his head at least from the moon light by a cap.* In his cabin he sleeps naked on a mat hammock. He does not protect his body by clothes, but, as he himself says by fire, which he keeps alive at all seasons of the year close to his sleeping place. If he must pass the night out of doors, he buries himself up to the head in the sand of the bank of a river, or he selects a dry place between smooth projecting tree roots, and collects a nest of leaves under and about him, or builds a light roof of palm-leaves over his sleeping place. If he must pass the night in an open field, he surrounds his body with light brush-wood or palm-leaves, of which he forms a temporary bower, and if he cannot have even this, he endeavours at least to cover his face from the night dew with brush-wood and palm-leaves. Any unusual change of temperature during the night awakens him: after that he does not sleep again, but endeavours to keep his body as much as possible in motion until morning. Nothing has such an effect in keeping an Indian awake for the whole night as cold. All these facts in the mode of life of the Indian, shew that he is by no means so much hardened against the influence of the weather as is commonly supposed. Indeed I think I may say that the European has greatly the advantage of him in this respect.† His cold nature, his inactive nervous system, his weak pulse, prepare as to believe how much he feels atmospheric vicissitudes. We are not then to be surprised if we find, that he trembles and shivers in frost and cold, and suffers from catarrhal affections in inclement weather.

* Is there any truth in the universal prejudice, that sleeping in moonlight is in itself a cause of disease, or is it merely, as some say, that when there is a clear moon, there is a clear sky, consequently a rapid deposit of moisture?—*Tr.*

† i. e. We suppose, taking the native as he is, and the European protected by clothes. The remark would certainly not apply to N. American Indians.—*Tr.*

(To be continued.)

On the Manufacture of Bar Iron in India. By Captain J. CAMPBELL, 21st *Regiment M. N. I.*

No. 3.

1. In India, our means of procuring information of the march of science in Europe are still so imperfect, that it is very difficult to find out what part of a new discovery may be known to others who have taken in hand similar investigations. We are therefore obliged to veil in obscure expressions, general descriptions which it becomes expedient to publish, to prevent the idea of the whole mode of operation becoming revealed to those whose attainments enable them to take a hint.

2. I am now indebted to a friend high in office at Madras, for what has lately been discovered in America and England, and to the 85th No. of the Civil Engineer's Journal, (published in October 1844,) for the state of the iron manufacture in France; from which it appears, that methods of treating the pure ores of iron, similar to those resulting from my own investigations, have been practically applied on the large scale both in America and in England, proving thus beyond a doubt, the feasibility of the plans I have advocated as the best adapted for India; and also, that if in France where wood fuel is so very dear, it can still be economically employed in the iron manufacture, that of course the same can be done by proper management in India, where the wood is so very cheap and abundant; and ores similar to those of France exist in profusion.

3. In my last paper, I have used the term "bloomery furnaces," and given calculations of expenses based on experiments with them. Furnaces of this kind, as generally known, may be defined as "cupola bloomeries," from the general resemblance of their shape to the cupolas for melting cast iron; and although they are cheap and simple to manage, and the best adapted for commencing operations

with, yet the operation not being continuous, but suspended, when the bloom is ready for removal, and the furnace allowed to cool, much heat and fuel are wasted which might manifestly be saved by maintaining the furnace always at a proper heat.

4. This objection may be remedied in what may be defined as "reverberatory bloomeries," in which the bloom is reduced and balled contiguous to the focus of heat, but in such a situation that its removal does not require the charge of ore put into the furnace to be suspended, nor the blast to be stopped. Furnaces of this kind were tried by Mashet, but did not succeed in consequence of the ore not being introduced in a proper manner. Even on the small scale at my disposal, I have succeeded in making "reverberatory bloomeries" answer perfectly well; but my mode of management though much the same in general principle, differs considerably from that employed by Mr. Clay in Scotland.

5. "The New York newspapers announce that Mr. Simeon "Broadmeadow, of New York, has invented a method, by "means of which the iron ore is by only one process con"verted into wrought iron, without being first made into "pig-iron, and at a less expense than the pig-iron can be "made. The iron ore is placed upon the floor of a rever"beratory furnace, the flame of the fire passing over it, when "a chemical compound is used to unite the elements of the "iron by separating the slag entirely from it. By this first "and only operation, the wrought iron comes out as perfect "in every respect as that by the double operation of pud"dling and piling pig-iron; and for the purposes of manufac"turing steel, even surpasses it. By this process wrought "iron of the best quality can be produced at a cost not ex"ceeding 25½ dollars per ton. It is also calculated that the "rough blooms, if the furnace is built near the mines of "coal and ore, can be made with a good profit for only 14 "dollars per ton. The inventor states, that with a capital

" of 100,000 dollars, forty tons of rail-road iron can be made " in every 24 hours."

6. As the inventor's account of his own process is not given, we are unable to judge whether it is the result of mere practical trials, or arrived at by a scientific inductive routine. The "chemical compound" alluded to, is "black cast iron," a very small quantity of which is sufficient to disturb the equivalent combining proportion of the elements of the ore, and by setting at liberty a portion of the oxygen, deprives the magnetic oxide of its characteristic refractory property, and leaves it subservient to the reducing action of the carbon in contact with it, and the operation of the carboniferous gases of the focus of the furnace. But the objection to the process is the great proportion of the ore which becomes separated from the reduced metal, in the form of what is practically termed "slag," and when a larger proportion of cast iron is used to prevent this, the process then becomes exactly similar to Mr. Heath's "cementatious process."

7. The process of Mr. William Neale Clay has been put into practice at the Shirva works, Kirkintillock, Scotland. " Ulverstone iron ore (hæmatite) is ground with about 4-10 " of its weight of small coal, so as to pass through a screen " of $\frac{1}{8}$ of an inch mesh. This mixture is placed in a hop- " per fixed over a preparatory bed, or oven attached to a " puddling furnace of the ordinary form. While one charge " is being worked and balled, another gradually falls from " the hopper, through the crown, upon the preparatory bed, " and becomes thoroughly and uniformly heated, the car- " buretted hydrogen and carbon of the coal combining " with the oxygen of the ore, advances the decomposition " of the mineral, while by the combustion of these gases, " the puddling furnace is prevented from being injuriously " cooled. One charge being withdrawn, another is brought " forward, and in about an hour and a half the iron is

"balled, and ready for shingling and rolling. The cinder "produced, is superior in quality to that which results from "the common system: it contains from 50 to 55 per cent. "of iron, and is free from phosphoric acid, which frequently "exists, and is so injurious, in all the ordinary slags; when "re-smelted, it produces as much No. 1 and No. 2 cast-"iron, and of as good quality as the ordinary "black band" "ore of Scotland. The cast-iron produced from the slag, "(amounting to one-third of what was originally contained "in the ore,) is mixed with the ore and coal in the pud-"dling furnace: and thus while nearly all the iron is ex-"tracted from the ore, as much wrought iron is produced in "a given time, and at the same cost of fuel, as by the old "system; while nearly $\frac{1}{3}$ more iron is produced by two pro-"cesses only, and of as good a quality as by the six processes "of the old system. The iron resulting from Mr. Clay's "process is stated to bear a high polish, is very uniform in "its texture, is ductile and fibrous, having more than an "average amount of tensile strength, and at the same time "appears to be more dense, as it possesses a peculiar sonor-"ousness, resembling that of a bar of steel when struck." It has also been converted into steel of a good quality. Mr. Clay's process having been discussed in the presence of scientific men interested in the subject, the general good qualities of the iron produced was allowed, and it was expected that the supplies of Paris ores, of iron ore in England, of Ulverstone, of Cumberland, and of Dartmoor, might be made available for making steel instead of Swedish iron.

8. Even in Mr. Clay's description, there appears to be either a want of knowledge of the correct ultimate principles of the process, or else this knowledge is concealed under ambiguous expressions. The gases resulting in the furnace are not carburetted hydrogen as is stated, and instead of their merely "advancing the reduction of the ore," the fact is, that the ore when brought to incandescence, burns in con-

tact with the gases, evolving in doing so, a heat so tremendous, that instead of the furnace being "injuriously cooled," the great difficulty is to prevent the furnace itself from being completely fused and destroyed.

9. The statement, that oxides burn and evolve heat during combustion in carboniferous gases, I conceive to be a new fact in experimental chemistry; and although I have at present but few books to refer to, in support of my assertion, I think the following extract (from Dr. Ure's Dictionary of Arts and Manufactures, page 913,) sufficient for my purpose at present: "It is probable that the coaly matter employ-"ed in the process is not the immediate agent of their reduc-"tion; but the charcoal seems first of all to be transformed "by the atmospheric oxygen into the oxide of carbon, which "gaseous product then surrounds and penetrates the interi-"or substance of the oxides, with the effect of decomposing "them, and carrying off their oxygen." Here we have no mention of any combustion or evolution of either heat or light, and as it is not likely that Dr. Ure would have been unacquainted with experiments on a subject to which he had given so much interest and practical attention, perhaps I may be allowed to claim the merit of having first discovered it. I cannot, however, at present describe the method of making the experiment, which is attended with phenomena as beautiful and dazzling as the combustion of iron wire in oxygen gas: because the mode of observing and managing the combustion forms a part of the practical management of my furnaces, and I would not now have mentioned the subject, but that any one endeavouring to repeat Mr. Clay's experiment, must have the opportunity of observing it.

10. While discussing the merits of Mr. Clay's process, Mr. Heath alluded to his own process of "cementation," with specular iron ore, and Indian pig-iron, by which he stated, that excellent iron for steel-making has been pro-

duced. He stated, that for this purpose, the Indian pig-iron might be procured very cheaply; but as it is well known that the Porto Novo Company were willing to repurchase old castings of their own iron at 40lbs. per ton; it is plain that they could not make it cheaper than this rate, or they would not have repurchased it; and if pig-iron could not be made in India for less than this, it is not likely that it could compete with wrought iron made on the spot with bloomery furnaces.

11. In France, the progress of improvement in the iron manufacture has been very rapid within the last 10 years, and so great has been the economy with materials expended, that although the price of charcoal is three times as great as it was formerly, yet the price of bar iron has fallen one-third. This result has been produced by the introduction of the hot blast from England, by the use of wood in the blast furnaces, and the combustion of the gas as given off in the blast furnace, to puddle and reduce pig-iron to the malleable state.

12. " On the use of wood in the blast furnaces in France, " many experiments have been made in the last 7 or 8 " years. Some have introduced the daily and habitual use of " green wood; others, have dried; others and by far the " larger number, have used a process for preparing it in a " close vessel by means of the heat lost from the mouth of " the blast furnace, so as to subject the wood to a less " advanced carbonisation than that performed in the forests, " and producing a combustible intermediate between dried " wood and charcoal. The use of green or torrefied wood has " not extended as far as might have been wished. Only 51 " furnaces make use of it, and even this number seems to di- " minish. Several reasons explain this result. The first is, " the irregularity produced in the proceedings of the fur- " naces. The green wood occasions coolings down, which " prevent fusion taking place in a regular manner, and tor- " refied wood always presenting a very variable degree of

" desiccation, or carbonisation produces a similar result. An-" other and more important cause is, that if a true saving of " fuel takes place by this process, it does not always shew itself " in money results; for if the works be at any distance from " the woods, then the cost of green wood to the furnaces " increases. In order for the process to spread, the works " would have to be seated in the woods. Whilst the " furnaces only consumed charcoal, the endeavour was to " place them near mines, rather than near forests, for the " ore weighs more than the charcoal consumed: but wood " weighing more than the ore, the neighbourhood of " forests must be sought, if torrefied wood is to be used " to advantage. Besides a great number of furnaces are " at the same time distant from both mines and forests, " being forced to seek a site where water power was avail-" able for the blowing machines. As the improvement which " has been completely successful, the use of the heat of the " furnace to heat a steam blowing machine, allows in new " works a considerable saving of money to be effected by " the use of torrefied wood. Water power for the blowing " machines is in fact useless, and as far as the mines allow, " the works may be placed in the midst of the woods of " which they are to consume the produce."

13. This method of using green wood is evidently just the same as I have alluded to in my last paper, as having been put in practice in my own investigations. But the vague expressions made use of, with reference to the objections to its use, such as "coolings down," and "fusion taking place in a regular manner," serve to show, that the principle upon which blast furnaces act is no better understood in France, than it is in England; and so far from "coolings down" occurring either in my blast furnaces or bloomery furnaces, I have found that when once the furnace has been properly constructed, and the proper arrangements made to ensure the success of the operation, that the same result

has been regularly produced for six months together, with none but natives to conduct the manipulation, after I had superintended the requisite adjustments at first.

14. The next improvement due to the French manufacturers, is a most important one. It is the introduction of what is termed "gas-iron, a term which is now used in "trade, and applied to a class of iron superior to coal-made "iron, and almost equal for most purposes to charcoal-iron. "Gas-iron, is iron manufactured with the gases lost in the "blast furnaces, or with those arising from gasification of "combustibles of small value, or unfit in their natural state "for working iron. This process originated in the works of "Treveray, (Meuse,) belonging to Messrs. D'Andelarre and "De Lisa, and is extremely important to works using vege-"table fuel. Refining with charcoal has already become "impossible in most of the French furnaces, on account of "the competition of coal, and in a very short space of time it "will be so with the rest. At present, coal bar-iron produc-"ed from charcoal pig is little better than bad iron entirely "manufactured in the English way, and fetches rather better "price, but the difference in quality will not compensate for "the great difference in price, and the cheaper article will "exclude the other. The gas process on the other hand, if "generally adopted, will save the old charcoal works, though "it also effects a great saving with regard to coal; an impor-"tant saving in the gas process is the diminished loss in "slag which is reduced one-half in the puddling and ball-"ing furnace. In the Treveray process, the gases lost in "the blast furnace, or the gases which have exhausted their "physical and chemical influence on the bed of fusion, are "collected and sent into the reverberatory ovens. These "gases before being so used in the subsequent processes, "are purified from the matter which they may contain in-"jurious to the iron. This is effected by a very simple appa-"ratus, and the pig-iron is brought into contact only with a

" purified gas flame. The arrangement of the gas oven, " with jets of hot air and hot gas intermixed, obtains a very " high temperature and perfect combustion, since the turn- " ing of a few cocks allows the fire to be regulated at will, " not only with regard to the intensity of its temperature, but " the chemical nature of the flame ; so as to have a neutral, " an oxidising, or a red active flame."

15. I have stated in my last paper, that I had reason to believe the gases produced by combustion in close furnaces held nitrogen in combination and I have adduced some of the circumstances which at first led me to suspect this fact; but I am unable to make public at present, some of the results of my imperfect investigations, because they are connected with the principles which I have applied in practice in my furnaces, with the true explanation of the composition of cast-iron, and with what I may be allowed to term the theory of " acerification," subjects on which I am anxious to preserve to myself the honor of completely analysing : and which I have long ardently wished to follow out, if I could have succeeded in persuading the government to afford me the slightest assistance in support of my labours.

16. My surmise on this point is directly contradicted by the analytical examinations of able French chemists, as given by Péclet (Traité de la Chaleur,) but I think it will be allowed by chemists to be probable, that nitrogen at a high temperature may have the property of combining with carbon and hydrogen, and also with oxygen : which compound may either be resolved into other gases at a lower temperature, or else that the mode of analysis may have been conducted so as to notice quantitatively only known compounds. My own surmises on the subject are not based upon chemical analysis, but on physical effects and phenomena which I have witnessed, and which I maintain could not be produced by carbonic oxide.

17. I will conclude this paper, by stating, that Mr. Clay's bloomery process and the French gas furnaces may be com-

bined, and I have experimentally proved, that the pure ores of India may be reduced in "reverberatory furnaces, bloomeries," without charcoal, wood, or coal: using any carbonaceous substance which is capable of being made to burn in a blast furnace and of affording gas. This mode of making "gas-reduced iron," promises to be valuable in many parts of India, where iron ore abounds, but fuel is scarce: but as the subject of "gas furnaces" will afford matter for a separate paper, I will not enlarge on this point at present.

January, 1845.

On Gas Furnaces. By Captain J. CAMPBELL, *21st Regiment, M. N. I.*

1. The use of "gas furnaces" is an invention due to the French, who have lately practically applied them on the large scale in the arts, and have succeeded in producing with them so high a temperature, as to answer the purpose of heating reverberatory furnaces for the fusing and puddling of cast iron, to reduce it to the malleable state. The Germans appear also to have been in possession of the invention prior to the French, but the principle was concealed until the publication of it in France.

2. In "gas furnaces" the carboniferous gases evolved from the mouth of large blast furnaces, or from any substance capable of burning in a close furnace with a jet of air from a blast pipe, are conducted through a range of heated pipes, and forced out in jets from a series of nozzles in the manner of a blowpipe; while a jet of heated atmospheric air is forced through the centre. Each jet therefore becomes a vast blowpipe blown with heated air, and by increasing the number of jets and concentrating the action of the flames, a very high degree of temperature is readily produced.

3. The first application of gas furnaces, according to Péclet, is dued to M. Aubertot, who in 1812 used the flame of a high

blast furnace to calcine lime and burn bricks. In 1829, after Reitron's discovery of the hot blast principle, the air-pipes were heated in the flame of the furnace both in France and England. In 1835, MM. Thomas and Laurens in France applied the flame of the furnaces to heat the steam boilers of the blowing machines; and in 1841, they made known their success in applying the gas process to reverberatory furnaces in the iron works of Treveray.

4. In India, I first became acquainted with the heating powers of the gas principles in August 1842; in consequence of the bamboos and ridge pole of the shed under which I had placed my little experimental iron furnaces, having been several times set on fire by the large volumes of flame thrown up from a furnace hardly three feet high. To prevent this, I had constructed a pillar chimney for the centre of the shed, with a nine-inch flue, into which the flame from the mouth of the furnaces was drawn up by the draft through lateral apertures: when to my astonishment, I found that in less than half an hour the whole flue was heated red hot from top to bottom, for more than ten feet in length, and a brilliant flame thrown out besides, from the summit of the chimney, more than four feet high; producing in the shades of evening a beautiful fire-work, resembling an immense "Gerbe," the sparks being afforded by the powder of the charcoal drawn up. The discovery of the different applications and mode of management of the gas of course rapidly succeeded; but although I was aware of the use of Thomas and Laurens' blowpipe principle, and what might be done with it, yet it was out of my power to try it upon any scale larger than a small experiment.

5. In Bengal, I consider the application of the gas furnace of immense consequence, as it affords the means of readily using the worst coals, now almost valueless to heat the steam boilers of the boats employed on the inland navigation of the rivers. Many other applications must also readily present

themselves to practical men, but at present I shall content myself with calling public attention to the subject in this brief notice.

January, 1845.

On a new compound of Iron and Carbon. By Captain J. Campbell, 21*st Regiment M. N. I.*

1. In January 1842, during some experiments for making cast iron with magnetic iron ore and charcoal, in which an intense heat was produced, I found among the products of the furnace some pieces of charcoal retaining perfectly their original form and appearance, but quite metallised, and for want of a better name I will call this for the present "ferruginised charcoal.

2. All the cracks and pores in the piece of charcoal were quite visible, and it seemed as if *wetted* with the metal, which pervaded its substance. When scraped with a knife, it resisted strongly, and shewed a smooth metallic appearance, strongly attracted the magnetic needle, and was readily raised by the magnet. Examined with a lens, the outside appeared covered with minute glistening planes of a leadish black colour. Filed in a vice, was cut by the file like metal, and gave a metallic surface of a dark-black lead colour, with some pores and specks. The filings had a black charcoal colour and appearance, but not quite the *soot* colour of charcoal powder, having a more leadish hue. The filings were completely raised by the magnet. A portion of the piece of charcoal retained the original appearance not having been *wetted* by the metal, this portion filed, had a dark soot colour, and the filings were not affected by the magnet.

3. A piece of the "ferruginised charcoal," weighing 31.82 grains, was put into a digesting flask, and an ounce of diluted pure muriatic acid was poured upon it; action

rapid, and gas given off was hydrogen from the smell. By mistake was forgotten for 14 months, when the solution had a rusty muddy appearance. On adding water, no action followed. Solution diluted and decanted, and analysis washed clean: dried on blotting paper, gave off the usual smell and fumes from the residue, on dissolving cast iron in muriatic acid; dried did not affect the magnetic needle. Examined by the lens, looked like a piece of charcoal: shewing the pores of the wood and the cracks. A great portion still showed the little glistening planes; dried at a low red heat in platina crucible over spirit lamp, weighed 6.40 grains. Had not altered in appearance from the heat. Was easily friable, and crumbled under an ivory paper knife into a soft powder, retaining the glistening appearance of the lump. Rubbed on paper had exactly the colour of fine black lead. Felt greasy, and gave polished lead coloured coat to the end of the finger. India rubber removed the stain readily and completely from the paper. The charcoal, unaltered part, did not crumble readily like the rest, but felt hard and coally under the paper knife. The graphite, heated red hot in a platina spoon, not altered at all, and did not glow or burn when a stream of air was directed upon it. The graphite with some fused saltpetre produced a violent action; effervesced, with gas and white smoke giving off. Action continued sometime, when subsided and cold, no signs of any of the graphite remaining, but the carbonate of potash had a dirty reddish appearance. Experiments on the muriatic solution decanted off the piece of "ferruginised charcoal," gave nothing but what is usual with common ferruginous solutions.

4. "Ferruginised charcoal" as above described, can be made with regularity and certainty at the expense of 10*d.* per 15 pounds of charcoal to 1 pound of the results: but I cannot at present explain the precautions required to produce the result, until I am able to resume again my iron experi-

ment. But I may say, that I am possessed of almost certain evidence that nitrogen is the active agent; though I must confess, that the theory of the operations is beyond my science.

5. Ferruginised charcoal can certainly be made for £200 a ton, and as it yields half of its weight of excellent graphite, is it not possible that it may prove valuable as a manufacture, when the worst black lead sells at 2 shillings a pound?

6. Imperfect as my information of this subject is at present, I shall abstain from entering into any speculations on what I have now announced, and shall conclude with remarking, that the only notice of any similar product which I have been able to find is in an experiment by Doberciner, which I have not at present the means of referring to.

January, 1845.

Extract of a Letter from Captain J. Campbell, *21st Regiment M. N. I.*

"With regard to Lieutenant Latter's account of the new French process for treating mineral sulphurets, in your 11th Number, I would remark, that I believe I am correct in stating, that there is no method known in Chemistry for making saltpetre afford oxygen to sulphurous acid gas, upon which the principle of the whole method turns. There seems to be no doubt, from the methodical description given, that the process is instituted in practice, but that some deception or concealment must have been practised by those who permitted the operation to be inspected. Does saltpetre at a red heat become decomposed by the contact of carbonaceous substances, and perhaps by carboniferous gases? It is perhaps probable, that in the same way that the oxygen combines with carbon, so also at a red heat, may the same combinations take place by the contact of sulphurous acid gas, but I am not aware that such an experiment has been tried, or the results made public."*

January, 1845.

Note on the above by Mr. A. Robertson.

* The description, referred to, of the apparatus for making sulphuric acid from metallic sulphurets, seems to be complete without evasion or concealment, and the apparatus itself to be admirably adapted for such a purpose. The theory of the process given, is, however, faulty, and in the details there appears to be an omission in regard to the saltpetre, which is not used alone, but mixed with its equivalent of sulphuric acid. The nitric acid so evolved enables the sulphurous acid gas to combine with oxygen, from the atmospheric air entering the lead chamber along with it, in a manner explained in the well known theory of Clement Desormes, which is noticed in every recent system or elements of Chemistry.

From what Lieut. Latter states of the ore used, that it sometimes contains not more than $1\frac{1}{2}$ per cent. of copper, that there is much iron in the residuum, and that it loses about one-fifth of its weight during the process, it is evident that much more of the iron pyrites than of the copper pyrites must often be present in it. In this case the process is a well known one, and has been carried on to a great extent in Britain during the last five years at least, when it was forced upon the manufacturers by the attempted monopoly of Sicilian sulphur, which had tripled the price of that article.

It is merely a question of relative price whether pyrites or sulphur can be most advantageously used. Sulphur, at present prices in Britain is likely the most economical, even though the maker from pyrites be helped by the sale of the residue to the iron smelters, as roasted iron ore. In Calcutta the sale of rough sulphur (from Muscat) has been a monopoly in the hands of some native merchants, and has ranged from two to three times the present price of rough Sicilian sulphur in Britain, but it is said that abundance of very pure sulphur might be had for the trouble of collecting it in many of the volcanic Islands in the Indian seas. Acid made from volcanic sulphur is pure, that from pyrites usually contains much arsenic, which unfits it for many purposes.

There are at present three makers of sulphuric acid near Calcutta, who all sell at the same price, two annas per lb. which considering the higher price of sulphur in India, and the very limited sale of acid, is lower in proportion than that at which it is sold in Britain, and it cannot well be expected to become less, while things continue as they are, unless a party possessing capital should for some particular reason be willing to submit to a temporary sacrifice.

As connected with chemical manufactures in India, it may be well to notice that a native production, sajee-mati, which a few years ago sold at less than one rupee per maund, has, in Calcutta, for the last two years, advanced to from three to four rupees per maund, and that British-made carbonate of soda has in consequence been freely imported. It would be desirable to ascertain the reason of this, as it is said to be abundant in some districts not far up the river, and to be had for the labour of gathering it. The soda contained in the sajee-mati is probably as essential to chemical manufacturers in India as sulphuric acid itself.

Observations on the Structure and Affinities of the Genus "Azima" of Lamarck. By R. WIGHT, M.D., F.L.S.; *and* G. GARDNER, F.L.S., *Superintendent of the Royal Botanic Garden, Ceylon.*

The genus *Azima* was first established by M. de Lamarck at page 343 of the first volume of the 'Encyclopedie Methodique,' in the year 1783. In the following year it was again characterised by L' Heritier, under the name of *Monetia,* in the first fasciculus of his 'Stirpes novæ.' The latter name, from what reason we know not, has been adopted by all succeeding writers, except Jussieu and Persoon. In accordance with the law of priority, we adopt Lamarck's name.

Azima tetracantha, Lam. grows very abundantly in the neighbourhood of Coimbatore, and being now profusely both in flower and fruit, we have been enabled to draw up the following description from recent specimens, from which it will be perceived that those which have previously been published are all more or less incorrect.

DESCR.—A dœicious rambling *shrub,* with prickly *branches* from 4-12 feet long. *Branchlets* opposite, obtusely 4-angled, pubescent, a little flattened at the nodes, which are about an inch distant from each other. *Prickles* two from the axills of each leaf, divaricate, somewhat triangular, grooved on the upper surface, terminating in a rigid acute point, and from half an inch to an inch and a half in length. *Leaves* opposite, shortly petiolate, ovate-lanceolate, acute at the base, pungent at the apex, coriaceous, indistinctly pennivenous, pubescent, of a light green colour, shining on both sides, from an inch to an inch and a half long, and from 8-11 lines broad. MALE FLOWERS small, sessile, axillary, solitary or aggregated, each furnished with two appressed mucronate bracts. *Calyx* viscously pubescent, urceolate, 4-cleft, segments cuspidate. *Petals* 4, hypogynous, linear-lanceolate, equal, estivation valvate, greenish-yellow. *Stamens* 4, hypogynous, alternate with the petals; *filaments* linear, stout, shorter than the petals. *Anthers* ovate, free, introrse, dehiscing longitudinally, connective, shortly produced, apiculate, incurved. *Ovary* abortive, conical acute. Female Flowers: *Calyx* irregularly 2-4-cleft. *Corolla* as in the male. *Stamens* 4, rudimentary, alternating with the petals. *Ovary* hypogynous, equalling the petals in length, turgid, glabrous, 2-celled, with a single erect ovate in each cell. *Style* none. *Stigma* sessile, peltate, pappilose, obscurely 2-lobed. *Fruit* a globose white berry (not unlike a large currant), 2-celled, or rarely by abortion 1-celled, when 2-celled with the septum nearly evanescent, cells 1-seeded. *Seeds* erect, orbicclar, plano-convex: *testa* coriaceous, brown somewhat rugose: *Albumen* none. *Embryo* green lenticular. *Cotyledons* fleshy, cordate-auriculate at the base, the lobes over-lapping and concealing the elongated straight *radicle.*

Lamarck makes no further mention of the natural affinity of *Azima,* than merely observing that "Il semble avoir des rapports avec le *Pisonia,* par son port; mais la fructification l'en eloigue un peu." Jussieu observes that judging from Lamarck's description, it approaches *Strychnos* or *Carissa,* but differs by being polypetalous. Bartling puts it at the end of *Apocyneæ,* along with some other genera with whose true affinities he was equally unacquainted. Lindley takes no notice of it in the first edition of his 'Introduction to the Natural System,' but in the second, places it doubtfully among his *Aquifoliaceæ.* Mr. G. Don follows Bartling in considering it an imperfectly-known genus of *Apocyneæ.* Harvey, in his 'Genera of South African Plants,' gives an original character, drawn up from Cape specimens, and puts it in the Appendix with the following observation:— "This genus has been referred to *Apocyneæ;* I cannot agree with the justness of the reference, but am unable to say with what order it should be associated." Meisner adopts Lindley's view, adding the following remarks: "Spinæ ad foliorum insertionem potius laterales quam axillares esse et stipularum locum tenero nobis (ex icone) videntur, unde genus vix hujus loci, sed forsan potius Rhamneis adnumerandun esse credimus.

The principal reason, it appears to us, why those Botanists who have written on this genus have not been led to refer it to its proper position in the natural system is, that too much importance has been attached to its being polypetalous. Notwithstanding this structure, we believe its affinities lean less towards the polypetalous than the monopetalous division of plants; and in the latter, we are inclined to place it as a distinct order between *Oleaceæ* and *Jasminaceæ.* That it is nearly related to these orders, more nearly indeed, than to any others in the system, our analysis clearly shows; but to neither of them can it be referred from the almost equal affinity it bears to each. Thus it corresponds with *Oleaceæ* in the structure of the flower, differing principally in having 4, not 2 stamens. If we reflect, however, that *Oleaceæ* is tetramerous in its floral envelopes, it is to be expected that truly oleaceous genera may yet be discovered having four stamens. The diœcious character of *Azima* is met with in more than one species of *Olea;* and free petals exist in *Linociera.* From *Oleaceæ, Azima* is essentially distinguished by its erect, not pendulous ovules, and exalbuminous seed. On the contrary, it agrees with *Jasminaceæ* in the nature of its ovary and fruit, but differs considerably in the details of its floral envelopes. From *Oleaceæ* it differs in habit, while it agrees with that of the scandent species of *Jesminum.*

By those who are inclined to keep up *Oleaceae* as a suborder of *Jasminaceæ*, (among whom may be mentioned Richard and Arnott,) *Azima* will perhaps be considered as a proof in favour of their opinion. We on the contrary, believe it to be one of those plants which occasionally turn up to prove the distinctness of orders, which were previously considered as scarcely distinct. This, however, was hardly required as regards the orders in question; the late Professor DeCandolle having shown in one of his earliest botanical works, (Prop. Med. ed. 2, p. 206,) that the two orders were at least not very nearly related, from the fact, that the members of the one would not graft on those of the other.

The following is the essential character we propose for the new natural order.

Azimaceæ.

Flowers diœcious. Male : *Calyx* urceolate, 4-cleft. *Petals* 4, hypogynous, equal, estivation valvate. *Stamens* 4, hypogynous. *Anthers* 2-celled, introrse, dehiscing longitudinally, connective, shortly produced, apiculate. *Ovary* abortive. Female : *Calyx* irregularly 2-4-cleft. *Corolla* as in the male. *Stamens* rudimentary. *Ovary* hypogynous, turgid, 2-celled, with a single ovule in each cell. *Style* none. *Stigma* sessile, peltate, somewhat 2-lobed. *Fruit* a globose berry, 2-celled, or rarely by abortion 1-celled : *cells* 1-seeded. *Seeds* erect, plano-convex : *testa* coriaceous, rugose. *Albumen* none. *Embryo* lenticular : *Cotyledons* fleshy, cordate-auriculate at the base : *radicle* inferior. A rambling shrub, with opposite leaves, from the axills of each of which spring two long, divaricate pungent prickles. Flowers small, axillary, sessile, solitary, or aggregated. Fruit a white fleshy berry.

Azima. *Lam. Ency. Meth.* 1, *p.* 343, (1783.) *Illus. des Gen. t.* 807. *Juss. Gen. Plant. p.* 465. *Person Syn. Plant.* 1, *p.* 145.—Monetia. *L' Herit. Stirp. Novae.* 1, *t.* 1, (1784.) *Schreb Gen. n.* 198. *Wild. Sp. Plant.* 1, *p.* 669. *Gaert. fil. p.* 247, *t.* 225. *Spreng. Syst. Veg.* 1, *p.* 369. *G. Don. Dict.* 4, *p.* 105. *Harvey Gen. p.* 411. *Meis. Gen. p.* 252. *Endl. Gen. n.* 5711 *et* 6891.

Character the same as that of the order.

1. Azima *tetracantha*, *Lam. bb. cc.* Monetia barlerioides, *L' Herit. l. c.*

Hab.—Common in the peninsula of India, in hedges and bushy places. Eastern districts of the Cape of Good Hope? *Zeyher.*

Observation I.—Lamarck and all succeeding botanists describe two species of this genus, the one here described, which is said to be common to India and the Cape, and *A. diacantha,* also said to be an Indian species, but only known from a figure in the 'Photographia' of Plukenet (tab. 133. f. 3.) To whatever genus this plant may belong, it certainly has nothing to do with the present one, the alternate leaves, and the position of the prickles or spines—infra-petiolar,—being totally at variance with it. Is it not rather some Rhamnaceous plant? Wildenow in his edition of the Linnæan 'Species Plantarum', refers to Rheede's *Isjerou Kara* (Hort. Mal. p. 73, t. 37,) as being identical with the plant of Plukenet, but the figure there given is certainly that of *Canthium Rheedii,* DC. The same figure is again quoted by Wildenow for his *Webera tetrandra (Canthium parviflorum,* Lam.) To these two species Sprengle has added a third, the *Camphorosma paleacea* of the younger Linnæus, which must also be removed from the genus. The materials which we possess render it more difficult to ascertain whether the *Azima tetracantha* of the Cape, and that of this country are identically the same species. Harvey seems to have had good materials from which to form the generic character which he has given. Judging from that description, we incline to believe that the species are distinct, from the fact, that the stamens in his plant are said to vary from four to seven, and that two or three of the filaments are sometimes combined. We have examined numerous flowers of our species, and have never observed more than four stamens, with their filaments always free. He further states the ovules of the Cape plant to be suspended from the summit of the cells; in ours they are always erect from the base.

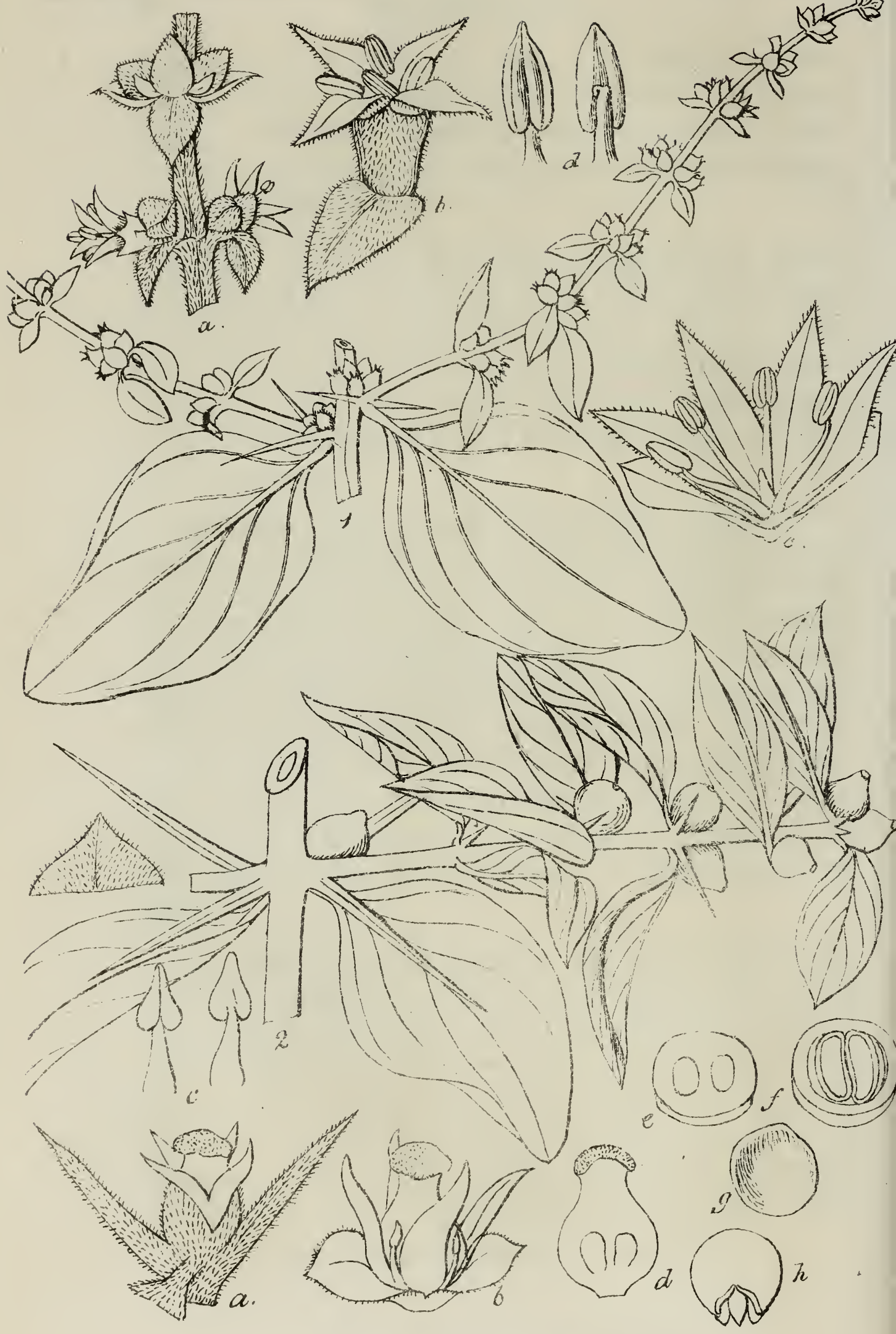
Before, however, a decision on this point can be come to, a comparison of specimens would be required. We know nothing of Wallich's *Monetia? Branoniana* (Cat. n. 7493,) from the banks of the Irawaddy, no description of it having as yet been published.

Obs. II.—In none of the various descriptions of *Azima tetracantha*, which we have consulted, is the stigma properly described, except in that of Mr. Harvey. This no doubt has arisen from two causes; first, the examination of dried specimens alone; and, second, from only examining the male flowers, the abortive ovary in which is, as always noted, conical and acute.

Obs. III.—What are the long prickles which give to Azima so formidable a character? Meisner, supposing them to be lateral with reference to the petiole, considers them to be of the nature of stipules. They are, however, distinctly supra-petiolary, articulated only with the bark, and easily removed. From between the base of each pair there springs either a cluster of flowers, or a small branch. To us they appear to be magnified, and very much modified representatives of those small scarious leaf-like scales which are found in the axills of the leaves, and surrounding the bases of the branchlets, in some species of olea. *O. paniculata* for example.

Obs. IV.—One of the reasons which M. Richard adduces for keeping *Oleaceæ* and *Jasminaceæ* united, is the circumstance, which he says he has discovered, that the ovules of the latter order are originally pendulous as in the former; but that they afterwards become erect in consequence of the growth of the ovary, whose apex does not elongate, while its sides extend considerably during the growth of the fruit.* We have now before us recent speci-

* Vide Lindley's Introd. to Nat. Syst. 2nd ed. p. 309.



Azima tetracantha, Lam.

mens of a new species of *Jasminum*,* collected on the Neelgherries, the careful examination of which does not confirm the statement of that eminent Botanist. In the virgin, as well as in the impregnated ovary, we find that the ovules are ascending, being attached to the inner angle of the base of the cell. They are not, however, so distinctly basilar as those of *Azima*.

Obs. V.—It has been usual to consider *Oleaceæ* and *Jasminaceæ* as related on the one hand to *Verbenaceæ* and those other monopetalous orders in which the number of stamens differs from that of the corolla; and on the other, to *Ebenaceæ* and *Aposcyneae*. The association of *Azima* with them more fully confirms the latter relationship, at the same time that it brings them closely in contact with *Ilicineae*. They may also be compared with some of the polypetalous orders, such as *Olacaceae;* and with such genera of *Aurantiaceæ* as *Iriphasia* and *Glycasmi*.

Explanation of the Plate.—I.

Fig. 1. Portion of a Staminiferous branch of *Azima tetracantha*. Nat. Size.

a. A smaller portion more highly magnified.

b. A single flower and bract.

c. A flower laid open.

d. Front and back view of an anther.

* This species may be characterized as follows:—

Jasminum *tetraphis;* scandent glabrous shining, branches and branchlets roundish, petioles geniculate, leaves oblong-lanceolate acute at the base, attenuated at the apex, 3-nerved, flowers from 3-5 terminal sessile, lobes of the calyx 4, rarely 2 or 3, subulate, erect, and about half of length of the tube of the corolla, limb of the corolla 5-6-lobed, lobes lanceolate acute shorter than the tube.

Nearly allied to Roxburgh's *J. laurifolium*, from which it chiefly differs in its sessile flowers, and fewer colycine lobes. Flowers white, fragrant; leaves from 2-2½ inches long, and about 12 lines broad.

Fig. 2. Portion of a branch of the pistiliferous plant. Nat. Size.

a. A single flower, showing its position with reference to the prickles and petiole.

b. A flower laid open.

c. Abortive anthers.

d. Verticle section of an ovary.

e. Horizontal ditto ditto.

f. Ditto ditto of a ripe fruit.

g. A seed.

h. An embryo.

To the Editor of the Calcutta Journal of Natural History.

My dear Sir,—After an attentive perusal of Mr. Batten's remarks on the snow line of the Himalayas, published in the Journal for October, 1844, I can see no reason whatever for altering my opinions on the subject. The very self-sufficient tone which pervades that gentleman's critique, would have induced me to waive the farther discussion of the subject, did it not occur to me that my silence might lead to the belief that I yielded the point at issue, which is so far from being the case, that I am now more than ever convinced, from all Mr. Batten has urged, of the erroneousness of the hitherto received doctrine *when applied to the Himalaya, as a general rule.* Although, therefore it may appear highly presumptuous to array the opinions of such light authorities as Dr's. Gerard and Lord, Captains Cunningham, Jack and myself, against those of the Commissioner of Kemaon, I shall nevertheless, for the sake of truth, endeavour as briefly as possible to show the actual facts of the case, as they now appear to be elicited by the controversy.

In his zeal to defend Captain Webb and others from an attack which had existence no where save in his own imagination, Mr. Batten appears entirely to have overlooked the fact, that what may be locally true in some parts of so vast and extensive a range as that generally known as the Himalaya, may yet be quite the reverse elsewhere on the same range, and this with regard to the question at issue appears to be precisely the case. I will venture to say that in recording our individual observations, it never for a moment entered into the minds either of myself or of my supporters, to pronounce Captain Webb's statements erroneous when applied to certain localities whence his facts were derived, but we thought it necessary to show that his doctrine *was not generally applicable,* and therefore that it stood in need of some modification.

Mr. Batten has well asked, " how can the observations of one individual made in one part of the mountains, upset the observations of another individual in another part?" But he has somewhat strangely forgotten to apply the question to Capt. Webb's statements, for how can facts observed by him in Kumaon and the adjacent tracts upset the observations of others made in different localities to the westward? And if they cannot upset them, then have we at once a clear and convincing proof that Capt. Webb's facts are merely locally and not generally true; his facts were the results of observations made in one locality, mine in another, and Dr. Lord's in a third; each is locally true, and while *in the two latter instances the facts agree,* they can no more disprove the facts observed by Capt. Webb, than his case disprove them.

I have already acknowledged the faultiness of my first letter, in so far as regards my having omitted to state in sufficiently distinct terms, that my remarks referred to the actual northern and southern aspects of the true Himalaya, or central, or main range of snowy peaks, and not to the aspects of secondary groups and minor ranges. My last letter, published in the October Journal explained all this, and the question now appears to be, " does the snow lie longer, deeper, and lower down on the Trans-Himalayan or northern aspect, than it does on the Cis-Himalayan or southern slope? I answer without hesitation, that as a general rule applied to the Himalaya in the proper acceptation of the term, the hitherto received doctrine is decidedly erroneous. Nor is the assertion devoid of proof, for if, as Mr. Batten declares, the observations made in different parts of the mountains by different individuals, cannot upset each other, we must necessarily admit that Captain Webb has recorded the truth as observed by him in Kumaon and its neighbourhood, and that Dr. Lord has also recorded the truth as observed by him to the westward. The phenomena in the two localities are therefore true, although directly opposed to each other, and furnish at once a decided proof that Captain Webb's doctrine, or at all events the doctrine deduced from his facts, is only *locally* and *not generally* applicable. But in support of Dr. Lord's statements we have observations made by other individuals in a part of the Himalaya totally distinct from the other two, and consequently if any general rule is to be deduced from the observations already made, it must rather tend to show that the snow lies longer on the northern than on the southern aspect, for as yet the evidence preponderates in favour of the northern side. It appears moreover that Mr. Batten in defending Captain Webb's statements, has drawn his conclusions from what is observable on the plains of Thibet, rather than from facts apparent on the northern slope of the Himalaya. The question, however, is not whether the snow lies longer on the elevated *plains* of Thibet than on the sourthern slope of the Himalaya, but whether it does not lie longer on the northern face *of those mountains.* This point indeed Mr. Batten has already decided, for he says, the northern slope of all the mountains retains the snow longer than the southern side and that *this applies equally to hills in Bhote!* That the snow lies longer on the southern slope of the central range than it does *on the plains of Thibet* to the north of that range, is not disputed, for comparatively little snow falls on those plains, and that little is soon dissipated by the prevailing high winds; besides which, the sun is very powerful on those tracts during the summer, and it is by no means wonderful under such circumstances, that two feet of snow should take less time to melt *on the plains of Thibet,* than four or six feet *on the more elevated southern slope of the mountains!* No great credit is due for such a discovery as this!

But Humboldt thought that Captain Webb's observations referred to the northern slope of *the mountains,* and not to the northern *plains,* for in his theory of Isothermal lines, supposing from Captain Webb's statements that the northern face of the Himalaya, was more speedily uncovered than the southern face, he endeavours to account for the strange phenomenon by attributing it to the effects of great heat, *radiating from the plains of Thibet,* thereby clearly proving that it was the mountains and not the plains that were alluded to, by Captain Webb.

Again if we allow that an equal quantity of snow falls over either side of the main chain, and that the radiation of heat from the plains below them causes that snow to melt, it will follow that the hottest side of the range will be more speedily uncovered than the other; this would furnish additional evidence in favour of the north, for the plains of India being hotter than the plains of Thibet, the snow would leave the southern aspect sooner than the northern, and if to this we add the influence of the periodical rains on the Cis-Himalayan side, there will remain little doubt as to which side retains the snow the longest.

What then becomes of the question? It appears to be simply this, namely, Dr. Lord observed that contrary to the usual belief the snow lay longer, deeper, and lower down on the northern than on the southern side of the Hindoo cush; Dr. Gerard, Captains Cunningham, Jack and myself observed the same facts in the districts beyond Simla, and lastly Mr. Batten, albeit a strenuous advocate for preconceived opinions, unintentionally shows, that precisely the same phenomena are apparent even in Bhote. From all observers therefore we have *proof* that the snow lies longer on the northren slope of the Himalaya than it does on the southern, and consequently that if everlasting snow, does in reality exist at all, it must be sought for on the northern aspect.

The result of the controversy then seems to be, that the usual doctrine is founded on insufficient evidence, and that Captain Webb's facts, if indeed he was not himself deceived, must be considered as mere local phenomena having little or no weight as regards the general question.

Having now placed the matter in as clear a light as my data will admit of, I shall here dismiss the subject, leaving its further discussion and elucidation in the able hands of Mr. Batten and "*all the men, women and children*" to whom he has so very facetiously, but unnecessarily alluded.

Mussoree, 28th February, 1845. THOMAS HUTTON.

A Note on Boodhism and the Cave Temples of India. By Thomas Latter, *Lieutenant, Bengal Army.*

It is a matter admitting of little dispute, although that portion of history is not so clear, as it might have been, had we been more industrious in our researches—that there was in very antient times a very intimate connection between Æthiopia and India. Our chief authorities on this point are of Indian origin;—and even when alluded to by Latin, or Greek authors, the information is declared as having been derived from Indian sources. The Indian authorities, however, invariably assert that Æthiopia was first visited and settled from India, and they enter not only into details connected with the circumstance, but likewise pretend at the same time to give the whole of the early history of that country. It is not my intention here to adduce authorities, to prove the falsity of their assertions, but I will only state that, taking it as a fact that a connection existed in early ages between the two nations, the very circumstance of all the reminiscences and remembrances of the incidents and facts of the occurrence existing, according to the Brahmins, on the side of India, is about the most powerful argument that could be adduced to prove that she, and not Æthiopia, was the visited party—for it is a notorious circumstance of every-day occurrence, that where families or individuals have separated from the mother-country, they long continue to treasure in their memories, and hand down to their descendants, all the ancestral traditions and recollections of the parent-stock; whereas the senior branch that remain at home rapidly lose sight of the young off-shoots. Bearing on this subject likewise, is the circumstance of the similarity existing between some of the figures of the Deities of the antient Egyptians, and those of the Hindoo idols of the present day—as was evinced by the well-known circumstance of the Hindoo Soldiers of the Bengal brigade, despatched to Egypt, to assist in the expulsion of the French under Buonaparte, having worshipped and acknowledged as identical with their own idols—the sculptured figures which they found in that country.

From the circumstance of the oldest temples of India being cave temples, (the antiqueness as it were of their type being in proportion to their position Westwards,) and the earlier of the statues of Boodh being of an Æthiopic caste of countenance, it is both probable that when the first Æthiopians settled on our, perhaps desert, shores,—it was at so early a date as to have enabled them to preserve their Troglodyte predilection for the cave; as also that the Bhoodistical religion was of Æthiopic extraction. It is an opinion held by most Egyptologists, and one that seems to gain ground by fresh discoveries, that to Æthiopia was Egypt first indebted for the commencement of her splendid proficiency in civilisation; perhaps to the same source may be due the equal progress which antient India had made in the same career. The dry climate of Egypt has enabled her to preserve the title-deeds of her claim; whereas her sister India has been daily for centuries, being robbed of the pledges of her right, as much by the destructiveness of her climate, as by the neglect of her Rulers; this neglect has made us the bye-word of the civilised nations of the world: is it not then incumbent on us to place on record these vestiges of her antient glory? At this very moment, perhaps, a whole side-wall of beautifully painted fresco may be falling down—unheard of by us all, uncared for, I feel assured, by none—but carrying with it into utter oblivion the glowing record of scenes of bygone splendor, of passing interest and truth. We must all of us, therefore, whatever may be our individual or professional predilections or pursuits, feel interested in the investigation of subjects connected with the antient state of India, and with the preservation of the reliques that have come down to us. But even the dry utilitarian principles, on which Governments profess to move, will find their reward in the same pursuits; for these subjects form a part of that system of Boodhism, which they prove to have agreed admirably with the mental structure of the race over which Providence has called us to preside. With it, they were a happy, contented and noble-minded race, highly advanced in arts and civilisation, as is shewn by the vestiges they have left; deprived of it by the Brahmin, they rapidly sank into that state of torpid barbarism in which we find them. If then the Government should shew them what they are capable of, by placing before them the record of what they have been; by culling, from the ethics of the Boodhist creed, dogmas which might be incorporated into the public system of education, truths which the Christian would find akin to those which he has been taught to follow, and which to the Indian would come recommended by their Indian origin and their sacred antiquity;—I say then by doing this, Government would be amply repaid in the rapid social and mental improvement of an affectionate and grateful people.

In our investigations into the ideas and feelings incident to man in an early age, or as we are pleased to call it "a savage state," we are fond of giving him credit for little else than a debased and brutal imagination;—whereas in reality the savage mind is capable of the most abstruse speculations, and even metaphysical deductions, the effect of a luxuriant and unfettered imagination: with few wants and those satisfied without difficulty, the contemplative savage had little else to do than revel in the creations of his own imagination. We find, therefore, the poetry of a rude and barbarous age as rich in its imagery as that of the most civilised epoch. It is even with some mental exertion that we moderns with all the concomitants of romantic scenery, a secluded locality, and the assistance of a memory stored with the ideas that have gone before us, can raise ourselves from viewing the air, earth and water around us—but as earth, air and water. Whereas in the eye of the savage his native land teemed with beings of an ideal essence and an airy form; with him, every fountain had its Naiad, and every dingle had its fay; each leaf in the wide forest owned its peculiar sprite who shielded with his little hands, its light bloom from the rude blast, and trimmed the notches of its edge; 'twas they, he loved to think, who sped the Mote-Dance in the sun-beam and smiled in every dimple of the stream. Every one of us must have remarked that the deeper we penetrated into the secluded forests and mountain ranges of India—and the more rude and untutored are their inhabitants—the more addicted do we find them to such picturesque superstitions and beliefs. Arguing, as I remarked before, a mind gifted with strong ideal powers. For this reason we should not (as some writers on Boodhism have been) be startled with the deep metaphysical abstractions of some of its dogmas, and declare that therefore it savors of a modern and not of an antient day. There is a true remark, bearing on this subject, made by Mills in his History of British India. When alluding to the fondness existing among the Afghans and other semi-barbarous nations for metaphysical speculations—he says, " these facts coincide with a curious law of human nature which some eminent philosophers have already remarked. The highest abstractions are not the result of mental culture and intellectual strength." And again, " the propensity to abstract speculations is then the natural result of the state of the human mind in a rude and ignorant age." And it was this that was the triumph of Socrates that he taught that the mind should release itself from the occupation of darkness—vague and useless speculations ;—and should be applied to making ourselves good citizens and subjects, and perfect in our individual calling. It was thus that he was said to have brought down Philosophy from the skies to dwell among men.

It will perhaps assist in explaining the points which I may have to dwell upon, if I give a slight sketch of what probably was the origin and progress of Boodhism. The best division we could make of the early families of the Globe, would undoubtedly be that which we find in Scripture, into those of Shem, Ham and Japheth—of the last, we know but little in the early ages to which I allude ; for they seem soon to have wandered beyond the precincts of history, and not to have returned within its cognisance until they had been deeply imbued with the religious opinions of the other two. But with reference to the families of Shem and Ham ; there appears to have been a marked distinction existing in their natural character, which seems to have so influenced their career, that, although they started from the same worship, they fell into different channels of superstition. The first and original worship of mankind, few will be inclined to deny, was that natural religion, a pure Theism, the belief in an individual Being who was the Supreme Creator of all things and Disposer of all events ; gifted with all the attributes of Omnipotence ; Omniscient, and Omnipresent ; the rewarder, and the punisher ; the father, and the judge. The mind of man however craves after substantiality, it could not long rest satified with the ideal realisation of a God, or the pure Spiritualism of His Worship. The first errors were induced by the presentation of substantial offerings to the Diety ; this led to the representing him symbolically ; then followed the more materialising influence, which betook itself to the worship of the symbol and of the offering, to the entire forgetfulness of the true God. It became necessary at last that mankind should be recalled to the purity of an early faith; and the injunction, that, as God is a Spirit, therefore he is to be worshipped in spirit and in truth—stands a record as well of the truthfulness of the premises, as the logical soundness of the deduction on which is based the prinple of the reformation introduced by the Great Founder of our Faith.

But it is singular to remark, that this inclination, inherent in human nature, to realise by substantialising the idea of a God, acted differently in the two families which we have under review. The Semitic Nations appear never to have entirely lost sight of the view of an individual God or Gods through all their symbols. Whether as Sabæans they worshipped the Sun and Moon and the starry Host, they were still identified in their minds as individuals either through the means of their supposed regents—or as exercising individual influences on mankind; the same was the case with the deification of ancestral heroes, gods and demi-gods, as obtained in Antient Greece and Rome. If adorers of the regenerative powers of Nature, they never lost sight of their individualities, and marshalled themselves as worshippers of the male or female power. The Hamite family on the other hand perhaps from being of a more enquiring caste of mind soon became skeptic; they at first doubted and then disbelived the existence of a creating God, a Demi-urge. The first question that they seemed to have asked themselves was; if there is a being who created every thing, space, and matter, where was he, in what medium did he exist, before he began to create —when nothing was? They soon got deeper in metaphysical wisdom (Boodhism) till lost in a perfect maze of subtle intricacies and wire-drawn distinctions. Still however with them the symbolising and materialising propensities of human nature were at work, if they were unable to exercise this influence in endeavouring to symbolise or materialise the idea of a God, they did so with metaphysical principles and mental qualities, &c. Their first symbols, as must strike every one, were necessarily numbers, for, if they considered that such and such, and so many metaphysical principles, or such and such, and so many mental qualities existed in the Mundane constitution, then immediately, that same number conveyed the idea of, and typified them. The next step was the still further materialising into tangibility, or of the eye, or of the hand, these numerical types or symbols. This was at first simply done by merely the necessary number of scores, marks, glyphs, or erections—either separately, or combined in figures. Soon however it was remarked that some individuals of the animal creation seemed happily by some idiosyncratic peculiarity; some striking conformation, habit, or instinct; some singularity in the mode of living or moving, &c. to convey the idea of some mental or metaphysical peculiarity, or quality; *they* then became the representation or symbol; the step from this to the worst species of Fetichism, the worship of living animals or their representations, was easy and natural. After this may be said to have followed worship evincing a still more debased and brutal state of mind, outraging all the ideas of nature, sense and truth, and that was the adoration of those many-armed, many-limbed, many-headed and many-bodied monstrosities. It was things of this type that the Bengal Soldiery recognised in their march over the plains of Egypt. The sketch that I have given above is exactly the progress that Boodhism has made in India, her most antient partiality was in a reverence for certain numbers; her earlier symbols were numerical marks and scores; her later types were animals; and the decadence of her purity was the worship of the beast. As an instance, how animals were used as symbols, I will state that in the eye of a Boodhist the Elephant typifies the man who is conversant with the esoteric dogmas of his craft, as much on account of the sagacious gravity of that animal, as from the circumstance that in crossing a river it sinks deeply into the stream; aptly representing, then, the man who has waded deep through the stream of spiritual knowledge and of reason, and who, calm and collected, whilst by superior sanctity and wisdom he avoids the sorrows and evils entailed by sin, can likewise turn his attention to the salvation of his fellow-creatures. The Horse, again, sinks deep into the stream, though not so much so as the Elephant, and is therefore chosen to represent the second grade. Whilst the light, timorous Hare, fleeing headlong from danger, floats like down upon the waters, and, making but little impression on their bosom, aptly emblematises the Neophyte, he who has penetrated but little. Confer on this subject the admirable resumé of this portion of Boodhism, given by that consummate and amiable scholar, the late Abel Remusat in his notes on the travels of Foue-Koue-Ki. One might adduce numerous instances of many other animals fulfilling their part in this roll of symbolic representation. Now we can trace with comparative clearness and facility, by the aid of history, an exactly similar process (all but the first step) in the religious system of the antient Egyptians. And it was this first step, the Mystic and the Ideal, which it is more than probable formed a part of those mysteries in which the Egyptian priests initiated Pythagoras and others, but which they were objurated not to reveal. We know but little of Pythagoras and his doctrines, but there are some startling coincidences in some of the outward observances of his schools, and those of the Boodhist of the present day. The belief in the Metempsychosis and the consequent unlawfulness of taking animal life ; the renunciation of all worldly riches and enjoyment ; the long period of contemplative silence and probation ; the general pantheistical tendency and stringent moral inculcations of their creed ; the celibate vow, not because women were held in contempt, but because the society of a wife and the rearing of a family awaken passions, and entail cares and solicitudes that are incompatible with deep mental abstraction ; the abstinence from the wearing of woollen apparel ; the sacredness of the yellow color, indeed, if asked to describe in Greek the yellow vestment of the modern Boodhist and Amharitic priest, one would employ the term ὁ φαιὸς τρίβων which expresses so quaintly and yet aptly the sub-flave, or dun-yellow garment of the follower of Pythagoras, for it is inculcated that the stole of the Boodhist priest, when indued even for the first time, should be threadbare and not new ; all these, and more, are points of similarity that seldom occur in systems of totally different origin. I have already had occasion to remark, in some notes which I was requested to draw up on a Boodhist symbolical coin, in the collection of the Asiatic Society of Bengal, how that many of the figures, and monoglyphs extant on the sculptures of Antient Egypt would be viewed as most powerful and expressive symbols in the eye of a Boodhist, as that paper is, I understand, about to be published in the Transactions of the Society, I shall not enter into the subject here. With reference to the next step, the symbolising metaphysical ideas and mental qualities by means of animals, we find it one to which the antient Egyptians were most particularly addicted ; as the Hawk emblematised to them the splendor of a God—so did the Basilisk or King-snake, that of a King ; "Truth," we are told was symbolised by an Ostrich, or a feather of that bird, because all her plumes were believed to be of equal length : not a single deified idea exists in the whole Pantheon of Egypt that had not got its Fetich Cognisance. Coincidences might be shewn between the ideas that were symbolised by certain animals in the minds of the antient Egyptians, and those of the modern Boodhist. Some of the explanations in that line given by Hor-Apollo, which have been sneered at by some authors, and the whole work branded as an imposition by others, would find a curious corroboration.

Another mode in which Boodhism is fond of symbolising its ideas is by colors, especially by the reflected light of Jewels, to this also were the ancient Egyptians attached as evinced by the Urim and Thummim—the play of those divinatory "Lights of Truth"—borrowed from them by the Hebrews. I should far exceed the bounds which I have already transgressed were I to attempt to do justice to this perhaps the most interesting part of my subject, I shall content myself, therefore, with merely having mentioned the fact, and adding that to the mind of a Boodhist every planet has its corresponding Fetich, and every one of these animals has its representative Jewel, and typifying color.

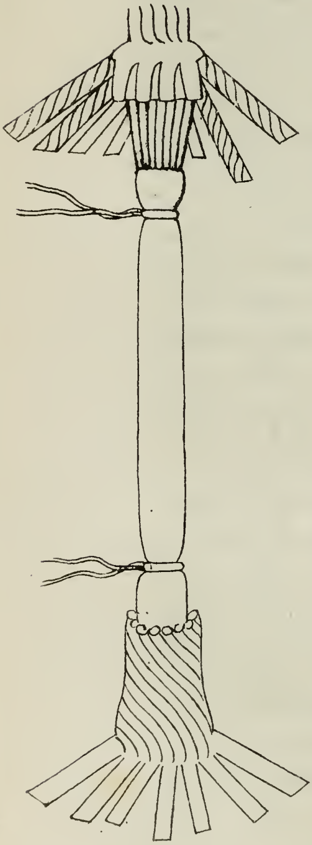
I have thus endeavoured to sketch the separate channels that superstition, the falling from the worship of the true God, took in the two families of Shem and Ham. But my subject would be incomplete, if I did not mention one cult, which they shared in common—one that took its rise from so striking and evident a circumstance—that it is probable neither borrowed it from the other. I allude to the worship of the Regenerative powers of Nature. The mind of some Savage of a more contemplative and intellectual nature than his fellows, must soon have become struck with the circumstance, that whilst when viewed at a distance the ruddy peaks of his native hills glowed with one lasting hue—and the dark outline of his forest haunts remained eternally the same; yet when closer inspected a stirring change was continually taking place: here some antient denizen of the wood came down thundering with decay, and there he saw the juicy sapling rising in its place; here the Mountain torrent sweeping its devastation before it, and there the Shoalbank growing into land; and even nearer home the same mighty influence was at work—his forefathers bore witness that his native village had been fixed in the same site from immemorable time, and yet a daily, at times perhaps to him a poignant, change was going on—here the old man gathered to his Sires, and there the nursling starting in his stead. This mysterious power became the object of his wonder and therefore of his worship; but here again the materialising and substantiality craving influences of humanity came into play, and appropriate symbols were sought for. The family of Shem, perhaps influenced by the Star worship of the Sabæan branch, chose the Sun and the Moon—the one as a representative of the Female, and the other of the Male power which they considered inherent in Nature. It is the fact of not keeping this circumstance in view, viz. that the Sun and the Moon were objects of worship in widely different points of view; that has caused so much confusion in endeavouring to explain the religious system of the antient Irish. By one class they were adored as King and Qneen of Heaven, as leaders of the Starry Host, this was Sabæism—by the other they were regarded, as I have remarked, as the mere visible symbols of the regenerative powers of nature. It is in this latter point of view in which Moses speaks of them when he blesses Joseph in the "precious fruits brought forth by the Sun, and the precious things put forth by the Moon:" indeed the whole passage strikingly alludes to the fructifying and regenerative powers of nature. "And of Joseph he said, Blessed of the Lord be his land, for the precious things of Heaven, for the dew, and for the deep that coucheth beneath, and for the precious fruits brought forth by the Sun, and for the precious things put forth by the Moon, and for the chief things of the antient mountains, and for the precious things of the lasting hills, and for the precious things of the earth, and fulness thereof, and for the good will of Him that dwelt in the bush." The symbols, chosen by the family of Ham, rapidly vitiated the worship, they were on the one side, a single numerical score or mark which progressed into a mono-style or erection; on the other a representation. The former was the prototype of that unhewn pyramidal mass, propitiated by the Canaanitish Nations with the obscene rites of Peor, which called down such severe punishment on the Israelites. It is singular that on this point also do we find a correspondence in the Boodhist land of India—in the Lingum Worship of Maha Deo.

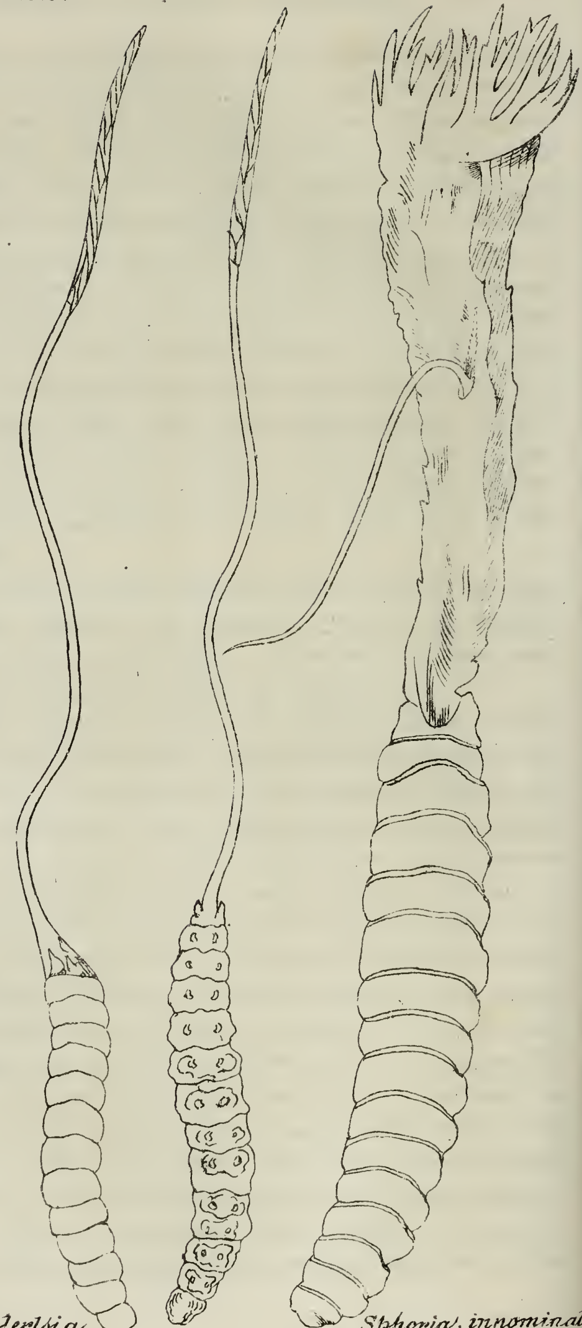
I have allowed myself to dilate on these subjects much more fully than I at first intended in order that those individuals who may be employed by the Government here in the investigation of those Boodhist remains to which attention has been drawn by the authorities at home—may, by having a general view of the whole question, be enabled to know to what peculiarities they must most essentially turn their attention: all may be briefly summed up in one word—Symbols—the greatest possible attention must be paid to the number of their component parts, carefully searching whether traces exist of any partially obliterated by time—these symbols whether numerical, or animal would probably be formed running along the architraves, friezes, and cornices: but I again repeat, the greatest attention should be paid to the number of their component parts; for instance, should there be a Star the number of its rays should be noticed—the three-rayed Star is of the most antient and rare type;—a four-rayed one never occurs; a five, is more antient than a six-rayed one; and the many-rayed are of a comparatively modern epoch. For instance should a five-rayed Star be found over the head of a figure, one would unquestionably be justified in asserting that the whole was of an African type and family; for the five-rayed may be called the African, as the six-rayed is the Indian Star; this peculiarity explains a circumstance which has been a puzzle, and which I am not aware has been solved; and that is that Hor-Apollo declares that among the antient Egyptians the number five was represented by a star. Another instance of the stress laid on certain numbers in the minds of a Boodhist is this; whatever Astronomical knowledge was possessed by the family of Ham, there is very little doubt that they were indebted for it to the family of Shem. One branch of the latter as they listlessly tended their flocks on the plains of Shinar, and during the clear and translucent nights of Chaldea, had little else to do than con the stars; their's was the belief in the seven planets, seven being to them a sacred number; these were the Sun, and Moon, (then considered as stars moving round the earth,) Mars, Mercury, Jupiter, Venus, and Saturn; to each in his turn was given the presidency of the several days of the week. To these seven the family of Ham seem to have added an eighth, whose influence according to the Indian astronomical system, was equally diffused over the whole week, to this eighth planet Cicero alludes in his tract *De Natura Deorum.* But it is more than probable that as our researches advance we may find that they did, as do the modern Boodhists, give a double influence to the Moon in order to make up the number 9, which is a sacred and holy number; thus identifying their peculiar reverence for the number "nine," with the reverence incidental to all savage minds, paid to the Wandering Star.

The next point to which attention must be paid is to color, wherever found, whether of the drapery or parts of the drapery, of the whole or parts of the figure. Some most important conclusions might be arrived at by means of such colorings.

To bring my subject to a close. As it is not probable that the Government of India—(the master of twice as many subjects as any other on the face of the globe, with the exception of China) will undertake the investigation of the antient remains of their own land, in the spirit, and on the scale that did the Government of France, and the little one of Turin, those of a foreign country in the case of Egypt; I need not enter upon what probably would be the best way to set about it. But there is one small portion, one mite which calls for their immediate attention; and that is the sending proper persons to copy the painted caves of Ajunta. Upwards of a month of the favorable season has elapsed; the jungles will soon be impassable from malaria; then will succeed the rains, which will add sadly to the work of destruction, whole pieces of fresco being loosened from the damp. It is difficult for words to describe the curious splendor of these remains; here may be seen painted in vivid colors, representations of the public, and social life of Antient India. In one compartment the public procession and the moving throng, in another

fig 3





Sphoria, Rolerlsia Sphoria, innominata

the interior of a private house, gentlemen of the olden times engaged in conversation, *taking refreshment from small cups* and surrounded by attendants; here a troop of gracile, and flower bearing maidens, and there the contortions of the young athletes; now the busy traffic of the market-place, then the port full of ships, the hum of its trade, and the creaking of its cordage speaking to the life. There, may be seen likewise representations of the leading types of the human race, the swart Æthiopian with thick lip, and curly pate, the fair-haired Son of the North, and the Red Man of the far West. And to think alas! that all this has remained for years within a few miles of one of the largest military stations in India—unsaid of—and unsung.

Calcutta Nov. 15, 1844.

The Vegetable or Bulrush Caterpillars. By James B. Thompson, M. D., *Physician to the British Hospital, Damascus, communicated by Captain* McNaghen.

This very remarkable plant, which is indigenous to New Zealand and New South Wales, may be considered as one of the most curious vegetable productions with which we are at present acquainted, and therefore merits as minute a description of its botanical characters as we are capable of giving from our very recent knowledge of its very peculiar characteristics. The New Zealanders have been long acquainted with it, and have used its top, when burnt, as colouring matter for their tattooing, rubbing the fine powder into the wounds, in which state it has a very strong animal smell. The natives eat these plants, too, when fresh, as they do also the fern-root. In the number of the 'Medical Times' for November 4th, 1843, is a short report of some remarks made at the Meeting of the Westminster Medical Society, on the occasion of my exhibiting the drawings of this vegetable, and at which time I offered some remarks on the opinions entertained by Sir William Hooker and Professor Owen, regarding the change produced in the caterpillar by the seed of a parasitic plant or fungus.

Plate II.—*Sphœria Robertsia and Sp. innominata.*

There are birds which dispossess others of their nests, and marine animals which take up their abode in deserted shells; but this plant surpasses all, in killing and taking possession; making the body of an insect—and that, too, in all probability, during the life-time of the insect—the origin from which the future plant rears its stem, and the source from which it derives its nutriment and support. We, therefore, may look upon this vegetable as one of the most surprising links between the animal and vegetable kingdom, yet noticed; and as such it deserves every attention, and as correct a description as our present imperfect acquaintance with it will admit of. The natives call it the *Ameto-Hotete.*

The *Ameto* is only found at the root of one particular tree, the *Rata.* The female *Pohuta Kana,* the root of the plant, which in every instance exactly fills the body of the caterpillar, in the finest specimens attains the length of three inches and a half; and the stem, which germinates from this caterpillar's body, is from six to ten inches high; its apex, when in a state of fructification, resembles the club-headed bulrush in miniature, and when examined with a powerful glass, presents the appearance of an ovary. There are no leaves; a solitary stem comprises the entire plant; and should this stem be, by any accident, broken off, a second stem arises from the same spot, which is one of the peculiarities of this plant, and not known to occur in any other plant with which we are as yet acquainted in the vegetable kingdom. The body is not only always found buried, but the greater portion of the stalk as well, the seed vessel alone being above ground. When the plant has attained its maturity, it soon dies away. When recently dug up, the substance of the caterpillar is soft, and when divided longitudinally, the intestinal canal is very distinctly seen. Most specimens possess the legs entire, with the horny part of the head, the mandibles, and claws.

The vegetating process invariably proceeds from the nape of the neck, from which it may be inferred that the insect, in crawling to the place where it inhumes itself prior to its metemorphosis, and whilst burrowing in the light vegetable soil at the foot of the tree upon which it was previously suspended, gets some of the minute seeds of this fungus between the scales of its neck, from which, in its then sickening state, it is unable to free or disengage itself, and which, consequently, causes it to die; and thus this seed, being nourished by the warmth and moisture of the insect's body, vegetates therefrom, and not only impedes the process of change in the chrysalis, but likewise occasions the death of the caterpillar. It is now quite clear that the vegetating process thus commences, and that, too, during the life-time of the insect. It is not improbable but that it might have received this seed while adhering to the tree, as there is no doubt but these seeds float about, and are suspended in the atmosphere, and are thus carried to a considerable distance beyond their present *locale.*

It is also more probable that the caterpillar has got this seed in its body previous to its inhuming itself, though it is the opinion of some very high authorities that it is after its inhumation that it gets the seed of this fungus.

The reason of assigning the process of vegetation to take place during the life of the insect, is this: that when changed into a plant, it always preserves its perfect form. In no one instance has decomposition appeared to have commenced, or the skin to have contracted or expanded beyond its natural size.

There are abundance of these plants to be found in New Zealand in certain districts, and always in a light peaty soil, where these trees are to be found upon which the caterpillars are being suspended previous to their inhumation. There are some very good specimens to be seen in the Museum of the Royal College of Surgeons.

A plant of a similar kind has been discovered on the banks of the Murrumbidgee river, in New South Wales, in a rich alluvial black soil. The insect in some specimens was six inches long, and the plant about the same, springing, as in the case of the New Zealand (*Sphœria Robertsia*) from the nape of the neck. This plant is quite different from the other in this respect; the New South Wales (*Sphœria Innominata*) has a thick stem, formed by the close union of several stalks which unite at the top, and are surrounded by a fringe, which, when expanded, assumes the appearance of a full-blown flower upon the surface of the soil, the rest being buried in the ground, this top has a brown velvety texture. Numerous empty shells and holes were observed in the soil in about the place where these plants are to be met with; and at night, the numbers of large brown moths were most remarkable, so much so as to extinguish a lamp. Both these specimens are cryptogamous plants.

Insects having a vegetative process of a similar kind, have been discovered in other parts of the world; and probably when the Flora of each country is more carefully examined, similar instances may be found in each of them.

At the British Association for the Cultivation of Science, held in August, 1836, a paper was read by Mr. J. B. Yates, 'On the vegetating Wasp,' found in the West Indies, and in which the author likewise was of opinion that the vegetating process commenced during the life of the insect; and the careful examination of these caterpillars will, I make no doubt, favour this hypothesis, which is now, I believe, very generally the received opinion.

If these views should be corroborated by future investigations, and found to be correct, the case of these plants and changes produced, will be an instance of a retrograde step in nature, where the insect, instead of rising to the higher order of the butterfly, and soaring aloft to the skies, sinks into a plant, and remains attached to the soil in which it buried itself.

There is some analogy between the mode in which these plants are produced and that of our own missletoe *(viscum)*, which is supposed to be propagated by birds, especially the fieldfare and thrush, which feed upon its berries, the seed of which pass through the bowels unchanged, and along with the excrement adhere to the branches of trees, where they vegetate. The missletoe of the oak has, from the time of the ancient Druids, been always preferred to that produced on other trees; but it is now well known that the *viscusquercus* differs in no respect from others.

In former times the Greeks attached many medicinal virtues to this plant, but we learn little concerning its efficacy from the ancient writers on materia medica. It obtained great reputation for the cure of epilepsy; cases given by Boyle: and Colbach afford several instances of its good effects in various convulsive disorders. It acts as a tonic, and is useful in hysteria and other nervous affections.

Observations of M. Raspail on the Chara mode of preparation. By the late W. Griffith, *Esq.* F.L.S., 1833.

Take an internodus of Chara detached from the plant, and deprived of the branches which spring from the two opposite articulations, by which the internodus is separated; the bark which covers it may be removed thus, the internodus is to be stretched out on a plate of glass shorter than the space comprised between the two articulations ; the glass is kept plunged in a shallow and small capsule filled with water. Each shred of bark is then to be pinched with the point of a scalpel, proceeding from one end to the other, ayant soin de ne pas pénétrir trop avant. When all the shreds of bark are removed, a cylinder incrusted with a white substance, adhering strongly, hard and brittle, and resisting the action of the scalpels makes its appearance. It consists of carbonate of lime, which must be removed by a lame emoussée, by scraping the tube longitudinally. If the tube thus prepared, be placed in the focus of a microscope and plunged in water, these phenomena are observed.

1. A white mesian line is seen crossing obliquely two longitudinal layers of a green colour, composed of longitudinal series of green globules, the direction of which is parallel to the white line; this line extends itself on each opposite side of the tube.

2. It is soon remarked that this white mesian line is a sort of line of demarcation, between two currents proceeding in an inverse direction, the course of which is marked by the hyaline masses which they carry with them. One of these currents proceeds on the left of the observer, the other on the right: but the globules of the one do not mingle with those of the other. On the line of demarcation large albuminous globules are sometimes visible, which obedient to the effects of the two simultaneous and opposite forces of the two currents revolve on their axes, being retained at the bottom of the liquid by their specific gravity.

Raspail placed two ligatures on the scraped tube $\frac{1}{4}$ of inch or so from the articulation : the tube included in these ligatures was detached from the plant. Not only did the circulation continue, but even, in the space of some days the ligatures fell off, the ends of the tube remained closed exactly by the union of their borders, and the circulation continued to take place from the 26th July 1827 to the 3rd September of the same year.

There is no septum in the tube: which is composed of a cartilaginous sheath, the parietes of which are thick but hyaline and very transparent. The interior of this tube is lined on each side of the mesian white line by a green membrane with parallel rows of green globules. This membrane may be detached from its adhesion to the sides of the sheath. The least *dialysis* of this green membrane stops the circulation; if it continue for some instants after the injury, the fluid circulates around, but does not cross the part deprived of the green matter. The fluid that escapes from the wounded cell coagulates rapidly on reaching the water, but it takes place at least much more slowly if at all in distilled water, one of these *flled tubes* placed in water re-produces a covering or incrustation of carbonate of lime: each of the cristals is imprisoned in the cellular interstice of a membrane, which is only the epidermis of the decorticated bark. If a tube that has been scraped &c. be placed in distilled water, no incrustation takes place. A drop of alcohol, liquid ammonia, caustic alkali or vegetable or mineral acid stops the circulation suddenly. He then states that the circulation is owing to aspiration and expiration or absorption and transudation which keep up constant currents; but only in the immediate *situs* of the parietes. Circulation in animals is carried on in the same manner, the composition of the fluid of Chara is exactly like the blood of animals, which he says is homogeneous, the serum and coagulum being formed alike, he says the globules finally disappear in water, the central globule is an optical illusion. He says that the currents of the Vorticella are produced, the ones going to the animal by aspiration, the ones proceeding from it by expiration: the ciliæ are illusions, depending on the difference of density of the expired liquid. According to him, the tube of the Chara is composed as are all the membranes of vegetable cells, of gum and lime; the green membrane is albuminous and incloses in its granulations resinous matter. The juice is composed in one of albumen precipitated in globules or dissolved in acetic acid and combined with phosphate of lime, and in the other of ordinary salts of albumen (?) tartrate of potass dissolved in albuminous acetic acid, the hydrochlorates of ammonia, soda and potass.

These observations were made on the *Chara hispida*.—See Fig. 3, Plate ii.

Dr. Justus Liebig in his Relation to Vegetable Physiology. By DR. HUGO MOHL. (DR. JUSTUS LIEBIG'S *Verhältniss zur Pflanzen-Physiologie.*) *Tubingen. Frues.* 1843.

This is the pamphlet of Dr. Mohl to which we referred in a leading article of May the 20th, and which consists of a critique on the work of Dr. Liebig, so well known in this country under the title of " Chemistry, in its applications to Agriculture and Physiology." Dr. Mohl says that work was anxiously looked for by botanists both on account of the reputation of Liebig as a chemist, and from a knowledge of the fact that they had much to look for from the aid of Chemistry in their investigation of the phenomena of the nutrition of plants. But Dr. Mohl observes that throughout the whole work there is a want of original experiment, which is the more wonderful, since it is written by the greatest experimenter of his day, and the possessor of one of the largest laboratories in Europe. Nevertheless Liebig every where insists on the importance of experiments, and is continually appealing to those of Theodore De Saussure. Under these circumstances the work can only be looked upon as an attempt to construct a theory from data already known to the world.

The next general remark by Dr. Mohl refers to the style in which the book is written. If not always correct, it is energetic and clear; the thoughts are propounded in short determinate propositions, and there is not the slightest indication of doubt or uncertainty about anything; the author seems to know everything for certain, and says it boldly out. This sort of style is apt to mislead the uninitiated, and frequently leads the author himself into positive contradictions; in fact, a thing is stated to be black or white according as it suits the author's purpose. For instance, in one place (p. 22)* he says that leaves do *not* decompose carbonic acid in the shade, (in which he is wrong,) and in another place (p. 121) he says the leaves *do* decompose carbonic acid in the shade, (in which he is right). Such contradictions are frequent, and prove that the author is neither well-grounded in the subjects on which he has undertaken to

* These numbers refer probably to one of the German editions.

write, nor has fully considered them. The manner in which Liebig attributes erroneous views, entertained perhaps by individual botanists, to " vegetable physiologists" and " botanists" in general, is objectionable and liable to mislead. Thus he says (p. 6) that " vegetable physiologists" consider humus as the principal food of plants. Now this is not true: vegetable physiologists have no sacred books in which their code of laws is contained, and if any individuals have maintained such a view, the great body has not. In fact, Ingenhousz, Senebier, Curt Sprengel, Link, and De Candolle, have all either denied it or taken other views. The doctrine of humus is altogether a chemical one, and has only been supported by chemists. Again, Liebig says (p. 24) that " all botanists and vegetable physiologists have doubted the assimilation of the carbon of the atmosphere by plants." Yet all books on vegetable physiology contradict such a statement; and the absorption of carbonic acid from the atmosphere is so generally admitted that Adolphe Brongniart, in the 13th volume of the " Annales des Sciences," has even proposed to account for the excessive vegetation of the primitive world upon the supposition, that the atmosphere at the period those plants were growing contained a larger amount of carbonic acid in its composition than it now does. This might have been considered misrepresentation, had not Liebig in many other instances displayed an equal amount of ignorance of botanical literature and facts. As, for example, when he says (p. 91) that the woody fibre of lichens may be replaced by oxalate of lime, and that in Equisetum and the Bamboo silica assumes the form and functions of the woody bundles, and (p. 36) that a leaf secreting oil of lemons or oil of turpentine has a different structure from one secreting oxalic acid.

An instance of Liebig's misrepresentation of facts occurs in his rejecting the theory of the respiration of plants. It is well known that plants absorb oxygen in the dark, and give out carbonic acid; and this has been attributed by botanists to a true process of respiration. This, Liebig thinks, betrays great ignorance on the part of botanists. He believes the giving out of the carbonic acid to be merely a mechanical process, and the absorption of oxygen to be a chemical one. He says all leaves, dead or living, absorb oxygen, and the more oil or tannic acid they possess, the more oxygen they absorb. He endeavours to prove this position by comparing, from tables made by De Saussure, the quantity of oxygen absorbed by the leaves of Pinus abies, Quercus robur, and Populus alba, as compared with the quantity absorbed by the Agave americana. Mohl remarks on this statement, that, in the first place, the quantity of oxygen absorbed by the Agave is put down at 0.3, when it ought to have been at 0.8, so as to affect the calculations very considerably; and that, in the second place, those plants in De Saussure's table which contain neither oil nor tannic acid in any quantity, as the Triticum æstivum and Robinia pseudacacia, are altogether omitted, although they absorbed more oxygen than those mentioned by Liebig; whilst the oily Juniper and Rue, which are also omitted, absorbed less.

Again, Liebig states on this point, that the absorption of oxygen has nothing at all to do with the processes of life. How is it, then, asks Mohl. that plants begin to be blighted when oxygen is withdrawn; that seeds will not germinate; that leaves lose their irritability; that the motions of leaves and flowers cease; that leaf-buds and flower-buds will not open when brought into an atmosphere without oxygen? But the way to settle the question of respiration would appear to be to determine whether the asserted relation between the quantity of oxygen absorbed and the quantity of carbonic acid given out was wrong. In De Saussure's experiments, there was found to be an exact relation in all cases. This would not be the case, were Liebig's theory of the origin of the carbonic acid correct.

These few general remarks, observes Dr. Mohl, will serve to indicate the claim of Liebig to become a reformer of botanical science.

The next part of Dr. Mohl's observations relates to the chapters of Professor Liebig's book, inscribed "The Assimilation of Carbon." The question at issue is, whether the plants owe their carbon to the absorption of organic or inorganic substances, Prof. L. having given his sanction to the latter opinion. The reasons which seem to have weighed most with him are, 1st, Humic acid loses its soluble character by exsication as well as by freezing; 2d, Even conceding that all the bases found in the ashes of plants should have been conveyed to their substance in the form of humates, yet the amount of humic acid thus conveyed to plants is not sufficient to explain the amount of carbon they contain; moreover, 3d, Even all the rain which falls on a certain area is not sufficient to explain the large quantity of carbon they contain: but the chief argument against the plants deriving carbon from humus is, 4th, That manured and barren ground will yield nearly the same amount of carbon in the plants growing thereon. It is, in fine, to be observed, that 5th, Humus and the carbon of plants must have the same origin, as it is impossible that there could have existed any primitive humus, for plants must have existed before humus. Plants receive, therefore, their carbon from the atmosphere, where it exists in sufficient quantity to supply all plants with carbon. Dr. Mohl says, then, that L. *has* arrived, in these remarks, at one or two results correct in the main; but he also shows that most of it (or at least as much as is *true*) has been known to Saussure 40 years ago. As the above axiom, however, is one of great importance in botanical physiology, Dr. Mohl proceeds to examine the doctrine of Liebig in detail. The argument stated under No. 1 proves, he says nothing—because the combination of humic acid with alkailies, stated under No. 2, is in direct contradiction to it. These parts of the question have been, however, already sifted by Schleiden; and the utmost which can be conceded is, that plants do not obtain *all* their carbon from the soil.

Liebig concludes one of his remarks relating to humus in the following words:—" As plants grown on an acre of unmanured meadow or forest-land will assimilate an equal amount of carbon to those grown on manured and cultivated fields,—as, moreover, the former soil will not become, by the process of vegetation, poorer in humus, but, on the contrary, richer; there must be a source different from humus or manure, whence plants receive their carbon, and this is the atmosphere."—This mistaken argument of Liebig, (says Dr. Mohl,) arises out of his confounding the origin of carbon in the whole of vegetation with that in a single plant, as well as on his placing unmanured soil on a par with that which is deficient in humus. A plant might require a certain amount of humus for its nourishment, and still prepare and yield, by the decay of its foliage or herbage, the same quantity, or even more than it has absorbed, for the growth of subsequent generations.

The next argument of Liebig discussed by Dr. Mohl (relating always to the origin of carbon in plants) is, that in antediluvian times, plants must have existed before humus ; and so they do now —witness the Lecanoras and Parmelias growing on the perpendicular cliffs of granitic mountains. This reminds him of the question, whether the egg or the hen existed first ; and being aware of the abuse which has of late been made of scientifie axioms being derived from mere algebraic calculations, he says that all sorts of results may be ex-calculated (herausrechnen) in that way.

To settle the question about the existence of primeval humus, Dr. Mohl makes the following remark on antediluvian vegetation. " What do we know of the incipient vegetation of the primeval world—and why, before the appearance of the highest developed plants, such for instance as Ferns, should not others which can live without humus, such as Mosses and Lichens, have prepared the humus necessary for the higher plants ?" This of course, is the eternal progress of vegetation in all times and in every place of the globe.

It is, therefore, clear (continues Dr. M.) that L. has completely failed to prove that plants do not use humus for their food. Besides, the question whether plants feed on organic or inorganic substances, was mooted long before the publication of L's. work. Although it is certain that the chief portion of plants is formed by the assimilation of inorganic substances, yet, the collateral questions, whether they receive organic as well as inorganic matter ; whether all or *only some* plants require organic substances for their existence,—these questions are far from an ultimate and scientifically-corroborated solution. Conclusions, moreover, merely based on uncertain observations, or made merely at random, cannot be of value, and ought to have been replaced by minute and well-devised experiments. In this manner, L. might have become eminently useful to science. He professes (it is true,) to despise minute experiments ; nevertheless, the Appendix to his Work contains the reprint of some made by Hartig, which he adduced in corroboration of his doctrine. But it is unworthy of a great chemist (concludes Dr. M.) to mix up experiments of men like Davy or Saussure, with those of a gentleman like Hartig, who, we are sure, does not aim at the distinction to be considered a chemist,—a science foreign to his pursuits.

The experiments which have been hitherto made relating to the question of the organic or inorganic nourishment of plants, may be divided into three classes. 1st, plants were reared in soil destitute of humus, either with distilled water or such as contained carbonic acid. Under both these circumstances they do not prosper; still, this does not prove the necessity of organic food, because they are here equally deprived of other inorganic substances, which they are in contact with, under common circumstances. 2d, Or, plants have been reared in powdered charcoal. L. says, (p. 58,) that they will attain in this material the most luxuriant growth, flower, and bear fruit; but he merely quotes in evidence the experiments of Lucas, reprinted in his Appendix. But the reasoning of L., under this head, is illusory. Lucas speaks of *vigorous* vegetation of plants reared in a *mixture* of charcoal powder and decayed leaves; of such as are grown in charcoal powder alone, he merely says that they speedily become rooted. Of their further vegetation he says nothing; and it has been proved by the experiments of Zuccarini that plants will not grow at all, or very badly, in this substratum. The same is stated by Saussure (Bibl. univ. xxxvi., p. 352,) who relates, that Peas reared in charcoal did not grow much better than those planted in mere sand. The third class of experiments relates to the question, whether plants will absorb organic substances dissolved in water, and especially humates; and whether they will prosper under these circumstances. The experiments of Saussure, Davy, and Sprengel are affirmative; but L. has reprinted (as stated before) those of Hartig, which are *negative*. The whole question, therefore, is, to say the most of it, one yet undecided. At any rate, it cannot be solved by experiments upon a single species of plants; and it is begging the question to state (p. 122) that, "All plants are the same in the chemical nature of their nutritive process."

Dr. Mohl then proceeds, at some length, to refute this unqualified assertion of Liebig. There is a considerable number, he says, of true parasites, which require for their food the juices of living plants. It cannot be doubted that such plants require substances of a peculiar chemical combination and quality for their food. Many such parasites are not green, and therefore cannot decompose carbonic acid, so that their food must necessarily consist of substances already assimilated by other plants, and stand in the same relation to the mother plant as the flower and fruit of other vegetables to their respective branches. Now this sort of nutrition from substances derived from living plants is also proper to a very large number of parasites (Loranthacæ) which are quite green, and therefore provided with organs for decomposing carbonic acid. Such plants are entirely similar in structure to those which grow in soil; but they must, of necessity, possess the capacity of feeding on substances already assimilated by other plants. To these *true* parasites are to be added the spurious parasites, which feed on decaying organic matter, amongst which some have green leaves, and others are destitute of that colour. The latter can have no capacity for decomposing carbonic acid, forming organic matter from it and water. The same is also the case with many other plants of a green colour, which although they decompose carbonic acid, still are proved by their place of abode to be dependent for their food on organic matter in a state of decomposition. From this series of plants there is but a step toward those growing in peat and heath-soil, &c. I do not mean, concludes Dr. Mohl, to prove by these statements that all plants feed on organic substances; my object is rather to explain that the introduction of organic matter into the system of vegetation is not, as Liebig asserts, necessarily detrimental to the economy of plants; and to show that it is by far preferable to have recourse to positive and precise experiments, than to indulge in groundless and general remarks and theories.

In the second chapter (*Origin and Nature of Humus,*) Liebig states, that vegetable matter is successively changed by decomposition into humus, and that it constantly forms a carbonic acid with the oxygen of the atmospheric air; all which forms a constant source of nourishment for plants, which decompose both the carbonic acid taken up by the roots, and that obtained by the leaves from the air. This, says Dr. Mohl, was known long ago. New, however, most certainly, is the argumentation by which L. intends to prove (p. 56) that humus is unnecesssary, and that plants derive their food exclusively from the atmosphere. In corroboration thereof, he adduces the antediluvian and tropical vegetation, and says of the former, that its gigantic Plams, Gramineæ (sic !), and Ferns, could dispense altogether with soil, on account of the immense development of their foliage, as they are also distinguished from those of the present world by their scanty roots. L. says further, that in hot climates the succulent plants require but a slight connexion with the soil, and develop themselves without its co-operation, in proof of which he adduces the slender roots of Sedum, Cactus, and Sempervivum. L. believes, in fine, that in lactescent plants the humidity absorbed from the air, and indispensable to their growth, is protected from evaporation by the very nature of their sap, as humidity is surrounded by caoutchouc and is protected by a sort of impermeable integument! *Risum teneatis, amici*—exclaims Mohl, in allusion to these opinions. The assertion that antediluvian plants lived on a soil devoid of humus is so extraordinary, that M. refutes it at some length. We know, he says, that monocotyledonous and cryptogamic plants possess no tap-roots, but merely fibres, which, although they are slender, still are very numerous. The assertion, therefore, that plants with thick, branchy roots (like our trees) obtain their food from the soil, and those plants which possess fibrous ones are nourished by the air—is untenable. L. himself " considers the absorption of inorganic substances to be necessary for the nourishment of plants; those, however, can only be absorbed by the roots." " The reader"—concludes M.—" will, I trust, not expect from me a refutation of Liebig's assertions on tropical vegetation, which are really beneath criticism. If the luxuriant vegetation of the tropics, with their virgin forests, Palms, and arborescent Grasses, is to be typified by a few Sedums, Cacti, or Sempervivums, and if lactescent plants are to be looked upon as surrounded by a coat of Indian-rubber; then, certainly, anything may be proved—and, not least, the ignorance of the propounder."

Professor Liebig's third chapter, inscribed " *The Assimilation of Hydrogen*," proves pretty well that all which Chemistry has made out about chemical processes in the interior of plants amounts to almost nothing. L. states, in the first instance, that woody fibre consists of carbon and the component parts of water, or of carbon *plus* a certain quantity of hydrogen. Here, therefore, the very first proposition in the progress of assimilation contains an *either* and an *or*. L. thinks (p, 60.) that decomposition of water is the more likely to take place, because water is the easier of decomposition; and this is plausible enough. But what shall we think of the consistency of Liebig, if in all other parts of his work the decomposition of carbonic acid is considered as a self-evident fact (p. 121); and leaves are said to possess powers of decomposition, stronger than that of the most powerful chemical agencies, because they can decompose carbonic acid, which resists the strongest galvanic battery! L. states further, that the formation of acids, of ethereal oils, (having no oxygen,) and of caoutchouc, *may be considered* as combinations of carbonic acid with water; all, or the greater part, of the oxygen having been eliminated. This may be true in a chemical point of view, but it remains to be proved that these combinations are really *formed* by water and carbonic acid, and are not the result of other organic combinations. But if the latter be the case,—if ethereal oils are formed by the mutual combination of organic substances,—if they exhibit certain determined stages of vegetable metamorphosis, then the decomposition of water and carbonic acid cannot be taken into account, because these do not exist as such in *organic* combinations; "and then" (concludes Dr. M.) "the process to which the above substances owe their origin is a far different one, and the explanation of Liebig is anything but a formula explaining their origin," but is quite as erroneous as the assertion would be that sugar consists of carbonic acid and spirits of wine.

In the fourth chapter, "*On the Origin and the Assimilation of Nitrogen*," L. starts from the correct assertion, that even in a soil richest in humus, no vegetation can take place without the co-operation of some nitrogenous substances; and that (as it has been proved by Boussingault) their nitorgen is derived from the atmosphere. But L. subsequently rejects the opinion (p. 65) that plants assimilate the nitrogen of the air in a direct manner, and derive their nitrogen from the ammonia contained in the rain-water (a discovery made by himself), adducing in proof that nitrogen is conveyed to plants in the form of ammonia, the analysis of the sap of Acorns, Birches, &c., in which ammoniacal salts have been found. This idea is certainly the most valuable in the whole of L.'s work. But here, as elsewhere, he has been satisfied with generalities, without looking to details of great importance in vegetable physiology. Considering the ammonia of rain-water sufficient for explaining the amount of nitrogen contained in plants, he has entirely neglected the nitric salts, and asserts (without adducing any proof) that Borage, the Chenopodia, and the Jerusalem Artichoke, owe their nitric salts merely to ammonia—an assertion by no means confirmed by the experiments of John.

In a chapter like that "On the Origin and Assimilation of Nitrogen," it was to be presumed that Liebig would have examined the form under which ammonia is conveyed to the plants. As almost all plants grow in black mould, the relation existing between the atmospheric ammonia and the humus was to be examined—a topic interesting not only in a theoretical but practical point of view. But L. treats the matter very slightly, merely stating (p. 83) that humus stands in the same relation to ammonia as powdered charcoal, viz., condensing the ammonia, but we have seen already that humus can *not* be supplied by charcoal, and although the latter substance absorbs ammonia even more forcibly than humus, yet plants will not prosper in it. This, therefore, does not corroborate L's assertion. The province of a true chemist, in this case, instead of being satisfied with the trivial fact that rotten wood absorbs ammonia, would have been rather to inquire whether these two substances will combine, and what combinations they will form. C. Sprengel and Mulder have lately asserted that humus and ammonia will form combinations soluble in water ; Saussure also found, in all sorts of humus, a soluble nitrogenous extract, by which he explains the conveyance of nitrogen to plants. Instead of making experiments, and without even taking notice of those of such men as the above, Liebig despatches the whole question with the assertion that the humic substances contained in black mould (Damm Ere) are entirely insoluble in water.

The explanation of the action of gypsum on plants is connected by L. with the existence of carbonate of ammonia in the atmosphere. He assumes that gypsum is decomposed by the carbonate of ammonia of the air ; and he considers it, therefore, a means of fixing ammonia, and conveying it to plants ; and he adds that—" This is obvious from the evident action of gypsum on the growth of grasses, and by the increased luxuriance and fertility of meadows manured with gypsum." This explanation (replies Dr. Mohl) is only true in a chemical, but not in a physiological point of view; because it is well known that gypsum is most beneficial to leguminous plants. But if its action consisted in fixing ammonia, there is no reason why it should not act beneficially on all plants, especially on Corn. And although L. asserts the latter to be the fact, (Am. d. Chem. u. Pharm. xli. p. 369), yet the farmers, who are pretty good judges in these matters, will not agree with the Professor. If L. explains in a farther part of his work the manuring influence of burnt clay and oxyde of iron by their attraction of ammonia,—an influence which, (he says) could not have been previously understood, it is certainly not to him that the discovery is owing, but to Sprengel, who in his "Doctrine of Manures" has also explained the influence of such substances by their attraction of ammonia.

Of the fifth chapter, headed "The Inorganic Constituents of Plants," Dr. Mohl says, that Liebig justly rejects the prevailing opinion, that the salts absorbed by plants act merely as stimulants, and is right in considering the bases absorbed from the soil as necessary constituents of vegetation. Liebig says, that all plants contain vegetable acids, which become combined with inorganic bases (or organic, formed by the plants themselves) into neutral or acid salts;—that, considering the constant presence of these acids, we have to infer that they serve some vital purpose, and that their formation constitutes some necessary part of the vital process. Hence, Liebig arrives at the conclusion, that several earthy or alkaline bases can be substituted for each other in the vital process, and that the quantity of the saline bases absorbed by plants depends on the saturating capacity of the acids they contain. This, (says Dr. M.,) is the second new and important principle contained in L.'s work. Still, it cannot be considered as perfectly evident, for it is only supported by the analysis of two plants. Whether the enigma which still shrouds the absorption of inorganic substances has been thus solved Dr. M. thinks doubtful. This theory, he says, is, in this respect, one-sided,—that it regards only the basal proportion of earth and alkali, and neglects the consideration of the specific proportion, which appertains to such substances in a lesser or greater degree. Many facts shew that the replacing of one base by another is only possible to a certain extent; that, moreover, the same quantity of a certain base, which may be absolutely required for the prosperity of one plant, may act as a poison to another, &c. In this respect, lime more especially is conspicuous, as the flora of the calcareous Alps, compared with that of primitive rocks, clearly proves. In this respect some plants are very fastidious, and will only bear one certain sort of soil, whilst others grow in both. In the species which may be called *fastidious of soil*, the substitution of one base for another cannot be supposed to take place.

In a subsequent part of his book, Dr. Mohl examines what Liebig has stated or retracted in his late work, " Organic Chemistry in its Relation to the Doctrines of Dr. Grubes and Sprengel." Dr. M. considers the explanations of L. in that place only as additional proofs of his inconsistency, and another sample of the uncertain style of his writings, " which leaves the reader, on almost every important topic, in perfect uncertainty what it really is that Liebig means." In only one instance, concludes Dr. M., the author has spoken plainly ; viz., in alluding to silica, of which he says that it is the first solid substance that is taken up by plants, and is that, moreover, whence the formation of wood takes its origin : acting, therefore, like one of those particles of a solution on which the first crystals are formed, and that in Equisetum and the Bamboo silica assumes the form and functions of the wood. This theory Dr. M. calls a physiological blunder, (as it certainly is,) proving Prof. Liebig's absolute ignorance of everything connected with the physiology of plants.

Another important point, says Prof. Mohl, (p. 37,) which L.'s theory does not explain, is, that the saline bases absorbed by plants are not only absorbed in the shape of carbonates, (which are easily decomposed by the mere vegetable acids,) but often also in the shape of phosphates, sulphates, &c. According to all experience, these salts are not less essential to vegetation than those bases combined with organic acids. Silica, also, is an ingredient equally essential to the growth of most, if not all, plants. Which part these substances take in the vital process, is (says M.) almost unknown, unless, indeed, we may presume that the sulphates yield plants the sulphur required for some of their organs. Of the phosphates we know still less; we are ignorant why they chiefly occur in young plants, and in their seed; and we are perfectly ignorant of the quantity required for vegetable growth—for analysis shows that the amount of phosphates varies considerably even in the same organ in plants grown on different soils, as is best seen in the different sorts of grain.

In that chapter which is devoted to the Culture of Plants, Professor Liebig puts forth a regular theory of vegetable nutrition—as far, namely, (observes Dr. Mohl,) as L.'s unconnected way of writing admits of any systematic arrangement. He again starts from the assumption, that humus cannot be absorbed and used as food by plants; for two reasons—one chemical, and the other physiological. He, in the first instance, denies that the humus of vegetable mould possesses the properties ascribed to it by chemists, it being absolutely insoluble in water, and not combining with earth into soluble salts. The latter, he says, may be seen in calcareous caves, whose stalactites, instead of consisting of humate of lime, do not contain a trace of vegetable matter. Dr. M. says that he does not intend to settle these opinions, for he has no doubt that chemists will take them up in due time. He merely throws out the following remarks:—"It cannot be positively asserted that the humates contained in vegetable mould are insoluble in water, because water will dissolve out of the soil a certain amount of an organic, brownish substance—an experiment which can be made with any garden soil; still coal of humus seems to possess the property of subtracting these substances from a solution passing or filtering through soil, otherwise (as L. has stated) all our springs would contain brown water. It appears, moreover, that besides coal of humus, the inorganic substances of the soil themselves possess (although in a lesser degree) the property of withdrawing from water the substances dissolved in it—a circumstance to which the greater purity of springs coming from a great depth may be ascribed. Still this withdrawal of organic substances is obviously only a partial one, for our spring-water is never free from organic substances—a fact borne out by analysis, as well as by the putrescence to which spring-water is subject. This perfectly agrees with the new experiments of Saussure, who found in all waters an azotised substance soluble in water." All these facts, therefore, give quite another result from that which L. has arrived at, viz. that the water which filters through vegetable mould will always supply plants with some portion of organic matter. How far this substance influences the nutritive process of plants, was the proper question for Liebig to examine, but which he has neglected to enter into. Saussure has, however, made some experiments on the absorption of humate of potash, and the extract of vegetable mould by the roots of plants (Bibl. Univ., vol. xxxvi. p. 340). Although these experiments do not strictly prove that this *is* really the case, under all circumstances; still they go so far as to prove, that it will be the case as long as the roots are healthy, and do not, by their putrescence, yield humous substances to the water. L., in a subsequent refutation of these experiments, ascribes their telling against him to an error of calculation! In another part of this chapter (p. 109), L. says, that humus, if not properly exposed to the influence of atmospheric air, will form with water a solution of a brown colour; but that no plants can grow in such soil, for the humus will consume all the oxygen contained in the air. It is (says Dr. Mohl), quite inconceivable how a man can write such things, when the inspection of any peat moss will show the fallacy of such assertions.

The second argument which L. brings forth to support his favourite assertion of plants not feeding on humus, is based on physiological grounds. He first announces as a general principle, that, under the appellation of food, such substances, only can be included, as being derived from external sources, can maintain all the vital functions, and which the organs of a plants can use for the formation of the substances peculiar to them. This ambiguous definition includes (says Dr. Mohl) some anomalies, and does not apply to several reputed kinds of food. Starch, for instance, is certainly one of the substances on which man feeds; yet he could not live on it alone. In farther explantion of his views, Liebig adduces the example of a grain of Wheat, which contains the necessary ingredients of the germ, and the first fibres of roots; and he adds that we have to suppose that these ingredients are mixed just in the proportion that is required for the development of those organs. If one of the ingredients, say starch or gluten, were superabundant, they would not serve either for the formation of leaves or otherwise Carbon, also, as well as ammonia and water, are always combined in plants with an azotised matter; and it is for this reason that substances, containing no nitrogen, like gum, sugar, &c., and consequently no humic acid (which stands next to them in a chemical point of view), are not used as food by plants, but would rather impede the vital process and kill the plant. (p. 116.) In analysing this string of assertions, Dr. Mohl observes, in the first instance, that the absorption of azotised compounds as food by plants is a fact doubted by no one; but he doubts whether the quantitative proportion between the absorption and digestion of azotised and unazotised substances, assumed by Liebig, be based on fact. L. says that this proportion must exist in the grains of Wheat. But Hermbstadt's fine experiments on the different sorts of grain show quite the contrary; for one sort of Wheat contains 41 per cent of starch to 34 per cent. of gluten, whilst another sort shows a proportion of 65 to 9. But this varying proportion of azotised and unazotised substances also occurs in the organs of vegetation themselves, as may be seen in the roots of Beet cultivated on a soil rich in vegetable mould, or in one manured with animal matter. Chemistry, therefore, does not support Liebig's assertions. Indeed, he himself, in some degree, contradicts his own statements, when he says (p. 119) that if plants obtain a greater proportion of carbon than of nitrogen, then the carbon will not be used for forming gluten, or albumen, or wood, nor for any constituent part of an organ, but will be secreted in the form of sugar, starch, oil, wax, resin, mannite, gum &c.

The assumption (continues Dr. Mohl) that the organs of plants consist of gluten, albumen, and wood, and that other constituents, like sugar, starch, &c,, are mere secretions, is decidedly wrong in an anatomical point of view, for the solid substance of all organs consists of woody fibre alone, and all the other ingredients are merely preserved in the cellular substance, &c. The same objection may be raised against the opinion, that starch, gum, &c., preserved in the cells, are mere excrements, and not constituent parts of the organ. On the other hand Dr. Mohl considers Liebig's opinion, that a greater amount of nitrogen is required for forming woody fibre, than sugar, gum, starch, &c., as perfectly true. This is corroborated by the experiments of Payen, who found in all young organs, while in a state of vigorous development, an abundance of nitrogenous juices—which leads to the conclusion that nitrogenous substances are essential to the development of new elementary organs, a position fully borne out by recent microscopical experiments on the formation of the cellular tissue in plants. If this is the case, we may also assume that the formation of substances nearly related to woody fibre, such as sugar, gum, and starch, requires also a certain amount of nitrogen; and that a less amount, although it may suffice for the abundant formation of those substances, will only produce a small amount of woody fibre, is an opinion adopted by Liebig. It may be also assumed, that if such an amount of nitrogen as is sufficient for the formation of a moderate quantity of woody fibre, is to be divided between the formation of gum and other similar substances (composed of carbonic acid and water,) and that of woody fibre—the same amount of nitrogen might suffice for the formation of a greater amount of woody fibre, and therefore, for the more vigorous growth of the plant; in those cases where the plant has already absorbed part of its food in the form of substances, which (being composed of carbonic acid and water) have also attained the first degree of vegetable assimilation.

Liebig believes, that, in this case, the function of the leaves will be impaired. This, however, it is impossible to decide, "as we have not even an idea of the variations which the assimilative process may undergo, according to the difference of the substances on which plants feed. It is also, in most cases, less essential to know whether plants absorb only organic substances and water, than whether it is necessarily in conjunction with inorganic matter, that such absorption takes place; in which case, the digestion (Verarbeitung) of inorganic substances would not be suspended; but, in conjunction with this assimilative process, another and different one would make its appearance." To decide on the existence of these processes, it would be necessary to know the metamorphoses which food undergoes in plants. But this is not the case, as we neither are aware of the manner in which gum or sugar are formed, nor of the further changes of these substances into woody fibre. Chemistry, it is true, can change wood and starch into sugar, but only by the application of strong chemical agencies, which we know are not made use of by plants. To imitate the real process is beyond the reach of chemistry; still, it is to this very process that plants owe their growth. Under such circumstances, all that we can do is to make plants absorb organic substances, and to observe the phenomena which their growth exhibits subsequently. It has been shown already that certain plants live only when they absorb organic substances; our cultivated plants prove the same thing, as well as the detailed experiments of Davy and Saussure, which have not been hitherto disproved. The theory of Liebig, therefore, is untenable, and is equally unsupported by experiment, or by exact reasoning on the nutritive processes of plants.

Liebig has himself felt that arguments founded on fact are required for the support of his theory, and he has pitched upon Mount Vesuvius to supply it. He dwells, therefore (page 131), on the luxuriant crops in the environs of this mountain, in a "soil, which, according to its origin, does not contain the least trace of organic matter, and still is considered as the very type of fertility." We possess, however, no chemical analysis of this soil, derived as it is from volcanic cinders, neither does L. say anything on the subject, but merely appeals to its general volcanic origin. But it would be a surprising thing (says Dr. Mohl), if a soil, on which, for many centuries past, most extensive farming operations (Dreisch-wirthschaft?) have been carried on, should be destitute of humus. This could be only the case, if, after every few years, it was again covered so deeply with the ashes of constantly new eruptions, that the ancient soil and all its organic matter should be placed beyond the reach of new crops. This, however, we know is not the case, and even such eruptions as do take place at intervals could not effect this. The heaviest fall of ashes (since the destruction of Pompeii) was that of 1822, which amounted on the slope of the mountain to 3 inches, and in the plain from 15 to 18 inches; but this was (according to Humboldt) the treble of any previous fall of ashes. We know, moreover, that even the slightest fall of volcanic cinders kills vegetation over an extensive area, so much so that one crop amongst eight near Mount Vesuvius is always lost through such calamities. It is, therefore, these very falls of ashes which cause the formation of a vegetable stratum on a large scale, and such must contain humus. This corresponds entirely with what Mr. Lyell states ("Princ, of Geol." ii., 148), that he found, near Pompeii, under the volcanic cinders of 1822, a layer of vegetable mould of the thickness of three inches.

In a subsequent part of this chapter (p. 124) Dr. Liebig expresses his surprise, that in all the works of Agronomists and Physiologists, one looks in vain for the leading principles of cultivation ; nevertheless, at the end of this part of his work, he states that cultivation supplies every plant with that sort of food which it requires for the development of such organs or substances as are most available to man. He further dwells on the means of arriving at that end, viz., the chemical analysis of the inorganic ingredients of soil. But these latter facts, says Dr. Mohl, were known long before Liebig, Charles Sprengel having written a series of memoirs, to demonstrate the importance of the inorganic ingredients of the soil, both for the general growth of crops, and for that of certain organs in particular. Under this head, Liebig certainly ought to have mentioned the name of Sprengel, and although he has not done so (concludes Dr. M.,) the history of science will amply repay the omission.

In the last chapter, which is headed "Rotation and Manures," L. opens the difficult question, why several crops of the same plant will not succeed on the same soil in an uninterrupted succession, and why, therefore, farmers resort to rotation. He thinks De Candolle's theory the best explanation of this, forgetting, it seems, that that coarse excrementitious theory has no better foundation than bad and injudicious experiments of Macaire Prinsep, the same man who misled De Candolle on other occasions also. Liebig, however, (says Dr. Mohl,) who has no idea that these experiments are fallacious and controverted by all succeeding ones of the same kind, works out this theory in its most minute details, and proves, *à priori* (p. 149,) that plants *must* have excrements. He divides the latter into two classes : those 'namely, which have been absorbed by the roots, but not being adapted for the nourishment of plants, are again returned to the soil ; and secondly, such substances as having been transformed in the vegetable organism by the process of nutrition, are the result of the formation of starch, woody fibre, gluten, &c. Excrementitious matter of the first class may serve as food for other plants ; nay, they may even be essential for that purpose. Those of the second, however, cannot be used by other plants in the formation of woody fibre, &c. until changed into humus, and decomposed into ammonia, carbonic acid &c.

This theory, says Dr. Mohl, is not only destitute of all reasonable foundation, but is directly contradicted by the experience of Rotation. There is no known evidence in proof of the existence of such excrementitious matter. It is true, Liebig says, that such *must* be the case, but then he adduces no proof except an ambiguous analogy with the animal kingdom, and forgetting, as he so often does, what he said (page 24,) " that analogy is the parent of that unfortunate comparison between vegetable and animal functions which places both on the bed of Procrustes, and is the cause of all error." " There is not," concludes Dr. Mohl, " the least necessity for assuming a secretion from roots. If substances formed by vital processes are of no further use to a plant, they are excreted in the form of gas through the leaves, or deposited in the form of secretion in the glands and other organs, or thrown off with decaying leaves." This theory is, moreover, at variance with the experience of what takes place in the shifting of crops. According to Liebig's views, the excrementitious matter of the second class above mentioned would not only injure the plants whence it is derived, but could not be assimilated by any others before it is transformed into humus. But experience points quite another way, because the stubble of Clover, Lucerne, or Saintfoin, which is unfit for the growth of those species, will at once produce excellent crops of other plants. If Liebig should attempt to meet this objection by saying that such excrementitious matter cannot be assimilated by the plants, whence they are derived, but may be used by others, he will upset his whole doctrine of vegetable nutrition, according to which not only all the organic compounds which remain behind after the formation of starch, sugar, &c., but even starch and sugar themselves (and thus all the organic substances of plants,) are absolutely deleterious to other plants. It is impossible, therefore, not to arrive at conclusions entirely opposite to those of Liebig, especially if we consider the phenomena of rotation at greater length, The barrenness of soil for the growth of one kind of plant, whilst it is still fertile for others, can only depend (says Dr. Mohl) on two causes. The first generation of plants may exhaust the soil of such substances as are indispensable to growth, so that the second generation will be starved ; and this certainly takes place : but it cannot be the main cause of the failure of crops, else manure would again render the soil suitable for the same crop, which is only the case to a slight extent. We must, therefore, assume that the first crops do communicate to the soil substances detrimental to the subsequent crops. These substances must be of an organic nature. It has been shown that these cannot be excrementitious, and therefore it follows that such deleterious substances must consist of organic compounds, derived from the roots which have accumulated and remained behind in the land. If, then, in a soil filled with the remains of roots, the same crop will only succeed after a lapse of years, whilst other crops will thrive luxuriantly, we may conclude, that the organic compounds of such roots will be absorbed by plants *previous* to their being decomposed into inorganic substances ; and that, consequently, plants of a different kind will use them for food, although those of the same kind will be injured by them.

After having assigned the utility of rotation to the formation of humus, Dr. Liebig states his views of vegetable nutrition at the different periods of growth. He says, that a plant returns just so much carbon to the soil as it has absorbed from it in the form of carbonic acid produced by decomposing humus. This supply of carbon is sufficient for many plants at the first period of their growth, but it is not sufficient to supply some of their organs with the necessary maximum of food. But the object of agriculture is to gain the maximum of produce, and this, says Liebig p. 154, "stands in a direct ratio to the amount of food which has been given to a plant during the first period of its development," therefore all pains are to be taken to increase the amount of humus.

The short and the long of these rather vague assertions (says Dr. Mohl), is, apparently, that a crop will be the greater the more food a plant has received from the soil before its period of flowering. But this axiom, although true in the main, is somewhat contradicted by another at p. 111, where it is stated that humus is useful to young plants, by contributing to the increase of their organs of atmospheric nutrition; but it is not indispensable, and its excess may even be detrimental in the first stages of development. The food, namely, which a young plant receives from the air in the form of carbonic acid and ammonia, is restricted within certain limits,—it can assimilate no more that the air contains. If, therefore, in the beginning of growth, the number of twigs, sprouts, or leaves overpass this proportion in consequence of a superabundance of food obtained from the soil at that period, when the plant requires more food from the air for the completion of its development, and for its flowering and fruiting than the air can supply it with, blooming and fruiting will not take place. In many cases, such food will merely suffice for the development of leaves, stems, or branches.

Here Dr. Mohl complains of the strange ambiguity of this part of Liebig's theory. In one instance (says M.), the usual quantity of humus in the soil suffices merely to form leaves, and if we want an abundant harvest, we must get it by conveying a maximum of food from the soil. On the other hand, humus adds *nothing* to the crops, but, on the contrary, is noxious, by conveying too much food, for it causes the production of too much foliage, a sufficient supply of food for which cannot be obtained from the air. Whence, then, does it arrive that a plant which has many leaves can *not* obtain from the air the food required for blooming, although it can do so if it has only a few leaves? It has been hitherto supposed that the reception of food from the air was in proportion to the number and size of its leaves; and this is plausible, but the contrary is not. When a plant standing in a moist and shaded situation grows too luxuriantly, and will not flower, the reason is not to be sought in a *deficiency* of food, but rather in its superabundance, and its influence on the too luxuriant development of its vegetative organs; for that will counteract the contraction of the axis and the metamorphosis of vegetative into floral organs.

Another statement, however, shows how Liebig arrived at the above conclusion. He says that, after the completion of its leaves, a plant does not require more carbonic acid from the soil; and that even perfect dryness of the soil will not impede the completion of its growth, if the plant continues to receive from dew and air the amount of moisture required for the process of assimilation; and that, in fine, it will derive in a hot summer its whole carbon exclusively from the atmosphere.

This assumption (says Dr. Mohl) is the result of an erroneous view of the fact, that in many plants—by no means in all—such organic substances are employed for the development of fruit, as, having been prepared by the leaves before the period of flowering, have been deposited in the stem or other organs, and are subsequently conveyed to the fruit. We know that some bulbous plants will fruit even when taken out of the soil. But general assertions, taken from special facts, can only lead to absurd conclusions. Let Professor Liebig cut plants in bloom above their roots (*unnecessary*, he says, at that period), and expose them to as much dew and rain as he likes, and see what will happen; or, as he is fond of experiments on a large scale, let him take the hay harvest for a test of this theory; which, after all (concludes Dr. Mohl), seems to be nothing more than a distorted and overdone *copy* of the doctrine of the development of plants given by Schwerz, in his treatise on Practical Agriculture (Anleiitung zum Pract, Ackenbau, iii. 56).

Besides the formation of humus, Liebig adduces another reason for the rotation of crops, viz., the relation which plants bear to the inorganic constituents of the soil. As every plant deprives the soil of certain ingredients, it thus makes it unfit for feeding similar plants, until by subsequent decomposition a fresh amount of such ingredients is again set free. To this proposition (says Dr. Mohl) no one will object; but it has long been known.

Having thus examined in detail the work of Dr. Liebig, Dr. Mohl concludes with the following general recapitulation. It appears upon the whole that Liebig has not availed himself of his chemical resources to clear up doubtful points in the nutrition of plants. Contrary to the spirit of a true investigator of nature, he has not formed his conclusions on the detailed facts of vegetable phenomena, but on random observations, or vague operations on a large scale, destitute of all precision. His calculations are based on arbitrary assumptions. His book, therefore, far from being a consistent and well-digested theory, swarms with contradictions and false reasoning. He does not possess a knowledge of the most elementary doctrines of vegetable physiology. His assertion that physiologists have hitherto considered humus as the chief food of plants is untrue. The assumption that plants live merely on inorganic substances is by no means new, but has long been one of the controverted points of vegetable physiology. The assertion that all Botanists have doubted the absorption of carbon by plants by their decomposition of carbonic acid, is untrue. The assertion that plants neither absorb organic substances, nor assimilate them, rests on mere theoretical speculation, and is destitute of all proof. The statements as to the relation borne to the atmosphere by plants in the dark is in direct opposition to every fact bearing on the subject. The assertion that the nitrogenous food of plants, and that which contains no nitrogen, are absorbed in certain proportions, is uncorroborated by the analysis of either the seed or the full-grown plant. The theory of the rotation of crops is contrary to experience, and unsound in its details. The assertion that plants receive their food during summer from the atmosphere alone, is incorrect.

On the other hand, it cannot be denied that Liebig's idea that plants derive their nitrogen from the ammonia of the atmosphere is very happy and pregnant with results. It is also probable that the absorption of saline bases is in direct ratio to the power of saturation of the acids formed in plants. These two views are a real gain to science, and it may be expected that his work will also have the merit of exciting others to make correct experiments on the nutrition of plants. But he has endeavoured to introduce into vegetable physiology a series of most erroneous notions, and his unbecoming outbreaks against other physiologists have proved him to be very little acquainted with the subjects on which his book is written.—*From the Gardeners' Chronicle for* 1843.

Fourteenth Meeting of the British Association for the Advancement of Science. York, September 25.

The General Committee assembled on Wednesday, at two o'clock, and the chair was taken by the Earl of Rosse. The minutes of the two last Meetings held in Cork, were read and confirmed.

The Report of the Council was then read, on the results of the applications made to Government pursuant to the recommendations of the General Committee at the Cork Meeting. It was stated that application had been made to the Master General of the Ordnance, for aid in conducting experiments on captive balloons, and that he had issued instructions to the Commandant at Woolwich, to afford every facility for the purpose. A resolution had been adopted at the

Cork Meeting, at the joint recommendation of several Sections, stating the desirableness of having contour lines of elevation engraved on the maps of the Ordnance Survey of Ireland, as had actually been done in the map of the county of Kilkenny, so as to show all the varieties and direction of level in the country surveyed. A memorial pointing out the advantage of such indications for drainage, road-making, regulation of water-supply, mining operations, and several other important purposes, had been presented to the Government, and though no distinct reply was given, information had been received that the contour lines had been ordered to be continued. The application for aid in the publication of Prof. Forbes's Researches in the Ægean Sea, had been favourably received by Her Majesty's Ministers; the sum of 500*l.* had been granted for the purpose; 500 copies were to be printed, 50 of which were to be placed at the disposal of Her Majesty's Government for presentation to various foreign bodies, 50 to be given to Prof. Forbes, and the remainder to be sold to the public at a considerable reduction on the cost price. The Government had also advanced a thousand pounds in aid of the publication of the catalogue of Stars in the Southern Hemisphere.

Section D.—ZOOLOGY AND BOTANY.

This Section met this morning at eleven o'clock, in the theatre of the Yorkshire Museum. The attendance at this Section was more than usually numerous.

The Secretary commenced the proceedings by reading a paper 'on the periodical birds observed in the years 1843 and 1844, near Llanrwst, Denbighshire North Wales,' by John Blackwall, Esq., F.L.S.—This was a continuation of the author's former observations on the same subject, which were commenced at the suggestion of the British Association, in order that extensive tables of the period of the arrival and disappearance of animals, and other periodic phenomena in the organic kingdom, might be obtained.

Mr. Arthur Strickland, of Burlington, observed that a single paper could not afford matter for inference. The period of appearance and disappearance of birds is very uncertain.

A paper was read by Mr. J. Hogg, on the Ornithology of a portion of the North of England, entitled, 'A catalogue of the Birds observed in South-East Durham and North-West Cleveland.'—The author entered into an extended view of the habits of many of the species, and made remarks upon the nomenclature of some of our British authors. He also proposed some modification in the classification of birds, adopting some of the *families* of Cuvier as additional tribes, incorporating at the same time with them the greater part of the families adopted by our English ornithologists. The number of species contained in the catalogue amounted to 210.

The President observed, that as the author had referred to some remarks of his on the willow-wrens, he could state that he believed that there were four British species, two of which were well known, and two more obscure. There was first, the *Sylvia trochilus*, which breeds on the ground, and builds its nest on heaths, and even in strawberry beds; secondly, wood-wrens, which were found in woods; thirdly, the *Sylvia rufa*, which occurred in his own parish, in Yorkshire; fourthly a bird called the chiffchaff, but confounded with the last, but which he called the *Sylvia loquax*. This is very common in Yorkshire. Why they are not distinguished, is, that the young birds have a brighter plumage than the old ones. Another bird mentioned by Mr. Hogg, the whinchat, was frequently called grasschat in Yorkshire, and followed the mowers during haymaking. The godwit had been mentioned; it had a long bill, and it was generally supposed that birds with long bills lived by suction; but this was not the case with the godwit, as it fed voraciously and flourished upon barley. It could not drink in deep water, but was always obliged to have recourse to the edge of a stream to drink.

Abstract of a paper 'On the Flight of Birds.' By T. Allis.—Birds require the centre of gravity to be placed immediately over the axis of motion for walking, and beneath it when flying; when suspended in the air, their bodies naturally fall into that position which throws the centre of gravity beneath the wings. The axis of motion being situated in a different place in the line of the body when walking, from that which is used when flying, the discrepancy requires to be compensated by some means in all birds, in order to enable them to perform flight with ease. Raptorial birds take a horizontal position when suspended in the air, and the compensating power consists in their taking a more or less erect position when at rest. Another class, including the woodpeckers, wagtails, &c., take an oblique position in the air : with these the compensating power consists in their cleaving and passing through the air at an angle coincident with the position of the body, and performing flight by a series of curves or saltations. Natatorial birds sometimes need very extended flight; they take a very oblique position in the air; they have the ribs greatly lengthened, the integuments of the abdomen are long and flexible which enables them greatly to enlarge the abdominal portion of their body by inflating it with air ; this causes a decrease in the specific gravity of that part, and raises it to a horizontal position. The compensating power consists in the posterior half of the body becoming specifically lighter, while the specific gravity of the anterior half remains unaltered.

This paper was illustrated by the skeletons of several birds.

Mr. A. Strickland, observing the guillemot upon the table, stated, that although this bird had the power of flying over the sea, it could not over the land.—Mr. H. E. Strickland had, originally, doubted this fact, but, from experiments he had made on the east coast of Yorkshire, he could confirm the statement of Mr. A. Strickland. He believed this fact had never been noticed by ornithologists.—Mr. R. Ball, of Dublin, stated that he had appended a note, to the effect that the guillemot could not fly on land, in a paper which had been published about eight days, by the Irish Archæological Society.

Mr. H. E. Strickland read the Report of the Committee 'On the Vitality of Seeds.'—Most of the experiments reported on at previous meetings, were still being continued. The Committee had received a large collection of seeds from Sir Wm. Jackson Hooker, which had been collected between the years 1800 and 1843. Of the seeds, nearly one hundred species, gathered in 1800 and 1801, only two species germinated, a Colutea and a Coronilla. The more recently gathered seeds germinated in a greater per-centage. Thus of forty-two species gathered in 1840, thirteen germinated. Of those which failed, were species of Cannabis, Othusa, Pæonia, &c.

The President observed, that he considered the results obtained by this Committee as exceedingly unsatisfactory, as seeds placed in different circumstances manifestly differed in the powers of their vitality.

Dr. Lankester stated, that absolute certainty, with regard to the period which plants would retain their vitality, could not be obtained ; but by a large number of experiments, in which every fact was accurately noted, principles of considerable importance might be deduced. Thus it would be interesting to know what relation the presence or absence of albumen had upon the vitality of seeds, as well as the relation of the chemical compounds, which recent chemists had developed in many of them ; and it was only by labours like those of this Committee, that it could be effected.

Mr. Francis Jennings, of Cork, presented to the Association a copy of a portion of a work publishing by the Cuvierian Society, and which is intended to comprehend a complete Flora and Fauna of the county of Cork.

Dr. Allaman read a paper ' On a new genus of Arachnidæ,' found parasitical in the posterior nares of the seal (*Halychœrus gryphus.*)

Mr. Peach read a paper ' On the Marine Zoology of the Coast of Cornwall.'—He first made some remarks on the habits and structure of the species of Blenny. He next drew attention to what he supposed to be a new species of Holothuria, and which from the circumstance of its having twenty tentacula belonged to the species typical of the genus. Although provided with twenty tentacula, it had but four rows of suckers. He then made some remarks on the *Nereis tubicola*, which he had observed floating on the water. He described the ova of the Doris, and confirmed the observations of of Messrs. Alder and Hancock relative to the larvæ condition of these nudibranchs. He exhibited a specimen of the *Cypræa monetas*, or money cowrey, which he stated to have been dredged up in a living state on the coast of Cornwall, and which he hoped would be now placed in the British Fauna.

Prof. E. Forbes expressed his great satisfaction at the discovery of a typical species of Holothuria on the British coast, which he had in his work stated, he believed, to exist, from the circumstance of typical species having been found in the seas of Holland and Denmark.

Although Mr. Peach had found but four rows of suckers, there would probably be seen the rudiments of a fifth. He considered the circumstance of *Nereis tubicola* floating accidental.

Dr. W. B. Carpenter confirmed Mr. Peach's observations on the ova of Doris, as he had found the same arrangement of the ova as mentioned by Messrs. Alder and Hancock.

Section F.—STATISTICS.

On taking the chair, Col. Sykes made a few observations on the nature and objects of statistical science, after which he called upon Mr. Porter to read a paper on the mining districts of France. This paper was a continuation of that which the author read before the Statistical Section at the Newcastle Meeting. On that occasion, the report was brought down to the close of the year 1836, and Mr. Porter now continued it from the official documents to the end of the year 1841. It must be remembered, that regular statistics of the mineral products of France was commenced in 1832, and consequently, we have as nearly as possible a power of determining the progress of mining industry in France, during a period of nine years. For the purpose of illustrating the advance made in this branch of productiveness, he directed attention to the following table, giving the value of minerals raised in the years 1832, 1836, and 1841; that is to say, during the nine years of which alone accurate records are attainable.

	1832.	1836.	1841.
Coal, Lignite, and Anthracite	f.16,079,670	26,607,071	33,159,044
Iron and steel	87,312,994	124,384,616	141,789,560
Silver and lead	856,673	881,534	774,033
Antimony	71,233	305,032	155,251
Copper	247,680	196,624	278,676
Manganese	105,150	152,671	147,783
Alum and sulphate of iron	1,077,595	1,760,607	2,052,043
f.	105,750,995	154,228,455	178,356,090
or in Sterling Money, £	4,230,040	6,169,138	7,134,123

The per-centage increase in 1836 over 1832 was 45·84
in 1841 over 1836 .. 15·62
and for the whole years .. .. 68·65, or,
7·63 per annum.

He next directed particular attention to the subject of coal, and described minutely the geographical position of the coal fields of France. The rapid increase of coal raised in France is shown in the following return :

Coal raised in	1814	665,610 Tons.
	1826	1,879,225 Tons.
	1836	2,544,835 Tons.
	1841	3,410,200 Tons.

Mr. Porter calculated that the quantity of coal raised in England was about ten times the amount raised in France.

The quantity of coal imported into France during 1841 was,

From Belgium	992,226 Tons.
Rhenish Provinces	196,502 Tons.
From Britain	429,950 Tons.
Other places	482 Tons.
	1,619,160 Tons.

The following figures present the number of workmen employed in the different divisions of the iron manufacture, and the value created in each of these divisions, in 1836 and 1841 :—

	1836.		1841.	
	No. of Workmen	Value created.	No. of Workmen	Value created.
		£		£.
1. Extraction and preparation of the ore	17,557	500,632	15,783	556,211
2. Production of pig-iron............	6,776	1,969,132	4,835	1,925,673
3. ——— Malleable iron.......	8,678	1,506,247	11,148	1,749,810
4. Drawing, rolling, &c.	8,615	812,486	13,165	1,208,946
5. Moulding, casting,&c.	2,149	186,927	2,899	230,942
Total, ...	43,775	4,975,424	47,830	5,671,582

In Great Britain we make four tons for one ton made in France, while the number of persons employed is greater in France than in England : viz.

In France	47,830
In Great Britain, ...	42,418

Mr. Porter stated that the amount of the other minerals raised in France was not of any great national importance. Coal and iron were the two great staples on which the prosperity of manufactures depends, and he presented this paper as a contribution to a comparative view of the mineral resources of the two countries, and the industrial arts connected with mineral produce. The protecting duties on iron were shown to have injured all the manufactures of France, and to have conferred no benefit on the iron-masters themselves.

In reply to some questions, Mr. Porter stated that the system of inspection in France was purely statistical, and had no right to authoritative interference. The absence of strikes in France he attributed to the habits of the people, and not to any vigilance on the part of the government inspectors.

Mr. Felkin gave an account of his visit to the coal fields around St. Etienne, and stated that the great obstacle to their increase of productiveness was a want of means of transit, and he believed that the railroads now being made would lead to more coal being raised, but that this coal would be found more applicable to steam-engines than to the processes of smelting iron.

A paper was read, sent by Mrs. Davis Gilbert, on the subject of agricultural schools. The chief purpose of the paper was to recommend the combination of spade-husbandry and the allotment system with the agricultural schools established under the national system. It was stated that at the Willingden schools the labour of the scholars in the afternoon paid for their tuition in the forenoon.

Col. Sykes read a paper on the rate of mortality in Calcutta. He stated that the population of that city consisted of 144,893 males and 84,812 females, making a total of 222,705 souls. It appeared from the monthly returns of deaths that the rate of mortality for the seasons follows the same laws of season as in temperate climates. The cold season being the most fatal, and April being a month of high mortality. In the months for the decennial period between 1831 and 1841, the following were the number of deaths :—

January 7,877, February 6,870 March 8,850, April 10,232, May 8,381, June 5,822, July 6,671, August 7,631, September 8,008, October 8,895, November 11,039, December 10,351.

As an illustration of the importance of taking a wide survey of facts for statistical purposes, it was noticed that the rates of mortality varied very much in different years; the minimum in 1831 being 2·90 per cent., and the maximum in 1833 being 8.07 per cent. The rates of mortality in persons of different creeds were very varied, as will be seen from the following table:—

Protestants	3·34	per cent.
Roman Catholics (chiefly Portuguese)	10·11	,,
Christians generally	5.46	,,
Mussulmans..	2·29	,,
Hindus	4·54	,,
Armenians	4·48	,,

The sanitary superiority of the Mohammedans over the other races, and particularly the Hindus, was illustrated by various comparisons, but the general result was the same as that given in the preceding table. A return was made of the rates of mortality among European officers, which showed the following various per-centages of deaths;—

	Single.	Married.
Colonels	7·02	4·85
Lieutenant-Colonels	6·38	3·92
Majors	2·76	2·96
Captains	4·18	2·55
Lieutenants	3·74	2·06
Ensigns	3·61	1·59
Field officers generally	4·12	3·75
Subalterns, including Captains ..	3·76	2·36
Officers generally	3·77	2·74

A desultory conversation ensued, in which no fact of importance was elicited, and the Section then adjourned.

Section G.—MECHANICAL SCIENCE.

In the absence of Mr. Rennie, who wrote to say he had been detained on business by the Government, Mr. John Taylor opened the meeting, but having to attend in another Section, Mr. Scott Russell took the chair.

The first paper read was on a new Scantlometer, by Mr. James Wylson. It is intended by this instrument to ascertain the scantlings (or depth and thickness) of timber used in buildings.

Sir Thomas Deane mentioned that since the meeting at Cork, the rooms in the Court House, which had been found most inconvenient for hearing and seeing, had been altered according to the plan proposed by Mr. Russell, which had been found to answer perfectly.

Mr. Hodgkinson was called on to report on the grant made last year for examining 'the Law of Defective Electricity of iron and stone,' but as this report was also made to the Mathematical Section, we need not here further allude to it.

Mr. Scott Russel then reported that the Committee on the Forms of Ships had now completed their labours; that the whole of the tables of the experiments, and all the drawings of the forms of the ships were now ready for publication. These tables were so voluminous, and the plates required for illustration were so numerous and expensive, that the question of publication was likely to be attended with some difficulty; but a Committee consisting of the President of the Royal Society, the Dean of Ely, Col. Sabine, and Mr. Taylor, had been appointed for the purpose of making the necessary arrangements. He had now to communicate to the meeting an important addition, which had been made to these experiments during the past year. The members of this Section were aware that the former experiments made by the Committee comprehended vessels of many forms, and various sizes, from the length of a few inches, to ships of 2,000 tons displacement, but in all these experiments direct mechanical means of propulsion had been employed, and not the force of the wind, and they were therefore regarded as applicable to steam vessels, rather than to sailing ships. During last year, however, most satisfactory experiments had been made, in which the propelling force was the wind acting on the sails of the vessel on the open sea. The circumstances in which this experiment originated, displayed in a striking manner the advantages conferred by an Association like this on the districts which it visited. The two gentlemen who had conducted this experiment were both Irishmen: one, Dr. Corrigan, of Dublin, having become acquainted, through the last meeting in Cork, with the experiments of this Association, determined on building a pleasure boat to carry out the principles which had been established by those experiments, and to have his vessel built on that form which was pointed out by these experiments as the *form of least resistance.* He accordingly built a small vessel of about four tons measurement, in the *wave form,* for the purpose of making experiments with it as a sailing vessel. The other gentleman to whom we were indebted for this experiment was Dr. Phipps, of Cork, now in London, who had formerly distinguished himself as a naval constructor, and had invented a form of his own, which had been attended with great success. At the last meeting in Cork he had become acquainted with the wave form, and it was under his superintendence that an experimental vessel had been built on the Thames, during last summer. The vessel had been tried on the Thames by Dr. Phipps, and subsequently in the Bay of Dublin, and the results of the experiments were laid before the meeting in the letters which had been received from Dr. Phipps and Dr. Corrigan. From these letters it appeared that the performances of this small vessel had been surprising. In speed she had already beaten every vessel with which she had been tried, and these included pleasure boats and yachts, some of them of high reputation for speed, and of four times her size. It was of course difficult to conduct experiments of this kind with mathematical precision, but the reports stated that the experimental vessel was not only fast before the wind, but weatherly, dry, stiff, and easily worked. The experiments on this vessel were still in progress ; and unless she should in future be beaten by some vessel of her own size, and of a different form, it would appear from these reports that the wave form might be adopted with as great advantage in the construction of sailing vessels, as it already had been in the construction of the fastest class of steam vessels.

Thursday, September 29.

Section A.—MATHEMATICAL AND PHYSICAL SCIENCE.

The President, on taking the chair, briefly observed, that the first papers which were usually laid before the Section, were reports drawn up at the request or at the expense of the Association. Of these some had arrived, and others were promised in the course of the week ; but he regretted to add, that one was prevented from being laid before them by afflicting circumstances in the family of the gentleman who had kindly drawn it up.

Sir D. Brewster then gave a provisional report on the hourly Meteorological Observations carried on at Inverness, at the expense of the British Association, by Mr. Thomas Mackenzie. It appeared from this report that the hours of mean temperature for the whole year were 8h. 30m. and 7h. 35m. the interval between which is 11h. 15m. which is called the critical period, and which is a constant quantity. This value of the critical interval at Leith was found to be 11h. 15m, which was the average of some years' observations; and it is interesting to observe, that the very same amount of the critical interval has been found at Inverness, in a much more northern latitude.

The President remarked, that Meteorological observations required the atmosphere to be in a very peculiar state, in order to insure accurate definition. He believed it was Struve who first remarked, that whenever the temperature of the night sunk much below the mean of the preceding 24 hours, no accurate definition of objects was to be expected. Dr. Robinson said, the hygrometrical state of the air was of much consequence for astronomical observations; he found that it required to be very near the point of saturation, as a difference between the wet and dry bulb thermometers of more than a degree or two precluded all accurate definition, the brighter stars having then a tendency to throw out scintillating lines ; and it was only in the moist state of the air that they appeared distinct in themselves, although surrounded by faint coloured rays. Rev. Dr. Scoresby remarked how one branch of physical research bore upon other branches. He believed that the hour at which Lord Rosse found that he could best test the accuracy of figure given to his splendid reflectors was that which Sir David Brewster had ascertained to be the time of mean temperature for the 24 hours. Lord Rosse said, that the test being the formation of a distinct image of a watch-dial placed at a considerable elevation, say 100 feet, above the tower, it was necessary, in order that there should be no tremor of the air, that the temperature within and outside the tower should be as nearly equal as possible, and that this was pretty much the time of the mean temperature of the day—about 20 minutes past nine in the morning.

'On the Analogy of the Existencies or Forces, Light, Heat, Voltaic and ordinary Electricities,' by John Goodman. The existencies, light and caloric, having by the labours of M. Melloni, Dr. Forbes, Mrs. Somerville, and others, been shown as analogical, and the identity of the electricities being established, Mr. Goodman proposed to exhibit the connecting link between the phenomena of caloric and electricity, to the properties of which (the former) the voltaic fluid, most nearly approaches. The term existencies is here employed by the author in contradistinction to the ordinarily received opinion that caloric, light, &c. are only *effects or phenomena* resulting from the *motion* of material bodies.

'On a Principle in the Theory of Probabilities,' by Prof. Young. —Let $p^1, p^2, p^3, \ldots p^n$ be the respective probabilities of happening of n independent events: then the following general principle will have place, viz:—

$p^1 + p^2 + p^3 + \ldots + p^n$ = the prob. of one of the events *at least* happening.
+ the prob. of two *at least* happening in conjunction.
+ the prob. of three *at least*.
:
+ the prob. of all happening together.

This general principle, Mr. Young observed, has not hitherto been noticed. It affords an intelligible interpretation of the sum of the probabilities of any number of independent events; and it is, moreover, useful in enabling us very readily to determine certain compound probabilities when others are already known.

'On Diverging Infinite Series,' by Prof. Young. The general principles sought to be established in this paper are. 1. Whenever an infinite series becomes divergent for particular numerical values, what has generally been called the generating function of the series requires a correction which cannot be disregarded without increasing an error infinite in amount. 2. And that so far from such series being, as usually affirmed, always algebraically true though sometimes arithmetically false, considered in reference to the generating function; on the contrary, they are always algebraically false, though sometimes arithmetically true—true, namely, in those cases, and those only, for which the algebraic function omitted becomes evanescent.

Prof. M'Cullagh communicated some remarks on an attempt lately made by M. Laurent to explain on mechanical principles the phenomenon of elliptical polarization ; and he showed that this attempt had failed. M. Laurent supposes the particles of the luminiferous ether not to be simply material points, but to have dimensions which are not insensible when compared with their distances ; and on this hypothesis he deduces a system of differential equations, the integrals of which he conceives to represent the phenomenon in question. The integral given by M. Laurent is, however, absurd, though this circumstance was not noticed by M. Cauchy, in the remarks and comments which he made on M. Laurent's memoir. The true integral of these equations (supposing them to be correctly deduced) was shown by Prof. M'Cullagh to indicate motions of the ether which do not correspond to the observed phenomena.

Mr. E. Hodgkinson gave an account of some further experiments " On the defect of Elasticity of Rigid Bodies". These experiments originated in the suggestion that possibly some of the results which Mr. Hodgkinson had communicated at Cork (see *Athen.* No. 827), had originated in the friction caused by the supports of the extremities of the bars on which the experiments were perfomed. He had therefore, in these later experiments, placed strong friction wheels as supports for the ends of the bars ; he had also changed the mode of measuring the deflection. He had previously used a wedge graduated on the side ; he substituted for this a fine screw with a divided micrometer head, by which he could measure the 10,000th part of an inch of a deflection. He then gave the numerical details of the sets taken by various bars after they have been loaded and then relieved. The most striking general results were, that the index of the power of the load to which he found the set taken most nearly proportional was 2 ; that every load, however trivial, caused a set, and that this set did not entirely disappear when the bar was given time to recover its state, but in general diminished greatly.

Dr. Scoresby inquired if Mr. Hodgkinson had tried whether a vibratory motion excited among the particles of the bar would enable them to recover their original arrangement. Mr. Hodgkinson had not, but promised to attend to the hint. Dr. Robinson suggested that the vibratory motions should not be excited with violence sufficient to cause mechanical derangement of the particles. Lord Rosse stated two facts bearing on Mr. Hodgkinson's investigations ; one, that the standards which had been made to replace those destroyed by the burning of the House of Commons had been found to alter very slightly but decidedly their dimensions, after having been finished with the greatest care. The other, that cannon were never permitted to be discharged more than 400 times under ordinary circumstances, for after that they were deemed unsafe.—Dr. Robinson stated that a fact which had always appeared very strange to him received a probable explanation from what he had just heard. It was found that the platina standard of a metre which had been constructed under the superintendence of the Academy, and which was a square prism, each of whose four faces, therefore, was entitled to be considered as the standard metre of France, when examined many years afterwards, had no two of its sides of exactly the same length : this was supposed to have arisen from the carelessness of the artist employed in its construction, who had accordingly been much censured. He now deemed it highly probable that it had been originally constructed perfect, but had altered its own form. He also mentioned a case in which the glasses of a telescope having been confined by adjusting screws to their places, to which it was necessary for the perfection of the instrument that they should be brought with extraordinary precision, the images of the fixed stars were found to form a cross of light; and it having occurred to him that the confining screws might, by altering the relative positions of the particles, affect their optical action on the light, it was found upon loosening them, that the irregular image disappeared.—Sir D. Brewster detailed many examples of the manner in which pieces of glass, being subjected to strains, by the derangement of their molecular structure, polarized light, showing zones of coloured spaces, with dark bands along the neutral parts, where the particles retained their natural arrangement. These delicate tints were found by him to vary in course of time; and a very curious fact was that if cuts were made by a diamond along the dark neutral spaces and the glass then divided, the parts were found to possess a structure precisely similar to the piece of which they were fragments; but the tints, though exactly similar, were much fainter.

FRIDAY.

'On the Meteorology of Toronto, and its comparison with that of Prague, in Bohemia,' by Col. Sabine.—The observations at Toronto were made during the years 1841 and 1842, on every day except Sundays, Christmas-day, and Good Friday, at intervals of every two hours. Since 1842 they have been made at intervals of an hour. For the purpose of rendering this communication more interesting, Col. Sabine had compared these Toronto observations with those made by M. Kairl, at the Observatory at Prague, in Bohemia. Col. Sabine entered into a comparative description of those two stations, both situate at a distance from the ocean between 300 and 400 miles in the middle of large continents. But there is one important difference, that in Europe we enjoy a climate of higher mean temperature, in proportion to the latitude, than they have in America, or the isothermal lines descend lower in America than in Europe. Thus the latitude and elevation above the sea of Toronto and Prague stand thus:—

	Latitude.	Elevation.
Toronto....	43° 39′...	330 feet.
Prague	50° 05′.......	582 ,,
Difference ...	6° 26′.......	252 feet.

Prague should be colder on account of its elevation, 0°′8 Fah.

Mean Temperature of Toronto	44°·4	Difference 4°·3.
,, ,, Prague,	48°·7	
Difference of Temperature corrected for difference of Elevation		Prague warmer 5°·1.

Prague being 5°·1 warmer than Toronto, although its latitude is 6° 26′ higher. Col. Sabine then drew attention to a table of the diurnal oscillation of temperature, and explained it. The very small differences in the results at the several hours of the two years, were remarkable, as showing that we have already determined the diurnal march of the temperature, as far as it can be obtained by two-hours observations, with a close approximation to the truth. It also appeared, that the climate of Toronto is warmer during the hours of the day, and colder during those of the night, than that of Prague. Another diagram exhibited the mean monthly and annual temperature in each of the two years, compared with Prague, and a mean temperature of twenty years. He then exhibited a diagram showing the elastic force or tension of the vapour in the atmosphere of those two places, and the degree of humidity produced by it together with their diurnal and annual oscillations. At Toronto the degree of humidity was greatest at the coldest hour of the day, and least at the hottest with remarkable regularity, the curve of humidity harmonizing with that of temperature, but being inverted in its range. The average state of the air at Toronto was that it contained 0·78 parts of the moisture required for its saturation. The curve of mean tension of the vapour had an ascending and descending branch in exact harmony with that of temperature. He then pointed out some remarkable deviations from this agreement, and particularized the climate of Trevandrum, in the East Indies. After examining the mean monthly humidity and tension, he proceeded to consider the atmospheric pressure, and compared the barometrical ranges at Toronto and Prague, and showed how remarkably similar were the phenomena which presented themselves in this subject over the two continents; and noticed a case in which, at each place, within the compass of a very few days, the highest and the lowest observed height of that instrument occurred, being apparently part of one great atmospheric wave. Col. Sabine strongly recommended that hygrometric observations should always accompany those of the barometer; and that reductions should be made and registered at the time, otherwise unreduced observations would be so unaccountable as to become worthless.

A discussion followed, chiefly upon the theoretic views adopted by Col. Sabine, all the speakers concurring in the value of the observations, and the skill and ability displayed in their discussion.

'On a new process of Magnetic Manipulation, and its action on cast iron and steel bars,' by the Rev. Dr. Scoresby. Dr. Scoresby found that it was impossible, by the ordinary process, to communicate the full charge of magnetic influence to very hard shear-steel or cast steel bars, or such as were best suited for retaining it, and therefore best for the manufacture of compasses. But he was led, by the theoretic views he holds, to try the effect of interposing thin bars of soft iron between the charging poles of the magnet, and the steel bar to be magnetized : this answered effectually and Dr. Scoresby exhibited to the section several experiments, whereby, with the old process, the magnetism imparted to the steel bars was very trivial, but by the adoption of the new process, a remarkably strong charge was communicated by one single stroke of the balls of the magnet over the bar.

Dr. Robinson exhibited and described the Orthochronograph, invented by the late Mr. Lowman, which, however, the Earl of Rosse, Prof. Stevelly and others, considered less accurate than other known instruments.

'Account of an attempt to establish the plastic nature of glacier ice by direct experiment,' by Prof. J. D. Forbes. These experiments were made in the month of August last upon the Mer de Glace of Chamouni, with the view of establishing that the increasing velocity of a glacier, from the side towards the centre, takes place (when the declivity is not very great) by the insensible yielding of one portion of the ice past another, without great rents at measurable distances producing discontinuity in the motion. The only permanent marks left by such differential motion are the veins, or blue-bands, to which the author has, in his published writings, attributed such an origin. A transverse line was drawn partly across the glacier in the most compact part which could be found, which was quite devoid of open crevices for a considerable space. The theodolite was planted over a fixed mark in the ice at the extremity of this line nearest to the lateral moraine of the glacier; and the relative, or differential, velocity of the parts towards the centre were determined at short intervals, and have been projected in a curve. This curve was shown to the meeting. It is evidently a continuous curve, convex towards the valley, and not a zigzag motion, such as must have resulted from distinct rents parallel to the length of the glacier. The length of the line, originally straight, whose *deformation* was observed, was 90 feet, and the ordinates of the curve were determined by accurate measurements at forty-five stations two feet apart. The experiments on the continuous flexion of the transverse line were extended over a longer period, at points 30, 60, 90, 120, and 180 feet from the theodolite, with similar results. The author concludes, 1st, that the sliding of the mass of the glacier over itself by insensible gradations cannot be denied; and that it is sufficient to account for the observed excess of progress of the centre above the sides of the glacier; 2nd, that this differential motion takes place in the direction in which the veined structure exists, and that it is impossible not to consider the one phenomenon as dependent on the other.

The discussion on this paper occupied two hours, and till the meeting closed, when it was arranged that it should be resumed on Saturday, at the sitting of the section, when the subject again occupied the attention of the section for upwards of three hours.

In consequence of the more than usual interest which attached to the proceedings of this section on Monday, when the Earl of Rosse described the construction of his gigantic reflecting telescope, we shall so far deviate from our custom, of reporting the proceedings according to the order of their occurrence, as to give this paper at once.

Long before the hour of meeting, the room was crowded to suffocation, and many ladies, and even gentlemen, could not gain admittance. The address was illustrated by a model, with its supporting piers and galleries complete, and by a working model of the grinding and polishing machine.

The Earl of Rosse commenced by stating, that the Council having intimated their opinion that some account of the experiments in which he had been engaged on the reflecting telescope would not be altogether devoid of interest, he would endeavour to describe, as briefly as possible, the manner in which he had attempted to accomplish the object in view, and the principal results obtained. When, about the year 1826, he first turned his attention to this subject, he considered that the knowledge of our own system might be almost considered complete. There were, no doubt, some portions of it, as the motions and distances of the satellites of Uranus, the masses of some of the planets, the rings of Saturn, and some others, which yet required elucidation, and would doubtless amply reward industrious research ; but on the whole, he conceived that our ordinary instruments, aided by the nice contrivances for accurate measurement which the perfection of modern art had introduced, were amply competent to aid in this branch of research the many men of genius who were engaged in it. But a new and a most interesting field had been opened to the view, and partially explored, by the indefatigable zeal of the distinguished Herschel and his no less distinguished and accomplished son. The subject of double and multiple stars promised a rich harvest, if our instrumental powers could be enlarged to any considerable extent ; and another field, no less promising, was that of nebulæ, of which some of those examined by the Herschels seemed to lay open to the contemplation of the astronomer regions in comparison with which our entire sidereal sphere might be considered as a mathematical point. Now, in examining these, he did not mean to deny that accurate measurements were of much importance —indeed, of the very highest ; but it must be obvious, that before we can measure we must be rendered capable of seeing. Here, then, he found the strongest inducement to attempt to improve the instrument by which this was to be accomplished. Two objects required to be kept in view : first, to give the telescope sufficient aperture to secure a sufficiency of light ; secondly, to increase to a sufficient extent the magnifying power. On these depended what might be called the optical power of the instrument, but particularly upon the former. For instance, the large telescope, of which a model stood before them, to be used effectually, must have a magnifying power of 300 times. Now, another instrument, very inferior in size, might have a much higher power, but, from the vast quantity of light which it collected into the image, objects in it became distinct which could not be at all seen by those of inferior aperture. The next question he had to determine was, whether he should attempt refractors or reflectors. Just at that time very large and very fine discs of the proper glass had been produced upon the Continent, and a strong hope was entertained of bringing the refracting telescope to a degree of perfection which had been hitherto rather hoped for than attained. But, upon a calm balancing of all the difficulties which opposed their construction, he determined to attempt the improvement of the Newtonian reflector, and that notwithstanding it was well known that an error of form of the reflector produced an error in the image more than five times as great as the same error in the refractor would produce. It was to the steps by which he attained this object that he was now about to direct the attention of the section.

" Having concluded that upon the whole there was a better prospect of obtaining by reflection, rather than by refraction, the power which would be required for making any effectual progress in the re-examination of the nebulæ, the first experiments were undertaken, in the hope of obviating the difficulties which had previously prevented the application of the brilliant alloy which may be formed of tin and copper in proper proportions to the construction of large instruments. The manner in which the difficulty had been met, was, by adding an excessive proportion of copper to the alloy, but the mirror was no longer susceptible of a durable polish, and, when used, its powers declined rapidly. It appeared to me, therefore, to be an object so important to obtain a reflecting surface which would reflect the greatest quantity of light, and retain that property little diminished for a length of time, that numerous experiments were undertaken and perseveringly carried on. After a number of failures the difficulties appeared to be so great that I constructed three specula, where the basis of the mirror was an alloy of zinc and copper in the proportion of 1 zinc to 2·74 copper, which expands with changes of temperature in the same proportion as speculum metal. This was subsequently plated with speculum metal, in pieces of such size as we were enabled to cast sound. These specula were very light and stiff, and their performance upon the whole satisfactory; but they were affected by diffraction at the joinings of the plates ; and although very brilliant and durable, defining all objects well under high powers, except very large stars, still as the effect of diffraction was then perceptible they could not be considered as perfect instruments. In the course of the experiments carried on while these three specula were in progress, it was ascertained that the difficulty of casting large discs of brilliant speculum metal arose from the unequal contraction of the material, which in the first instance, produced imperfections in the castings, and often, subsequently, their total destruction; and it appeared evident, that, if the fluid mass could be cooled throughout with perfect regularity, so that at every instant every portion should be of the same temperature, there would be no unequal contraction in the progress towards solidification, nor subsequently, in the transition from a red heat to the temperature of the atmosphere. Although it was obvious that the process could not be managed so that the exact condition required should be fulfilled, still, by abstracting heat uniformly from one surface (the lower one), the temperature of the mass would be kept uniform in one direction, that is, horizontally; while in the vertical direction, it would vary in some degree as the distance from the cooling surface. These conditions being satisfied, we should likewise have a mass which would be free from flaws, and, when cool, would be free from sensible strain; nothing could be easier than to accomplish this, approximately, in practice; it would be only necessary to make one surface of the mould (the lower one) of iron of a good conducting material while the remainder was of dry sand. On trial, this plan was perfectly successful; there was, however, a new, though not a very serious defect, which was immediately apparent—the speculum metal was cooled so rapidly that air-bubbles remained entangled between it and the iron surface; but the remedy immediately suggested itself, by making the iron surface porous, so as to suffer the air to escape; in fact, by forming it of plates of iron placed vertically side by side, the defect was altogether removed. It only then remained to secure the speculum from cooling unequally, and for that purpose it was sufficient to place it in an oven raised to a very low red heat, and there to leave it till cold, from one to three or four weeks, or perhaps longer, according to its size.

"The alloy which I consider the best, differs but little from that employed by Mr. Edwards: I omit the brass and arsenic, employing merely tin and copper in the atomic proportions, namely, one atom of tin to four atoms of copper, or, by weight, 58.9 to 126.4. As it was obviously impossible to cast large specula in earthen crucibles, the reverberatory furnace was tried; but the tin oxidized so rapidly, that the proportions in the alloy were uncertain; and after some abortive trials with cast-iron crucibles, it was found, that when the crucible is cast with the mouth up it is free from the minute pores through which the speculum metal would otherwise exude; and therefore such crucibles fully answered the purpose. It was very obvious that the published processes for grinding and polishing specula, being in a great measure dependent on manual dexterity, were uncertain and not well suited to large specula; accordingly, at an early period of these experiments, in 1827, a machine was contrived for the purpose, which has subsequently been improved, and by means of it a close approximation to the parabolic figure can be obtained with certainty;

as it has been described in the Philosophical Transactions for 1840, it is unnecessary to do more than to point out the principle on which it acts. The speculum is made to revolve very slowly, while the polishing tool is drawn backwards and forwards by one excentric or crank, and from side to side, slowly by another. The polishing tool is connected with the excentrics by a ring, which fits it loosely, so as to permit it to revolve, deriving its rotatory motion from the speculum, but revolving much more slowly. It is counterpoised, so that it may be made sufficiently stiff, and yet press lightly on the speculum ; the pressure being about one pound for every circular superficial foot. The motions of this machine are relatively so adjusted that the focal length of the speculum during the polishing process, or towards the lateral end of it, shall be gradually becoming slightly longer, and the figure will depend in a great measure upon the rapidity with which this increase in the focal length takes place. It will be evident that a surface, spherical originally, will cease to be so, if, while subjected to the action of the polisher, it is in a continual state of transition from a shorter to a longer focus ; in fact, during no instant of time will it be actually spherical, but some curve, differing a little from the sphere, and which may be made to approach the parabola, provided it be possible in practice to give effect to certain conditions. An immense number of experiments, where the results were carefully registered, eventually established an empirical formula, which affords at present very good practical results, and may hereafter, perhaps, be considerably improved. In fact, when the stroke of the first excentric is one-third the diameter of the speculum, and that of the second excentric is such as to produce a lateral motion of the bar which moves the polisher, measured on the edge of the tank, equal to 27, the diameter of the speculum, or referred to the centre of the polisher, of 1.7, the figure will be nearly parabolic. The velocity and direction of the motions which produce the necessary friction being adjusted in due proportion by the arrangements of the machine, and the temperature of the speculum being kept uniform by the water in which it is immersed, there remains still other conditions, which are essential to the production of the required result. The process of polishing differs very essentially from that of grinding : in the latter, the powder employed runs loose between two hard surfaces, and may produce scratches possibly equal in depth to the size of the particles: in the polishing process the case is very different; there the particles of the powder lodge in the comparatively soft material of which the surface of the polishing tool is formed, and as the portions projecting may bear a very small proportion to the size of the particles themselves, the scratches necessarily will be diminished in the same proportion. The particles are forced thus to imbed themselves, in consequence of the extreme accuracy of contact between the surface of the polisher and the speculum. But as soon as this accurate contact ceases, the polishing process becomes but fine grinding. It is absolutely necessary, therefore, to secure this accuracy of contact during the whole process. If the surface of a polisher, of considerable dimensions, is covered with a thin coat of pitch, of sufficient hardness to polish a true surface, however accurately it may fit the speculum, it will very soon cease to do so, and the operation will fail. The reason is this, that particles of the polishing powder and abraded matter will collect in one place more than another, and as the pitch is not elastic, close contact throughout the surfaces will cease. By employing a coat of pitch, thicker in proportion as the diameter of the speculum is greater, there will be room for lateral expansion, and the prominence can therefore subside, and accurate contact still continue; however, accuracy of figure is thus, to a considerable extent, sacrificed. By thoroughly grooving a surface of pitch, provision may be made for lateral expansion contiguous to the spot where the undue collection of polishing powder may have taken place. But, in practice such grooves are inconvenient, being constantly liable to fill up: this evil is entirely obviated by grooving the polisher itself, and the smaller the portions of continuous surface, the thinner may be the stratum of pitch.

"There is another condition, which is also important, that the pitchy surface should be so hard as not to yield and abrade the softer portions of the metal faster than the harder. When the pitchy surface is unduly soft, this defect is carried so far that even the structure of the metal is made apparent. While, therefore, it is essential that the surface in contact with the speculum should be as hard as possible, consistent with its retaining the polishing powder, it is proper that there should be a yielding where necessary, or contact would not be preserved. Both conditions can be satisfied by forming the surface of two layers of resinous matter of different degrees of hardness ; the first may be of common pitch, adjusted to the proper consistence by the addition of spirits of turpentine, or rosin ; and the other I prefer making of rosin, spirits of turpentine, and wheat flour, as hard as possible, consistent with its holding the polishing powder. The thickness of each layer need not be more than one-fortieth of an inch, provided no portion of continuous surface exceeds half an inch in diameter, the hard resinous compound, after it has been thoroughly fused, can be reduced to powder, and thus easily applied to the polisher, and incorporated with the subjacent layer, by instantaneous exposure to flame. A speculum of three feet diameter thus polished, has resolved several of the nebulæ, and in a considerable proportion of the others has shown new stars, or some other new feature."

In conclusion, Lord Rosse exhibited drawings of the nebulæ, as figured by Herschel, and also as they appeared in the telescope constructed by his Lordship.

Fig. 88, of Herschel, or 2 Mesier, and 21h. 25m. δ—1° 34′ south many of the stars into which it is reduced by his telescope, are as large as those of the first magnitude to the naked eye.

Fig. 81, Herschel, the bright nebula near ζ Tauri, figured by Herschel as perfectly elliptic and resolvable, but no stars seen, is seen in the telescope, with three-feet aperture, as a rather oval cluster of stars, with projecting filaments of stars, some of these filaments extending considerably, so as to give something of the idea of a scorpion.

Fig. 29, of Herschel. The ring nebula of Lyra, shows in the three-feet telescope, seven stars, one triple. It is an annular cluster, with fringes, and the nebulous-looking centre in patches.

Fig. 45, of Herschel, a planetary nebula, is also seen as anannular cluster.

Fig. 26, of Herschel, the " Dumbell Nebula," is seen as an irregular cluster, or rather two in juxta-position, and nothing of the exact elliptic termination of Herschel's figure.

Dr. Robinson and the Marquis of Northampton briefly addressed the section.

THURSDAY.

SECTION B.—CHEMISTRY AND MINERALOGY.

'On the Mineral Springs and other waters of Yorkshire,' by W. West, Esq.—The results of analysis of the waters of Harrowgate and other places were detailed with great minuteness, and the districts from which the waters were collected described. The quantity of sulphate of soda existing in some of these springs was very great, and to this salt was principally ascribed their medicinal qualities.

Mr. Hunt drew attention to the fact discovered by him in Cornwall, that the quantity of muriate of soda in the waters of that county, increased greatly with their depth, until, at the depth of 312 fathoms, he had found as much as $6\frac{1}{2}$ per cent. of that salt.—The Rev. W. V. Harcourt stated, that the waters of an artesian well in the neighbourhood of York, gave evidence of a very great increase, in the quantity of its saline ingredients as it increased in depth, giving at its greatest depth, 48·3 grains of the sulphates of magnesia and soda per gallon.

Prof. Daubeny communicated a verbal account of the phosphorite rock in Spanish Estremadura, which he, in conjunction with Captain Widdrington, R.N., had last summer undertaken to explore. He stated its occurrence in one solitary mass, penetrating clayslate, the dimensions being at most 16 feet in width, its length along the surface of the rock extending to about 2 miles, whilst its depth is unexplored, but certainly considerable. He stated its composition to be about 80 per cent. triphosphate of lime, and about 14 fluoride of calcium, and pointed out the first cause of the secretion of so large a mass of both these substances in the older rocks in order to supply two necessary ingredients to bones and other animal matters. He stated his having detected fluorine in all the bones and teeth of recent as well as of older date which he had examined, and suggested that as a rock of such a composition could hardly fail to be useful as a manure, if it were found in an easily accessible locality, it would be worth the while of geologists to search for veins of this mineral in the older rocks of this and of other countries, where there was a facility of transport.

Mr. Pearsann observed, that the presence of fluorine in bone had, in all probability, escaped detection from the fact that the fluate of lime was soluble in muriatic acid, from which, by evaporation, it could be obtained in crystals. He had tried experiments with phosphorite as a manure without any appreciable advantage.—Mr. Solly stated, that in some experiments on the comparative advantages between the phosphorite and the phosphate of lime in bone, the superiority was decidedly on the side of the phosphorite, which was applied in the state of fine powder, mixed with the soil. He then suggested for inquiry, whether fluorine might not be formed by the plants themselves.—Prof. Graham remarked that fluorine could not be detected in the ashes of plants. He considered that the fluorine in bone was derived from water.—Dr. Carpenter made some remarks on the differences observed under the microscope in the molecular structure of the phosphorite and the phosphate of lime in bone.

'The Influence of light on the germination of seeds and the growth of plants,' by Mr. R. Hunt.—The author postponed a full report on this subject until he had been enabled by the experiments of another year to reconcile, if possible, some very anomalous results. Several experiments were described, all of which went to confirm the statement originally made by Mr. Hunt that light prevented healthful germination, and was detrimental to the growth of the young plant. The author now gave the results of some experiments made with a view of determining the question of the production of the woody fibre. He finds that plants growing under the influence of light which has permeated blue aud red media, contains more water than those which had been grown under the influence of rays which had permeated yellow and green absorptive media. On the contrary, the formation of woody fibre is greatest in the plants grown under the yellow and green relatively as follows :—

Those under the blue leaving	7.16 per cent. of woody fibre.
the red	7.25
the green	7.60
the yellow	7.69

Young plants in a healthy state were removed from the garden to the influence of the isolated rays. In all cases, the plants died under the yellow light in a few days; they slowly perished under the influence of the green, and only grew healthfully under the red and blue light.

Prof. Grove wished to make some inquiries relative to the supposed existence of a new principle in connexion with light, which was regarded by Mr. Hunt and others as the active chemical agent, to which was to be ascribed all the phenomena of photographic action, and the most genial influence on the growth of the young plant.—Mr. Hunt explained that the luminous calorific and chemical spectra were capable of producing extremely different effects. That the light coming from the sun was not at all equal in quantity to the heat; and that that element was much less than the amount of chemical power. He showed by diagrams, that the quantity of chemical power increased in the spectrum as the light diminished, and that when the light was at a maximum the chemical action was at a minimum. It was also stated, that by the use of absorbent media, light of great intensity could be obtained, which possessed scarcely any chemical power; and on the contrary, that this chemical principle of the solar beam could be obtained in the same way with but a very small amount of light.

Dr. Bateman described Mr. Phillips's method of discovering Adulteration in tobacco.—The basis of this plan is the ascertainment and comparison of the relative proportions of soluble and insoluble matter in tobacco; water being the solvent. Numerous experiments have proved that every kind of vegetable matter has a determinate portion, which is soluble in water; thus rhubarb-leaves range from 18 to 26 per cent., and horse-radish, lettuce, oak, elm, and many others, have their definite limits. This amount, with reference to tobacco, in no case exceeds 55 per cent. of the tobacco: and thus if tobacco be adulterated with matter soluble in water, the extractive or soluble part is increased, whilst the ligneous and insoluble matter are correspondingly decreased. A sample of genuine tobacco, by careful manipulation, affords 50 per cent. of soluble matter, and when another portion of the same tobacco has been mixed with 15 per cent. of soluble matter, the sophisticated article can contain only 85 per cent. of tobacco; and it would be found by experiment to afford to water 57.5 of soluble, and 42.5 of insoluble matter, thus affording proportions for calculating the actual amount of adulteration introduced.

SECTION C.—GEOLOGY AND PHYSICAL GEOGRAPHY.

'Report of the Committee for registering earthquake shocks in Scotland.'—The report is confined as usual to the detail of shocks observed by Mr. M'Farlane, at Comrie, in Perthshire. During the last twelve months thirty-seven shocks have been registered, but few were so violent as to produce any effect beyond the neighourhood of the town. The most intense occurred on Sunday the 25th of August 1843, during the morning service, and was felt simultaneously over more than 100 square miles. The Seismometer at Comrie vibrated $\frac{3}{4}$ inch W.

'On a newly discovered species of unio, from the Wealden strata of the Isle of Wight,' by Dr. Mantell. The species of unio described was found near Brook, on the S.W. side of the Isle of Wight, imbedded in the laminated clays and sands of the Wealden formation, which compose the line of cliffs between Freshwater Gate and Brixton. They were associated with the wood and branches of coniferous trees, and are considered by Dr. Mantell as affording an additional proof that the Wealden deposit was formed in the bed or delta of the river of the country of the Iguanoden, and not in an estuary of the sea. The extensive layers of *Paludinæ Cyclades*, and minute freshwater crustaceans *(Cyprides)* must have been slowly and periodically deposited in tranquil water, either the river bed, or inland lakes connected with the main stream. The species of unio hitherto noticed in the Wealden are small and delicate species, the largest not exceeding two inches in length : the subject of the present memoir, which the author proposes to call *U. Valdensis* on account of its geological habitat, is a very thick and strong shell, several specimens measuring five inches in breadth, three in length, and two in thickness.

A paper was read by Prof. Ansted, 'on the importance of preserving mining records,' and to prove that without parliamentary interference, there is no prospect of obtaining or preserving such records.

Mr. Sopwith stated, that exact information would not only be conducive to the progress of geological science, but of the highest importance to the general interests of the country. The subject had been brought before the Association at Newcastle : a committee was then appointed, the representations of which to the Government led to the institution of a Mining Record Office, in connexion with the Museum of Economic Geology, and of an officer to take charge of such plans and records as should be deposited there. But, notwithstanding all that had been done, much remained to be done, and he was convinced that the sanction and aid of the Legislature could alone effect a general registration of mines.—Mr. J. Taylor described several instances of the evils resulting from the want of such information. On one occasion 80,000*l.* had been expended on a copper mine in Cornwall, which became less productive the deeper it was worked and was finally abandoned. In this case a minute record was kept of the state of the operations, and the reasons for their abandonment, so as to afford a complete refutation of the pretensions of a company which had been recently formed for the purpose of re-opening the works. In Mexico, on the contrary, workings had become unprofitable on account of their expense, during the war with Spain, a record having previously been made of the state of every part of the mine. These mines had subsequently been drained and re-opened under Mr. Taylor's directions, and the account of them found to be very correct. He was convinced that much loss of life and much expensive litigation might be avoided, if mine owners were bound by law to keep a record of their proceedings. There ought to be no mystery or secret in mining; it answered no good purpose; in the mining operations of Cornwall for fifty years there had been no secrets; a meeting was held every two months, at which all accounts were made up and made known publicly.—Sir H. T. De la Beche attributed many of the accidents in the mines to the absence of documents respecting old workings and adjacent mines. The Goverment had done all in their power for the preservation of mining records, but difficulties had been experienced in inducing interested parties to avail themselves of the opportunities thus afforded.

'On the Sections of the Cretaceous and Tertiary Systems in the S.E. of the Isle of Wight, and the bearing of the evidence they afford in the history of Animal Life,' by Capt. B. Ibbetson and Prof. E. Forbes.—Three models had been constructed by Capt. Ibbetson from trigonometrical surveys in order to illustrate the sections of cretaceous and tertiary systems of the S.E. coast of the Isle of Wight. Measurements of all the strata, both tertiary and cretaceous and tables of their fossil contents, were also laid before the meeting. Reviewing the strata deposited from the cessation of the Wealden to the prevalence of a fresh-water eocene formation in this locality, the authors laid stress on the following facts in the local history of organized nature during that long period :—That the seas in which the lower greensand was deposited occupied the area described, in consequence of the sudden subsidence of the great Wealden lakes, and presented from the very commencement a Fauna which was truly marine, and most of the members of which began their existence with the commencement of the cretaceous era in England. Almost all the animals which appeared were such as were new to the oceanic Fauna, but among them were many forms representative of other species which had existed in the oolitic ocean. Secondly, that this Fauna continued, though apparently diminishing in consequence of the extinction of species from physical causes, until the commencement of the deposition of the gault, when a new series of animals commenced, among which a few previously existing species lived on, but the greater part were either representative or peculiar forms. The same system of animal life appears to have continued throughout the remainder of the cretaceous era in this locality, although great differences in the distribution of species, and many species *local in time* occur, depending on the very great change in the mineral conditions of the sea bottom during this epoch. The chalk formation especially presents many peculiar species, owing rather to the zone of depth in which they lived, than a new zoological representation in time. The authors called attention to the assemblage of minute corals, sea-urchins, terebratulæ, and *Spondylus spinosus*, in that part of the Culver Section at which is seen the junction of the chalk with flints and the hard chalk, as corresponding to the characters which mark a very deep sea Fauna at the present period. Thirdly, that in the tertiary formation which succeeds there is an entirely new Fauna, distinct as to every species in this locality, though elsewhere connected with the cretaceous strata by the presence of that remarkable mollusk, *Terebratula*

Caput-Serpentis, which lives even at the present day. This Fauna, which did not appear until after the deposition of a considerable bed of mottled clays containing no traces of animal life, commences similarly to the Fauna of the two cretaceous periods by a series of clays containing numerous peculiar myaciform shells, and their associated Pectunculi and Ostraceæ. The earliest fossiliferous bed at Whitecliffe Bay is a most remarkable thin stratum, almost entirely composed of a species of shell-bearing annelid, the Ditrupa (*Dentalium planum* of the Mineral Conchology), which appears to have lived but a short time and suddenly disappeared. In the midst of these strata beds charged with myriads of foraminifera, probably indicating some change in the sea's depth, appear and cease. The sudden conversion of the sea into a fresh-water lake, indicated by a stratum of Paludina clay, its return into a brackish state, and the consequent re-appearance of certain marine animals, its reconversion into a fresh-water lake thronged with myriads of fluviatile mollusca, and the almost momentary influx of salt water during that period, lasting only so long as to enable a race of oysters to live and die away, all render the tertiary strata in this locality highly interesting. From the great zoological break between the eocene and the chalk, the authors conclude that a third or uppermost cretaceous formation, characterized by a Fauna which would link the middle term of that system with the middle term of the tertiary, has disappeared in this locality, whilst they regard the cretaceous system there present, as composed of two divisions, equivalent in time, the older consisting of the lower greensand, and the upper or later composed of gault, upper greensand, and chalks, considered as one system.

Mr. Oldham reported the progess of the 'Observations on Subterranean Temperature in Ireland, undertaken at the request of the Association.—In July 1843 thermometers were placed at the copper mines of Knockmatson Company, Waterford, which are worked to the depth of 774 feet. Of the four instruments employed, one was hung in the open air four feet from the surface; one hung freely in the gallery at the depth of 774 feet; one in the rock at the same depth; and one in the lode or metallic vein. The rock is indurated clay-slate, the ore massive copper pyrites in quartz veinstone. The average of all the readings of these thermometers during eleven months was as follows :—

		Thermometer at the Depth of 774 feet.		
	At the surface.	Air.	Rock.	Lode.
Average, ...	50·026	57·176	57·369	57·915
Maximum, ..		58·25	58·5	58·5
Minimum, ..		56·	56·5	

Taking the average temperature in the rock as the mean at that depth, and allowing 100 feet for the depth to which the action of solar causes may extend, or to the line of no variation, there is an increase of 7.343 for the depth of 674 feet, equivalent to 1° in 91.82 feet, a rate of increase about one-half as rapid as the rate deduced from a large number of observations in England, which gave an increase of 1° in 45 to 50 feet. Mr. Oldham also noticed the fact that there was a gradual decrease in the actual temperature during these observations ; the average of the thermometer in the rock being 57.718 during the first half of the observation, and 57.004 during the latter half, being a decrease of.674 during the eleven months, although more men were employed, and the works more extensive than at the commencement.

Friday.

'Critical Remarks on certain passages of Dr. Buckland's Bridgewater Treatise,' by the Dean of York.—[We give but a brief abstract of this communication, as it was published the following day, in the form of a pamphlet, entitled, 'The Bible defended against the British Association !,]—The author objects to the theory of the original formation of the earth, and the various subsequent changes in its condition, described by Dr. Buckland, because his theory will not account for the many facts made known by geologists. These facts are, principally, the abundance of limestone rocks in formations of all reputed periods ; the absence of a complete series of rocks, as represented in tables of the strata, at any one locality ; the non-universality of the coal, lias, &c. ; and the inversion of the strata at Malvern and Abberley. He also gives Dr. Buckland credit for many improbabilities, such as the formation of all the strata from the wreck of granite alone by the action of rainwater ; the omission of the *sea*, &c., in his account ; the growth of trees on bare granite ;

and fish living in fresh water,—in water only. The Dean then proposes a theory of his own, "to account for every modern discovery." He supposes that the world continued as it was made for nearly two thousand years,—the land, air, and water being all thickly peopled. He then introduces a series of violent convulsions, continuing for *several days* uninterruptedly, by which *all* the strata, from the *Silurian* upwards, were formed. Submarine volcanoes burst through the granitic crust of the earth, and poured their streams of lava into the sea, and torrents of rain descended from the higher lands. The author does not insist on attributing these agencies to natural or supernatural causes. The strata first formed would only contain "a few crawling reptiles, crinoidea, or trilobites;" the second would overwhelm the saurians, who lived on the edge of the waters; the next, "the heavy animals, who, in the flood that is covering the land, are unable to fly fast enough to the hills"—the megatherium, the didelphys, the pterodactylus, &c. Strata would thus be formed every day, the materials arranging themselves according to their specific gravity. The coal he supposes "to ooze out from the side of the volcano," and the plants in it to have been caught by "the shale thrown up high into the air, and falling with velocity to the bottom, carrying down upon the coal the large leaves of ferns, &c., which it meets with in its descent." The lias fossils were sunk to the bottom by the clay suspended in the turbid waters adhering to them; and the oolites were formed out of the "purer lime, tossed and rolled about into little balls." "Lastly, the chalk subsides and the sand—but little remains for these to inclose—and little is inclosed within them." In this manner a deluge of but a few weeks' duration would, in the opinion of the Dean of York, produce the whole series of the stratified rocks, and explain every discovery which cannot, he says, be accounted for by the theory of Dr. Buckland.

Prof. Sedgwick rose to offer some comments on this communication. "But before I proceed to do so," he observed, "I think it right to state a few circumstances respecting the principles on which the association acts, and the motives by which its members are brought together. Our object is, the *comparison of facts;* the sifting of them, by kindred spirits meeting together, in the pure love of truth, for the advancement of science, and thus ascending to higher generalizations, and the knowledge of those laws by which individual phenomena are governed. Every man has generalized to a certain extent, by separating peculiar and individual facts, embodying them in some general conception, and giving it a name. Wherever truth can be expressed in language, it is done as a generalization. As we advance in the discoveries of science, facts multiply so fast upon us that they would become unmanageable, if we could not group them by certain resemblances, or include them under some simple law, which is merely an expression of a general conclusion derived from facts which we know to be true and from which all those phenomena proceed, as necessary and inevitable consequences. The moment we arrive at the knowledge of such a law we can assume, in a certain sense, a prophetic character, and predict events with certainty, because we know that the Author of nature is unchanging in his operations, and that the same effects will follow the same causes in times to come as in times past. Astronomical predictions afford a familiar example of the certainty of these conclusions, and, in fact, whenever we act upon *experience* in the most homely affairs, we act on the same principle. We meet together here to extend our generalizations by new facts, or to modify those laws at which we had previously arrived by embodying all the new truths we have attained, so as to bring our generalizations up to the condition of present knowledge. In some cases we have tested our general conclusions so often that we are as certain of their truth as we are of our own existence. There are others in which we have not arrived at any such certainty, and it is exactly such conclusions, and the facts connected with them, that we meet here to discuss. Even in astronomy there are still certain residual phenomena, at present not fully explained; but in a new science like geology, which brings to light such a vast variety of unexpected phenomena, such indications of intense and powerful action, the mechanism of which is but imperfectly comprehended, it is most advantageous that collections of facts, brought here by observers with different views, should be closely examined, in order that one may check another, and that laws of phenomena be made out, before any one presumes to put forth any theory of the earth and its formations. I speak not now of the moral effects of such meetings and discussions, although they are of immense importance, but I speak now of the primary object of this Association, which is the furtherance of physical science, on the principles pointed out. On this ground I hold it certain, that the discussion of broad theoretical questions and cosmogonies, like those now brought before us, is utterly unfit for the present meeting. If this practice be once allowed, any man will be at liberty to overhaul the pages of a volume like Dr. Buckland's 'Bridgewater Treatise,' pregnant with most important truths, and, without any personal knowledge of the subject, or a single new fact to offer, he may raise objections to which it would be impossible to give an adequate reply because they are drawn from considerations out of the province of facts and observation. To describe all the conditions which the earth has undergone from the primeval days of chaos to the present time, were indeed impossible; and the liability to misrepresentation ought to deter any man from attempting it, did he even suppose he had the means of doing so. Besides, this is not our object, which I again assert to be the examination of facts, either to modify our theories and generalizations, if we have gone too far, or bring into harmonious order our new facts, by some new and noble generalization. We have nothing to do, as members of the Association, with moral or religious or political truths, in which the elements of human passion are so liable to be mingled. Every one who brings a statement of facts to this meeting, asserts his willingness to abide the test of observation and experiments; and when a paper is brought here which deals not with facts, but with theories and cosmogonies, we should reject it altogether, as in its nature unfit for our notice. Its discussion is permitted now (but will, I trust, never be permitted again) out of regard to certain opinions and feelings, in which we participate with the Dean of York, and which not one of us would resign but with life itself. At the same time, we are willing to show, on all proper occasions (though this be a very improper one), that we are not afraid of facing any of the difficulties with which the speculative part of our subject may be surrounded."—So far our reporter endeavoured to follow the remarks of Prof. Sedgwick in the order and words in which they were spoken. The remaining portion of our report must be considered as a short and imperfect abstract of what was said:—With regard to Dr. Buckland's 'Bridgewater Treatise', I believe that his account of the successive changes by which the earth has been brought to its present state, substantially represents facts. His account of the original nebulous condition of the earth, is not a wild conjecture, but a probability, suggested by the phenomena of the heavens. We know that at the present day the whole globe is composed of a few elementary substances, taking either a solid, fluid, or vapoury form, and that by an increase of temperature such as we believe to have once existed, they would all be reduced to the last of these conditions. The condensation of such a mass of incandescent vapour by the radiation of its heat, might form a shell or crust about a liquid centre; but he neither says that *all* the solid matter was granite, nor that all the liquid was rain-water. Dr. Buckland proceeds to state that this shell would be composed of granitic and kindred rocks; that is to say, rocks of crystalline structure; not stratified, or arranged in laminæ, by the force of gravitation acting on particles held in suspension in a fluid and spread out by currents. Now, it is a fact, that all the lowest rocks with which we are acquainted have some such character. It is true they contain but a small per-centage of carbonate of lime, and some other constituents of the strata formed upon them, but these may have been derived from the waters that covered them, or the interior of the globe; for in such a mass who shall say what are the elements within? Sir Humphrey Davy supposed the interior of the earth to be the reservoir of the metallic bases of the earths; and as the cooling of the earth must have been attended with a diminution of bulk, this crust would inevitably be broken and corrugated, and the fluid contents of its interior from time to time forced out. The objection which the Dean of York has taken to the truth of our tables of the superposition of the strata, is founded on a total misconception of the nature of our investigation, and of the facts of the case. No stratum can be universal, any more than the sea, in which it was formed can be supposed to have been universal; and as the sea has always been shifting its boundaries, it follows necessarily, that in some places certain terms of the series will be wanting, and a formation of high antiquity be overlaid by one of much more modern date. The sections given by Mr. Murchison only show the strata which appear in the actual escarpments, as seen in ravines and sea-cliffs, and wherever nature has exhibited them; and I affirm, that these sections prove the truth of our arrangements. Even where there are exceptions, they do not vitiate our arrangements; for we can give a rational explanation of them, and, by showing them to be exceptions, they confirm our previous conclusions. The Dean of York objects to Dr. Buckland's account of the formation of the various strata which succeed these first-formed mineral masses, and proposes, instead, a theory of his own, by which, he says, "every phenomenon can be explained;" and as it is one thing to find fault with a theory, and another to propose a better explanation, perhaps it will be well to compare the Dean's hypothesis with the actual facts, in the order he has himself adopted. First, we find a set of strata reposing on those before mentioned, and evidently formed from them by the mechanical action of tidal currents and surf beating upon shores; stratified rocks containing no fossils, either because their structure has been altered by crystalline action, or because they were formed before the existence of organic life—a supposition which appears to be the more probable, since in passing through the successive strata above them, in descending order, we find the number of species, and of types also, gradually diminish, still we arrive at a point where they appear to cease altogether. Upon these again we find sedimentary rocks containing fossils, and beds of limestone, which are nothing more than ancient coral reefs, for we can trace the corals as they grew, and see that they are all absolutely distinct from any now existing; and with these are beds of bivalve shells, not scattered at random and broken by violence, but lying in pairs, where they lived and died, and were quietly entombed. And out of all the multitude of species which then existed, surely some would have survived the changes which succeeded, and still be found in our own seas, if, as the Dean York supposes, those changes were limited to a few days in their operations. Next to these Silurian rocks, as they are called, is the old red sandstone,—a system many thousands of feet thick in Scotland, most of it being coarse conglomerate, formed of pebbles worn round on a sea coast, and requiring an enormous lapse of ages for their formation. With these are occasionally found beds containing fish of forms strange and unknown at the present day, and supplying new links and analogies to the zoologist in his classification. Passing southward, we find the same series of rocks enormously developed, in Herefordshire and the adjoining counties, becoming finer in their composition, as if leaving the coast, and approaching a deeper sea; and still further south, in Devon and Cornwall, we find the same rocks, occupying the same place in the series, assuming a new mineral type and swarming with animal existence. If we look to other countries we find still this formation, containing the same remarkable fish spread over large regions in Russia and America, and, indeed, wherever geological investigations have been carried. In almost all this series of rocks there is no such cementing *lava* streams as the Dean supposes; rocks do occur, though there are numberless examples of disrupting igneous action. With respect to the inversion of strata at Malvern, which the Dean thinks inexplicable by any forces which geologists can bring to bear, it happens to be no uncommon occurrence. In Liege the very miners are perfectly familiar with this circumstance, and the certainty of the fact may be at all times ascertained by following the inverted beds along their strike, till, after various changes and contortions, they at length assume their true position. Passing on towards the coal strata, we find thick beds of limestone and grit, with which the coal is found almost universally to be associated. The extent of the coal formation itself, in various parts of the world, is much more wonderful and difficult of explanation, than its absence from other regions. I cannot stay now to inquire into the causes which promoted its formation at this particular period, but when I remind you that it is thousands of feet thick, that the beds of coal themselves are acknowledged by botanists and chemists to be entirely formed of masses of vegetables swept down into the sea by annual torrents, or the growth of ages in peat bogs and forests, and the deltas of rivers, that it contains the fronds and stems of hundreds of ferns and other plants, all of extinct species, and requiring for their growth a climate widely differing from our own, it does indeed seem scarcely worth while arguing against a theory which attributes these extensive and complicated phenomena to the "mud thrown up by a volcano, and catching the leaves of trees in its descent!" Again, passing on to the new red sandstone, with its tracks, of peculiar and extraordinary animals—the lias, with its no less wonderful saurians and shells,—not the shells of the present seas—not the crocodile of the Nile or the Ganges, but forms now utterly past away, we must pause for a minute to consider the startling announcement made by the Dean respecting this period. He says, that after the trilobites and crinoidea had been buried by the mighty inundation he had brought over the earth, and after the saurians and other inhabitants of the shore were intombed, we should expect to find next those "heavy animals who were unable to fly fast enough to the hills, the megatheria, didelphys pterodactyle, &c." In this selection the Dean has been particularly unfortunate. The megatherium was, indeed, an enormous animal—mightier than any of the present degenerate inhabitants of the earth; he lived by tearing down the trees of the forest, and browsing on the leaves and branches; he was armed with terrific claws, and protected by a skin more dense than that of the rhinoceros; but, unfortunately for the Dean, he was one of the *last caught* even according to his own hypothesis, and, as we believe, did not exist till ages after, if indeed, he were not coeval with the earlier races of men. His next example, the didelphys, did certainly appear and perish in the oolitic period; it was, in fact, the earliest warm-blooded animal that existed on the earth,—but what was it? A little opossum, not bigger than a guinea-pig! The third is, if possible, worse chosen than the rest—" the pterodactylus! Why, the pterodactyle was the *flying dragon* of the ancient world, and would have been far enough above the hills ere a flood could overtake him. For any man so unacquainted with the most familiar facts of our science as to confound together three animals of a different epoch, and so utterly unlike in their physical structure, is itself a portent in the history of geology: nor would such an exposure have been allowed were it not for the considerations before alluded to. As regards the period of time occupied in the formation of the strata, I will mention but a few circumstances. In one part of the oolitic series, we find beds of coralline limestone, separated by a small thickness of clay, and in this clay are multitudes of crinoids, whose bases yet remain fixed to the rock on which they grew: in that little bed of clay is represented at least a period of time sufficient for the growth of these animals. In another formation, the lias, I have traced for twenty miles together a deposit of the coprolitic matter of the great saurians of the period, a formation which could only have taken place, tranquilly, during the lives of many generations of those animals. In a newer part of the series, the rocks constituting Portland Island, we find, resting on beds of marine limestone, layers of vegetable soil containing large prostrate trunks of dicotyledonous trees, and portions of their branches remaining upright, and fixed in the earth by their roots; and trunks of plants resembling the recent Zamia, standing where they grew, but silicified, and covered up with beds of fresh-water limestone. Here, again, a few feet of strata represent a period of time in which the sea was converted into dry land, the land overgrown by forests; and this again became a fresh-water lake, inhabited by shells allied to species now existing. To the single stratum, therefore, where these trees were found, belongs a period of time sufficient for the growth of a forest. Time would fail me to tell the numerous changes of physical condition, accompanied with corresponding changes in animal organization, which characterize every division of the cretaceous and tertiary strata. The Dean of York, indeed, says, that "little remained for them to inclose, and little is inclosed within them." Here, again, is a strange ignorance of notorious facts, for these are the very strata in which the traces of organic life are most varied and abundant. The conclusions of geologists would indeed be vain if founded on such irrational guesses and absurd hypotheses; but by a steady and humble study of nature, in a subject so vast and comprehensive, we could make but little progress, did we not call in the aid of the zoologist, the botanist, and the chemist, and, paying the utmost respect to their opinions, regulate our conclusions by their evidence. In determining the succession of the strata, or any other problem in our science, we must be content to ascend, step by step, from small assemblages of facts, to higher generalizations, until we obtain the whole sequence. With regard to the succession of animal life, the evidence is so conclusive that no naturalist or competent observer will now deny that new species have continually appeared—not by the transmutation of those before existing—but by the repeated operation of creative power. In his ordinary dealings with the natural world God works by second causes; so that one natural phenomenon may be said to flow directly from another. But when we see successive orders of animal existence, and successive organic types, which once ministered to the functions of animal life, we can only say a living spirit had been breathed into dead matter, far differing from the mere causative of material laws, and that the beings of whatever order were the effect of a direct creative will. In conclusion, the Professor remarked, that what he had stated was as nothing in comparison of the evidence which might be brought forward in support of his argument. There might be difficulties in the dark investigations of science, but the way to throw light upon them was to sift them to the bottom, and not to shut our eyes like frightened children and think thereby to save ourselves from danger. Truth could never be opposed to itself; and the perception of truth, whether physical or moral, was but a perception of one portion of the will of God. He was not permitted there (he knew that were he to make the attempt he would very properly be interrupted by the President) to enter on a great question by formally attempting to reconcile the phenomena of geology to the language of the word of God. But he had no fears as to the result of such an attempt, if soberly made on right evidence and in the simple love of truth; nor did he doubt that the highest discoveries of science would ever be found in perfect harmony and accordance with the language and meaning of revelation.

'On the Excavations of the Rocky Channels of Rivers, by the recession of their Cataracts.'—Mr. Featherstonhaugh drew attention to the manner in which extensive lacustrine and marecageous districts upon the continent of North America, have been drained and rendered fit habitations for man. During his researches in that part of the western hemisphere, he found evidences upon all the rivers whose valleys were bounded by lofty escarpments, that the gorge in which each river flowed had been cut out of the land by the recession of a cataract. The river Mississippi flowed in a valley of this character. From the Falls of St. Anthony to its mouth in the Gulf of Mexico, the distance was about 2,000 miles, during the first 1,200 of which these escarpments, varying from 200 to 450 feet in height, were every where found, divided from each other by a width varying from one to two and a half miles, the valley being during the greater part of this course thickly studded with well-wooded islands, amongst which the waters of the river flowed. Upon a level with the surface of these islands were extensive plains connected occasionally with lateral valleys coming through the escarpments, the soil of which was identically the same with that of the islands, being a light vegetable sandy soil much mixed up with decayed freshwater shells; showing that these soils were the old muddy bottom of the river, deposited when it occupied the whole breadth of the valley from escarpment to escarpment. These, and analogous appearances upon the courses of other American rivers, especially the immense lacustrine deposits separating Lake Erie from Lake Huron, seventy miles in breadth, were adduced as proofs of a great diminution of the quantity of fresh water once occupying the lakes and the fluviatile courses of that continent; indeed, from the difference of level between a point on the Wisconsin River and the channel of the upper Fox River, over which boats now pass in time of great floods, the water communication betwixt the Mississippi and Lake Erie seems to have been uninterrupted. This portion of the paper was intended to show, that the quantity of water in the rivers in ancient times so far exceeded the quantity flowing in them at present, that the cataracts in the rivers must have been much more powerful, and that therefore the process of excavation of the rocky channels of rivers by the recession of their cataracts, must have been then effected in much shorter periods of time than at present. From all these considerations, and from the known fact that the Falls of St. Anthony had not receded more than twenty yards in the last 100 years, the author drew the deduction that the whole valley of the Mississippi, from the falls of St. Anthony to the point where the escarpments terminate, had been excavated by the recession of that cataract, and that the excavation had proceeded at a much more rapid pace than it does in our times. The author next proceeded to explain the peculiar mechanical power which streams employ in forming their channels by the operation of cataracts, and divided it into two methods, the *molar* or grinding process, most common in mountainous countries constituted of primary rocks and the *subtracting* or undermining power exercised upon strata of a softer quality. To illustrate the first of these methods, Mr. Featherstonhaugh exhibited a beautiful pictorial view of a remarkable cataract in the Cherokee country, called Ovnāy Kay Amāh, or White Water, which he visited in 1837, and which had not attracted the attention of any other traveller. This cataract was at a point several miles from the extreme edge of the mountain, and was upwards of 600 feet high, the water falling in various pitches and inclined planes from the top to the bottom. Wherever the water found a depression in the surface of the gneiss it lodged there, and on the first fortuitous pebble coming into the cavity the work of destruction would begin, the current incessantly whirling about the pebble, and grinding the sides of the rock until a *pot-hole* was formed. These were there in great numbers, some of them four feet in diameter and six feet deep. Where great numbers abounded, the parietes became at length weak, and, giving way, all the pot-holes would coalesce into one. This process being repeated in various portions of the rock, the cohesion of the mass became diminished ; and at the season of periodical floods, huge masses, weighing forty-tons and upwards, would be precipitated to the bottom. This was the state of the great fragments at the bottom of the ravine, all of them bearing evidence of having been dislocated by the power of the water exercised upon the pot-holes. Such was the method by which this gorge, several miles long and about 600 feet in depth had been ground out of this mountain of gneiss. At this locality were the evidences of the volume of the river having once been at least ten times larger than at present. A semi-circular ledge of gneiss, at the top, east of the stream, and 1,200 feet wide, was worn bare for a great distance, and down its perpendicular face was concave, as if the river had been projected over the top, and the screen of water in face of the concavity, and the concussion, and the moisture, had produced the usual effect, of peeling off the coats of the rock. It presented much such an appearance as the rock at the Horse-Shoe Fall at Niagara would do, if the water were to be so much diminished at that point as to abandon it, and to be projected only from the comparatively small fall of the Schlossa, on the American side of the river. For the other example of the *subtracting*, or undermining power exercised in the recession of cataracts, the Falls of Niagara were taken, of which a flat view was given, together with a section of the rocks. Mr. Featherstonhaugh had published a paper in 1831, explaining the recession of this cataract. It is well known that the river Niagara flows upon a bed of limestone from which it projects itself, and that this rock is supported by a strong bed of friable shale upwards of seventy feet thick. The moisture arising from the screen of water, the current of wind behind it, and the concussion, loosen and remove the shale, and the superincumbent limestone, losing its support, falls down. In this manner the cataract has receded at least six miles from the Queenston heights. Mr. Featherstonhaugh expressed an opinion that this operation of excavating long channels of rivers, as in the instance especially of the Mississippi, may be considered in the class of providential arrangments, since by it the lakes, swamps, and immense marecageous surfaces become drained, and rendered salubrious and productive habitations for man. There were many other interesting points brought forward in this paper, of which we have only room for this abstract.

'On the physical character and geology of Norfolk Island,' by Capt. Maconochie, R.N., K.H.—The group, of which Norfolk Island is the principal, is situate in lat. 29° 2′ S., and 168° 2′ E. long., 900 miles E.N.E. of Sydney, and 1,350 N.E. from Cape Pillar, in Van Diemen's Land. Norfolk and Philip Islands, the largest of the group, are about 6 miles distant from each other; about a dozen others, the Nepean and Bird Islands, are little more than dry rocks distributed about them. Norfolk Island is not quite 5 miles long, with a medium breadth of about 2½ miles; and its superficies is said to be 8,960 acres; its greatest elevation is the double summit of Mount Pitt, 1,050 feet high; its sea-front is high and precipitous, presenting cliffs 200 and 250 feet in height, and the small streams which occupy the ravines in winter, fall, in cascades 30 or 50 feet high, into the sea. Philip Island is about 1¼ mile long, with an average breadth of ¾. Its most elevated point is probably two or three hundred feet less than that of Norfolk Island. It is everywhere precipitous, furrowed by deep channels, and densely wooded, though the timber is small and of little value. Both these islands are masses of porphyry, much decomposed on the surface; boulders of compact greenstone are abundant in both islands, especially in the fields and watercourses of Norfolk Island, where they are employed as building materials. They are also found imbedded in the porphyry at the greatest depths to which the rock has been penetrated by wells or exposed in ravines. Near the south-east extremity of Norfolk Island are extensive beds of sand and limestone resting on the porphyry ; the limestone, which is the lowest formation, is from 12 to 20 feet thick, and occupies about 20 acres of comparatively flat land; in two places it has been fractured, and upheaved from an angle of 10° to absolute verticality. It is thin-bedded, the laminæ being usually one to three inches thick, of fine quality, slightly mixed with sand, but yielding 90 per cent. of lime. The sandstone appears to be entirely a modern formation, lying upon and against the dislocated limestone ; the bar and projecting rocks along the whole south-east front are composed of it, but it is no where above 6 feet thick ; below it is found an unctuous black clay full of vegetable remains, especially the leaves and seeds of pines and other island trees. The sandstone is only compact on the coast, where it is still forming; it contains marine shells, and incrusts the boulders of greenstone on the coast. Being porous, and filled with saline particles, it forms a bad building stone, the houses built of it requiring to be rough-cast with lime. Opposite the settlement which is placed on these beds, and about 600 yards from the beach, Nepean Island rises to the height of 50 feet; it is about a quarter of a mile long, and of a horse-shoe shape, open to the east. The limestone of which this island is composed is used for the shafts of chimneys ; its east and south-east beach is formed of sandstone. No water has been found in it, and its vegetation has, within the last few years, almost disappeared, owing to a colony of rabbits which, having destroyed every thing edible, have now themselves perished. It is reported that in 1793 this island was only a boat's length distant from Norfolk Island, but that in 1797 two severe earthquake shocks were experienced, by the second of which the nearer point of the Nepean was submerged, and the channel altered to its present form. The rocks which pave the channel between these island are almost all limestones, whilst elsewhere they are porphyritic. The Bird Islands are rocks of porphyry distributed along the north shore of Norfolk Island; they are of no economic value, and are tenanted only by sea-birds. [See Statistical Section, Monday.]

Mr. Elias Hall read a communication 'On the Midland Coalfield,' being the substance of a pamphlet in course of publication.

THURSDAY.

SECTION E.—MEDICAL SCIENCE.

The first paper read was a report on Asphyxia, by Mr. Erichsen, The different theories previously held on the subject were examined. and tested by a series of experiments, and from an examination of all the results the following conclusions were drawn:—1st, That, although the persistence of the respiratory movements has some influence in maintaining the circulation through the lungs, yet that their arrest is not by any means the sole cause of the cessation of the circulation.—2nd, That a diminution in the force and frequency of the contractions of the heart, consequent upon the altered quality of the blood circulating through its muscular substance, is one of the principal causes of the cessation of the circulation in asphyxia, as is evident from the fact that when the force of the heart's contractions is maintained by a supply of arterial blood to its muscular substance, it is enabled to propel black blood through a collapsed lung.—3rd, That the obstruction which has been found to take place in the pulmonary and systematic circulation is due to the venous blood exciting the contractility of the minute divisions of the arteries and pulmonary veins by acting on their special sensibility.—4th, That the cause of the stoppage of the circulation in asphyxia is, therefore, threefold, depending, 1st, upon the arrest of the respiratory movements; 2nd, upon the weakening of the heart's action, and 3rd, upon the obstruction afforded to the blood by the refusal of the smaller divisions of the arterial system to receive venous blood. The author then adverted to the subject of the treatment of asphyxia. After reviewing the plans generally adopted, he stated as a fact, determined by a considerable number of experiments, that if artificial respiration be set up, even after the heart have entirely ceased to act, the left cavities of that organ will fill themselves with arterial blood, the congested condition of the lungs be removed, and the pulmonary artery be emptied of its blood, and this without the action of the heart being renewed; unless when pure oxygen gas was used, when these effects took place with much greater rapidity; and the author succeeded in many instances in restoring the circulation after the contractions of the ventricles had ceased; he, therefore, recommended insufflation with this gas in extreme cases of asphyxia.

The Secretary read a paper by Dr. Heming, on a disease of the tongue. The author described the disease, the appearances of which although varied in degree, were uniform in character. In the early symptoms the tongue is œdematous, sulcated, and prone to become ulcerated on the borders of the sulci, or in parts which may be irritated by the contact of a decayed or ragged tooth; the surface then becomes morbidly smooth in longitudinal streaks, the papillæ being apparently obliterated; the whole organ assumes the same character, becoming dry and hard in its texture, the ulceration becomes more marked, is sometimes superficial, and in some cases forming deep ragged ulcers; in one case the ulcers had pierced entirely through the organ. The author detailed five well-marked cases: they all occurred in females, and the general constitutional health was much impaired, the patients suffering from sick head-aches, deranged digestion, œdematous ancles, &c. In some cases the disease was of many years continuance. In the treatment, the author deems the restoration of the general health of primary importance: after the ordinary aperients, he gave soda and cicuta, and continued these remedies many weeks. The local application found most useful was nitrate of silver; by perseverance in the treatment every case got well.

Evening Meeting—Thursday.

The Earl of Rosse, on taking the chair, directed attention to the provision made for the continuance of the business of the Association by means of the Council, in the intervals between the annual meetings. This arrangement rendered it necessary that he should be present to resign his seat to his successor, and it delighted him to witness a meeting of the Association under such auspicious circumstances. After an interval of thirteen years their body was revisiting its birth place, having achieved many great triumphs, and having still greater in progress; all their exertion had been directed to the intellectual improvement of mankind; and the increase of interest in their proceedings manifested by the increase of numbers, was at once evidence that these efforts had been successful, and had been appreciated by their countrymen. It was gratifying to designate as his successor in the chair one of the first of living mathematicians, and one not less estimable for his moral qualities, than admirable for his scientific attainments. His contributions had enriched their reports, as his presence had given interest to their meetings. His Lordship then dwelt at some length on the value of mathematics ; it was the foundation of all the certain sciences and it kept them all in their just proportions. Mathematics formed an engine of enormous power, which conferred upon us the control over the dominions of time, space, and number. They taught us the laws that regulate the order and secure the permanence of the universe; but while thus sublime in its applications, it could accommodate itself to our humblest wants. Were mathematical science to be lost, the misfortune would be felt through the whole wide range of commerce and manufactures, and through all the relations of life. The sailor would no longer be able to find his way over the pathless ocean ; the merchant could not collect the varied products of nature, as he would have no means of transport; and all engineering would become mere guesswork. Even in our remote agricultural districts the loss would be felt, for the surveyor would be wanting to arrange the boundaries of property ; indeed, so pervading and necessary was that knowledge, that without it even the commonest engagements and relations in the intercourse of society could not be carried on ; and he adverted to the still greater advantages which must flow from a more extensive application of its principles. He looked upon the present meeting as the first of a new cycle ; and as the objects of the Association were permanent in nature, all interested in the advancement of science must be rejoiced to see such signal indications of the permanence of the Association's prosperity. The history of all science showed that minute facts were first observed, and elementary principles first established ; but its progress was from strength to strength, and the advancement was accelerated by co-operation and the sympathetic activity of all intelligent men. This augmentation brought a rich reward ; for every page added to the great record of knowledge, and registered for mankind one of the eternal laws which the wise Creator had framed for the government of the Universe.

The Earl of Rosse then resigned the chair to the Dean of Ely.

(To be continued.)

The late Dr. HELFER.

A discussion having recently been raised regarding the late Dr. Helfer, Col. Hutchinson of the Bengal Engineers, in a warm defence of his late friend remarks, that he cannot but feel assured from the good tone and Christian spirit which has generally marked the *Friend of India*, the Editor of that Journal will be sorry for having been led into the assertion of any thing that was untrue regarding a most amiable and honorable man, whose zeal and talents were so well known to all who had the pleasure of Dr. Helfer's acquaintance.

The Friend of India on the other hand remarks, that if led into error in stating the great bulk of Dr. Helfer's collections did not come into possession of the Government at whose expense they were made, he is willing to retract the statement and appeals to public officers and scientific men who must be well acquainted with the circumstances of the case.

The question as to the disposal of Dr. Helfer's collections is certainly so far as we are competent to judge, not worth disputing about. But if Col. Hutchinson be desirous of arriving at the real value and importance of the collection obtained by Government from Dr. Helfer during the period of his employment in the Tenasserim provinces, three years we think, he has only to pay a visit to the Museum at the India House. We are greatly mistaken if he will there find the collections of Dr. Helfer which cost the public nearly a lakh of Rupees, are at all equal either in extent or value to many contributions that have been made at little or no expense by several members of the Public Service in India, who have been less fortunate on the score of patronage than Dr. Helfer.

That Dr. Helfer was an amiable and accomplished man we allow, that he was in any way scientific, or possessed of a single qualification for the duties on which he was deputed to the Tenasserim Provinces, beyond a moderate share of zeal and energy under privations to which he seemed to have been accustomed, we cannot allow.

So long as persons of rank and influence will take upon themselves to patronise things they do not understand, instances such as that of Dr. Helfer will not be uncommon. What could Col. Hutchinson possibly know of Dr. Helfer's qualifications as a Naturalist? And yet he not only appears to have ventured to judge for himself on this point, but to have exerted himself in influencing the judgment of others. "In requesting you to use the means of your valuable paper in his behalf, it was not as you say to put bread into his mouth, but simply to draw the attention of Government to Dr. Helfer's scientific attainments of which he had been giving proof by his interesting lecture before the Asiatic Society on the indigenous Silk-worms of India, that by the assistance of Government he might be able to pursue his researches as a naturalist, as much for the benefit of Government as for his own private advantage." Thus writes Col. Hutchinson, constituting himself a judge of acquirements of which he could know nothing, in a strange gentleman of whom he knew equally little, however respectably he may have been introduced!

With regard to the lecture on silk-worms at the Asiatic Society, all that was original in it belonged to Mr. Hugon of Assam, whose paper on silk-worms of that province was placed rather inexcusably before publication, in Dr. Helfer's hands. The lecture consisted of a chapter from the popular account of the manufacture of silk in Dr. Lardner's Cyclopedia, from which it was transcribed word for word, though read as an original composition, and received as such by the President and members present who knew about as much of the matter as Col. Hutchinson himself.*

Science is by no means considered essential to good sense by Englishmen. Before Dr. Helfer became acquainted with this peculiarity in our national character, he was content as a physician on his first arrival in Calcutta to commence practice as a Homeopathist. In this he encountered the opposition of the faculty, was constrained to abandon practice, and in the course of a week to become a naturalist. Poor man, he required all the address he possessed to sustain the elevated position in his new profession to which the indiscretion of his friends raised him, but he had in this, fewer competitors to encounter, than in medicine. Accomplishments and address, more particularly a taste for Music obtained for Dr. Helfer and his lady, influential friends in the highest circles, who urged his acquirements, not in Music, but as a naturalist with unceasing importunity on the Government, and if any one should feel disposed to blame the measure of his employment in a scientific capacity, what are we to think of the Asiatic Society as the first to recognise such claims?

A promise of employment having been unconditionally afforded, the next question his friends had to dispose of was his salary. Mr. Griffith's employment on the N. E. Frontier was supposed to be a case in point; overlooking however the relative position of Dr. Helfer as compared with a distinguished officer in the regular ser-

* The circumstance was pointed out to Mr. J. Prinsep in time to prevent the appearance of the *lecture* in the Journal of the Society. It was also exposed if we may use the expression, in a letter singed *Bombox Mori* in the Hurkaru.

vice of the Company, his allowances were made the same, namely 500 personal, and 500 travelling charges. What was the result, poor Griffith' if he halted for a day, conscientiously omitted to draw travelling charges, while Helfer on the other hand worked his allowances up, according to Col. Hutchinson to 1200 rupees per mensem.

If men who put themselves forward as the patrons of science which they do not understand, at the public expense, as Col. Hutchinson appears to have done in the case of Dr. Helfer, were only to reflect on the injury they do society by bringing science into disrepute, to say nothing of the injury they inflict on real merit, they would probably act differently.

In Calcutta Dr. Helfer made a collection of plants before he became aware that cultivation destroys the distinctive characters, just as domestication changes the colour of pigeons, nor did he appear to be aware when he began to collect in Calcutta that the flowers or the fruits, were at all necessary to specimens.

With regard to other collections ; birds during the first twelve months amounting to 5 or 600 specimens, were made over to the Asiatic Society, for Government; the duplicates, of which the greater part consisted, were returned to Dr. Helfer for transmission to Germany, where, no doubt the commonest things from India would in many parts be great novelties. There were no further collections, that we are aware of obtained from Dr. Helfer, unless sundry baskets of clay sent up to the Asiatic Society without intelligence or meaning, can be termed such.

The most valuable collection made by Dr. Helfer during his employment in the Tenasserim Provinces was insects, particularly beetles, which required no further art than was sufficient to catch, and plunge them into spirits of wine. This collection was retained by Mrs. Helfer partly on the plea of its having been made by herself, and partly on that of her late husband having been no wise bound by the nature of his agreement with the Government, to give up all his collections. On both these grounds Mrs. Helfer may have been quite right.

Helfer however found coal on the little Tenasserim river, which, though it could not have remained many years longer undiscovered, would have been worth all he cost the Government had he given a good account of it, but unfortunately his reports on the subject are barely intelligible.

THE

CALCUTTA JOURNAL

OF

NATURAL HISTORY.

The Natural History, the Diseases, the Medical Practice, and the Materia Medica of the Aborigines of Brazil, by Dr. Von Martius. *Translated by* John Macpherson, Esq., *Assistant Surgeon.*

(Continued from page 33.)

Catarrhal affections.

Catarrhal affections manifest themselves chiefly by diarrhœas from the bowels, by pleuritic attacks, inflammation of the throat, eyes or ears, and by Parotitis: but abdominal affections are the most frequent.

These catarrhal attacks are commonly ushered in by fever: but the Indian is not on the whole much inclined to such violent developments of nature's reactive powers. Parotitis produces the strongest febrile symptoms. It causes violent constitutional fever, and the Indians are more afraid of this than of any other disease, as it always ends in tedious suppuration, at times in sloughing.

The Indians who live in the western provinces, suffer most from such catarrhal attacks, which often appear epidemically, especially after a dry cold south-west wind has blown for a long time over the continent, or when north-east winds suddenly change to the south-west. At such times catarrhal fevers often occur, which are very dangerous to children, and often kill them with symptoms of suffocation: a bad kind of influenza. The Indians along the coast of the eastern provinces often suffer from such sudden changes of wind, and from the cold sea breeze; and Dr. Paiva of Bahia assured me, that the fresh east winds, which there serve to invigorate Europeans and white men in general, and indeed in the neighbourhood of the sea are considered beneficial in incipient phthisis, act unfavourably on the Indian population.

While the Indian is by such influences easily exposed to catarrhal complaints, he suffers from rheumatic ones in a much less degree. The latter, which have their seat chiefly in the serous membranes, and the muscles, appear to have less foundation in the constitution of the Indian than in that of the white and black races. No doubt by catching cold, and by exposure to draughts of air after full meals, or by passing the night in damp forests, violent pains in the limbs (called Curimentos by the Portuguese) are often produced. But these darting, tearing or lancinating pains, which often take away the free use of the limbs, and in a few hours render a healthy man stiff and motionless, frequently attain such a height, as to become dangerous to life, and require the most careful treatment by powerful diaphoretic and anti-spasmodic medicines, and at times by free venesection. They are especially common about full-moon, and, in the neighbourhood of the sea, about the time of spring tides, are aggravated at night, and often interfere with the liver and nerves of the abdomen, apparently by gouty metastasis. So far however as I know, these rheumatic affections are rare among Indians. The insensitive pituitous constitution of the red man seems to predispose much less to rheumatic than to catarrhal affections, the latter characterised by abundant secretions.

Diseases of skin.

Besides these catarrhal affections, certain cutaneous diseases appear to arise from the causes just indicated, for instance Nettle-rash, Pemphigus, and Zona. They are almost always ushered in with gastric or bilious complications, with or without distinct pyrexia, and are slight and have no disagreeable sequelæ.

A widely spread disease in the country is an erysipelatous form of disease (*erythema vulgare*, of Bateman) which is called by the Portuguese, Sarna. It does not attack whites only, who are often for a long time much annoyed by it, but the red race also. The latter however seem less predisposed to it, and throw it off more readily, perhaps, as in them it is usually the consequence of excess in eating. Indeed this chronic erysipelas, which often produces painful ulcers, seems to be generally connected with imperfect digestion and impaired secretion of bile. But many people ascribe it to irritation from the sting of insects, and especially of the so-much dreaded musquitoes. It is indeed no wonder, that the naked Indian, exposed day and night to the attacks of this blood-thirsty insect, suffers more than the Brazilian provided with clothes. In the northern districts, especially along the Amazon and its tributaries, where the Indian is during the greater part of the year persecuted by the small gnat (Simuleum pertinax) all day, and by the long-legged musquito (Culex molestus) all night, it is no wonder that his whole body at times exhibits bloody spots, which by the continued re-application of the sting, and the intolerable itching, cause a peculiar form of eruption. It is called, *piera*. It presents spots of skin, in some places raw or superficially ulcerated, in others covered with light crusts and scales of blood. They occur on all parts of the body, oftenest on the back, on the shins, and the calves of the legs. A burning pain, and an intolerable smarting make this affection so great an evil, that the European cannot help feeling sympathy with the sufferer, when he remembers the effects of the gnat on the uncovered portions of his own body.

It fastens on his skin, and raises the epidermis immediately into a vesicle, into which is poured a drop of blood, which then dries up, so that by the third day it can be removed by a needle like a dried-up pustule. The insect, which only stings in the light of the sun, causes no pain when it begins to suck. But afterwards a burning itching sets in, which is quite disproportioned to the number of stings, and drives the European, unaccustomed to it, almost mad, while the Indian bears it with placid equanimity. The constitution often sympathises. Feverishness, loss of appetite, headache and swelling of the inguinal glands set in, and in unfavourable cases frequently end in suppuration, but more commonly in resolution after a few days. This *piera* must, from its general diffusion over the greatest part of Brazil, and from the simultaneous epidemic attacks which it makes in whole districts, be considered one of the peculiar diseases of these lands.*

But besides it, the Indians are subject to various other skin diseases; among the most common, is a chronic painless psoriasis, in the Tupi language, *Curuba* (or when it occurs in animals *Pyruça*) which attacks chiefly the joints of Indians living in the plains; and the face, the head, and the feet of those who inhabit forests. It is remarked in general, that such eruptions take on moist forms among the inhabitants of woods, and drier ones among those of plains. I have observed a quite peculiar disease, (which must be reckoned a kind of ichthyois,) among Indians of the race of Puru-Purus. The whole body appeared studded with irregular, generally round, isolated or confluent blackish spots of various sizes, which to the hand gave the feeling of slight indurations of the skin, and did not yield any cutaneous discharge,

* Musquitoes are troublesome enough to new arrivals in this country, and often cause irritative fever.—*Tr.*

although their surface was uneven, and rougher than the rest of the skin. The vicinity of the spots was frequently paler than the sound skin; in some cases, almost quite white. These patients suffered from enlargement of the liver. This disease of the skin is said to be hereditary, and is considered by the neighbouring races, a national sign of the Puru-Purus, the Amamatis and the Catauixis, on which account they go by the name of ' the spotted.' Perhaps this disease may be derived from the amphibious life of these savages, their bad food, and the custom of anointing themselves with crocodile, or Lamantin fat. In the same neighbourhood, I also saw a cachectic Indian of the race of Catauixis, who had on his face and arms many white spots and points, and was distinguished besides by an almost morbidly excessive growth of hair. This disease too is said to be hereditary, nay infectious also: individuals who have laboured for some time under any of these various skin diseases, have a cachectic appearance, which distinguishes them at first sight from their healthy neighbours. The uniform copper red colour changes into a dirty yellow, or into a characteristic livid paleness, and a muddy heavy look pervades their dark eyes. In such cases the hair gets gray, earlier than is usual, in the American race. In general the Indian preserves his straight, shining black hair up to his 60th year, without any perceptible alteration. The women become gray earlier than the men. I may here take the opportunity to mention a very peculiar disease of the hair, which I observed not in Indians, but in a woman of mixed Indian and European blood. Long hairs grew under the cutis of the arms and knees, and developed themselves with suppuration, and though pulled out, renewed themselves from time to time. I saw her at Joazeiro on the river S. Francisco, where common salt effloresces from the soil, and she reminded me of the disease called Wolosez, which occurs on the Don, at Tscherkask and in other places in the south of Russia, where the soil contains salt, and which consists in hairs growing out of wounds.

I have also observed a kind of athrax, and of painful boil among these Indians.*

Febrile diseases.

I pass to the consideration of febrile diseases. Among them, I must first name the acute exanthemata, small-pox and measles, for they are among the worst plagues of Brazil. To them, to syphilis, and to excess in the use of brandy, is the great mortality of the red man to be ascribed.

Small-pox.

According to all accounts, this disease was entirely unknown to the inhabitants of Brazil before the arrival of the Portuguese. But now it has penetrated into the deepest wilds with fearful celerity and the most calamitous results, and every tribe knows and fears this disease as the most deadly poison to its blood. In the Tupi language, it is called Meréba-ayba, *i. e.* the bad disease. Unfortunately it must be told, that the European settlers in many districts, for instance in the interior of the provinces of Maranhaô and Pernambuco, have with fiendish cunning contributed to bring the plague among the Indians, and thereby devote a harmless population to the most frightful death. Where the Indians have attacked the settlements of the Portuguese with the purpose of robbery, plunder or murder, there the colonists have hung up in the woods shirts and other pieces of clothing poisoned with small-pox, and fearfully realized the fable of Nessus. The Indian is, by his constitution, ill formed for the development of small-pox. The eruption of the exanthema is slow and difficult. Racked with violent headache, and burnt up with heat, the Indian usually rolls himself up in his hammock, and strives carefully

* This account of cutaneous diseases is not very complete: we are much in want of a distinct history of those prevailing among the natives of India.—*Tr.*

to exclude every breath of air, and thus increases the violence of his fever, or rushes into a running stream in which he hopes to quench his inward fire. In it he often dies of apoplexy: but others, who keep quieter, often do not live till the eruption appears, but die previously of violent delirium. In other cases the outbreak of the exanthema is accelerated by cold baths or by hot drinks, and it appears to such an extent, that the whole surface of the body is like one huge sloughing sore. In some again large spots of inflammation are formed under the cutis, which sometimes pass into putrid suppuration, and sometimes cause metastasis to the head or the lungs, and cause death after the most horrible symptoms: but even the common forms of the exanthema are bad enough; the uniformly coloured regularly formed pustules are often attended with a very painful cough, and attacks of Angina. In other individuals, we see besides regularly developed pustules, others which are fallen in, wrinkled, black or with black spots, or the whole body is covered with a black exanthema. The disease attacks individuals of every age and sex, but it is especially dangerous to elderly people of atrabilious and sluggish temperament, to pregnant and parturient women, and is on the contrary got over more easily by people of a younger and healthier age. Women, seized with small-pox, frequently miscarry: parturient ones communicate the disease to their offspring: no wonder then, if the Indian is seized with the dread of certain death, as soon as he feels the poison in his veins, or sees any of his family attacked by it. Thus, small-pox plays the same part among the red men that the plague does in the East. Wherever it appears, all family ties are dissolved: the sick are often left alone without help; while those who are well, stricken with blind terror, fly bereft of their senses into the woods. The Governor General of Estado do Pará was once with all his staff in a vessel that was to convey him from Pará to Macapa.

He had one and twenty Indian rowers. They suddenly got the alarm that there was a case of small-pox in the ship, when they instantly sprang overboard, into deep water and made for the shore, leaving the Europeans to shift for themselves. Dobrizhofer relates of some of the wild Indians, that on intelligence of the approach of small-pox, they do not fly in a straight line from their homes, but double about in all directions, thinking thus to be more likely to escape their deadly foe. In the year 1819 an epidemic of small-pox prevailed in Pará, from which about 8000 men suffered, and of which at the worst time 36 to 68 died daily. The epidemic which in the year 1734 attacked the thirty settlements of the Jesuits in Paraguay, was a fearful one. Of the population then estimated at 140,000 souls, 30,000 died. In the year 1765, when the settlements were increased to thirty-two, 12,000 Indians died. On the whole it is to be observed, that the epidemic is always more virulent where many people live close together, than where the huts are single and scattered, and this is of course more common among Indians than European settlers. Experience has also hitherto proved, that the worst small-pox epidemics, which have worked the greatest havoc among the red men, have *originated from newly imported negroes*, and gradually spread inwards from the coast. This too was the case with an epidemic in Pará in 1819, which was introduced by a slave ship from the N. W. coast of Africa.

We observe few Indians with small-pox marks, as most of them die under the disease. Blind and deaf Indians were in some places the only remains that I found of whole villages. The Brazilian doctors assume, that under the most favourable circumstances one-fourth of those attacked are saved.

It is on the whole proved by general experience that mixed races, negroes, and white men, get through the disease much more easily than the Indians.

Measles.

This too is a very pernicious and widely spread disease among the Indians, (called by the Portuguese Sarampo, and in the Tupi language Mixùa-Rana, i. e. false small-pox.) A Brazilian missionary tried to prove to me that this disease also was unknown to the aborigines before the arrival of Europeans, and the accounts which I got from the Indians on the Yupurá, seemed to confirm it. But the declarations of Doctor LaCerda and others, made me think it more probable that measles must have prevailed among the Indians before that event. The disease is especially common among children before the warm rainy season, spreads epidemically with great impetuosity, and commonly kills in the first stage with symptoms of violent inflammatory fever ; hooping cough and dropsy are frequent sequelæ.

Scarlet fever.

This or an exanthematous disease very like it, appears also epidemically from time to time on the banks of the Amazon and the Rio Negro. But it is more dangerous to the white and mixed population, than to the red.

Fevers.

Now as regards simple fever, it has been already remarked, that the sluggish, unexcitable constitution of the Indian, and the slight energy of his nervous system do not predispose to such forms of disease as are borne specially by the nervous system, or at least reflected by it. The most marked character observable in this respect, is the want of distinct periodicity in his disease. Intermittent fevers are thus more rare than remittent, and tertians are less frequent than quartans. In the exacerbations, stupor and heaviness are more common than regular pyrexia. Typhus fever with highly developed affections of the nervous centres is rarer than that which bears the character of synochus. Their fevers are often accompanied with cutaneous eruptions, and frequently with gastric and bilious complications. An unfavourable termination frequently occurs suddenly, with colliquation and dysenteric evacuations.

The belief that periodic diseases depend much on the phases of the moon, is exceedingly common among the Indians, and that they are more violent at new and full moon, than during the first and last quarter.* In the neighbourhood of the Amazon stream the belief is prevalent that all feverish complaints are more dangerous when the waters are high, (from December to April) than at other seasons; somewhat analogous is the popular belief on the east coast of Brazil, that all fevers have stronger exacerbations during the flood than during the ebb, and that the spring tides, which occur when the moon is passing the meridian, are very dangerous. At such seasons fever patients are said to die frequently from sudden apoplexy. Piso has remarked this.

Chronic inflammation of the liver.

The most common fever of a bad kind, from which not only the Indians, but all the inhabitants of Brazil suffer, sets in with the symptoms of synochus with biliary complications. It is at bottom a chronic inflammation of the liver, which under certain circumstances puts on a febrile character, sinks back again to a chronic state, and after repeated exacerbations generally produces in the end a fatal result, by disorganisation, induration or chronic suppuration of the liver: at times, along with general putrid fever, at times with dropsy; more rarely, with the rupture of the larger vessels, or sudden mortification.

All the injurious influences already indicated and the heat of the climate predispose to this disease. It is one of the most common among the Indian as well as the civilized population, especially in low, damp, steamy neighbourhoods, as along the course of the Madeira, the Tocantin and the Amazon. From simple loss of appetite with a feeling

* No one suffers long in this country from intermittent fever, without having impressed on him the belief in lunar influence.—*Tr.*

of oppression in the hypochondria, and a slight remittent fever, up to the most violent inflammation and its worst terminations, this disease presents an uninterrupted chain of the most varied phænomena, according to the individuals, the locality, the accidental complications and the duration of the disease. It involves the most different organs, and developes itself in the most different ways accordingly. While its beginning can often be checked by a few purgatives and a careful diet, in its higher degrees it defies the skill of the physician; and the great mortality of the Indians, who know no remedy with which to protect themselves, is chiefly to be ascribed to this disease. The (Baços) fever cakes which appear as the most common result of this disease, are so common in many districts, that one cannot help considering it as endemic, as goitre is in others.* The whole of my boat's crew on the Yupurá was often afflicted with liver cakes of such a size, that they were perceptible to the eye without the aid of feeling; the whole aspect of these patients betrayed at first sight the deeply rooted nature of the malady. They were pale, ill coloured, gloomy, listless and without appetite, and shewed the greatest repugnance to their ordinary diet dried fish, salt-meat, beans, and Mandiocca flour) and an increased craving for brandy. It was melancholy for me to be scarcely able to do any thing for the wretched condition of these people, who would have required long and careful treatment, and instead of receiving this, fled to their woods, where they were only threatened with a still quicker death. Men between the ages of 30 and 50 seemed most subject to this disease, probably from their unsettled mode of life: women less so; I have however seen boys and even children suffer from it.†

* For the sake of uniformity it would be very convenient if we could make out these liver cakes to be spleens. Enlarged liver is not often observed, while enlarged spleen is exceedingly common among the natives of Bengal..—*Tr.*

† Lallemant, an intelligent physician of Rio Janeiro, describes a similar disease, in which he says the heart is enlarged, instead of the liver.—*Tr.*

Chronic stomach disease.

With this disease which although it is at first slow, afterwards progresses with the most acute symptoms, two other affections of the digestive organs are associated, regarding the nature of which I still remain much in the dark. The one is the condition which the Brazilians call Engasco. It is a peculiar kind of indigestion, characterised by a heavy feeling of over-repletion, by continued belching, joined with rumbling and griping in the stomach, occuring after meals, and attended by a constantly diminishing power of making fresh blood. Women are especially subject to this condition, and it often might be described as hysterical dyspepsia or Anorexia. Raw coarse food eaten in excess seems to be the commonest cause of this disease, nostalgia is another cause, when Indians are retained by settlers as labourers, in a condition foreign to their usual mode of life. When the disease is once established, they have often a constant craving to eat, the* mud of rivers, the lime from the walls, or pieces of wood. This disease is even still more common among negroes, and individuals of mixed negro blood, and is common at places along the coast, where the planters can neither by warning nor by punishment break young slaves, who have once acquired it, of the habit.

Spinela.

The other chronic disease of the digestive organs, which I have several times observed in Indians, especially among the civilized offshoots of the Tupis in Bahia, Pernambuco and Maranháo, is a bending inwards of the ensiform cartilage of the sternum. Piso described this disease (edit. 1658, p. 36,) as being endemic there, and called by the Portuguese Spinela; he called it a ***Prolapsus Cartilaginis mucronatæ.***

* The river clay which I saw Indians in the neighbourhood of Coari eat, contains according to Ehrenberg's microscopic investigations, the following polygastric infusoria with silicious coats, Eunotia Bidens, turgida, gallionella granulata? Himantidium arcus, of silicious earthy plants, amphidiscus Martii, A. Rotula, spongiolithis aspera, Sp. inflexa, Sp. rudis, spongilla lacustris.

It is probably the result of rickets, and the immediate consequence of organic alterations in the vicinity of the digestive organs. Dr. Paiva told me that he had observed in the bodies of those who had died of this disease, great varicosity of the coronary veins of the stomach, and Piso remarked that they could be recognised at first sight by lumps in the arms. The inhabitants often complain for months, nay for years, of a shooting or burning pain in the region of the heart, which is greatest when the stomach is full, and at times becomes quite intolerable. It increases after every full meal, and after all violent movement of the body. At the same time there is an increased secretion of mucus in the stomach, and in some individuals a great tendency to the production of acid. To get relief from the violence of the pain, the patient lies down in a horizontal position on his back or on his side. At times the pancreas sympathizes, as seems to be shown by an immense quantity of saliva and mucus coming up into the mouth. The habit of the patient is cachectic, and reminds one of a spleen case. After several years suffering, dropsy or putrid fever sets in.*

Save this remarkable one, which deserves a thorough investigation on the part of the Brazilian doctors, I have not observed any form of disease among the Indians, which I can describe as being of a rachitic nature. Yet it is not rare to see children in a state of atrophy, reminding us of the scrofula of Europeans.

These are the victims of neglect, especially in cases where their mothers have died. Infants at the breast and small children are by these savages abandoned almost wholly to the care of their mother. While she, with the love of an ape,†

* I have lately met with a strange case apparently of ossification and eversion of the ensiform cartilage, the end of which may be felt projecting against the skin a little to the right of the mesial plane, the affection has been coming on gradually for a year or two, it causes acute pain after a full meal, the man is otherwise healthy, and well-made.—*Tr.*

† So in the original.—*Tr.*

bestows on her infant not the care of a single year, but continues lactation till it is four or five years old, no one else in the house cares the least for the little one, and if it be deprived of its mother, it is always neglected, and falls away into the most miserable condition. Such unlucky children not unfrequently die of hunger; if they are able to maintain a wretched existence, they remain in a state of weakness and of atrophy resembling that of the neglected children of European manufacturing populations. If, however, they live long enough to attain the power of supporting themselves, they appear suddenly to regain their lost ground. I at least have never seen boys or girls of the age of 12, who had not the usual strength and cheerfulness of the red man. The only exception to this, was in the case of such girls, as, on the appearance of the catamania, suffered from the strange mismanagement, which is commonly adopted. In many cases the girl is at that period subjected to a three weeks' fast. She is removed from all intercourse with the tribe, made to lie alone on a sort of scaffolding at the top of the hut, and there allowed only water and a little fresh cooked fish for nourishment, so that in this wretched penitentiary she is often starved down almost to a skeleton, and for a long time afterwards suffers from the consequence of such unnatural privations.

Syphilis.

It is well known that this disease has made great ravages among the Indians. It has penetrated into the remotest districts, and like an eating worm gnaws at the marrow of these devoted people, who use against its violent inroads only a few vegetable medicines, and yet gain more by their use, than from the treatment of the European doctors, who continue to use mercury far too freely. I have observed among the Indians along the Amazon rapid infection and rapid spread of the disease. If improvement did not take place soon and decidedly in the hands of the doctor, the infected used to fly in despair to the woods, after which I never could get further accounts of them. The Indians themselves believe universally that syphilis was introduced by the Europeans. It is unknown among communities which have not had intercourse with the Brazilians. Nevertheless I do not declare decidedly for the opinion, that syphilis is a disease of the old world.

The Indian suffers little from other diseases, which are especially connected with the assimilative and plastic processes. I have indeed observed a few cases of lymphatic swellings in the arm and knee joints, and also ankylosis of the lower extremities in a couple of old Indians, but it was the result of injuries not of constitutional disease.

Diseases of the Bones.

The bony framework of the Indian is slow in attaining its full strength and firmness. It is known, as Herodotus remarked, that the bones of the head of negroes are harder than those of white men, and the same is reported by Spanish writers of the Americans. And not only the first conquerors, but later observers have remarked that the bones of the skulls of Americans are of uncommon thickness, and resist the blows of Europeans better than the skulls of their own race do. But there can be no doubt that the bones of the pelvis and of the skull are exceedingly firmly knit together, and attain an unusual thickness; and in church-yards and charnels the bones of Indians may thence be distinguished from those of Europeans. The development of the teeth is also strong. Dentition is late in commencing, and slow in its progress. The second set of teeth are distinguished by the absence of that transparent milk-white colour, which is so commonly found among Europeans, especially in northern lands; they are rather of a yellowish-white shade, and little transparent; the enamel lasts long, and the old men generally lose their teeth by their gradually falling out, and seldom from partial decay:

this may possibly be owing to their hardly ever eating hot foods. Teeth and still more bone diseases are accordingly rare among the Indians. I have only seen a few diseases of bone, viz., *exostoses* of the fibula, which were treated with advantage by the juice of Euphorbiaceæ and fomenting with the leaves of a variety of pepper. Toothache among them is generally rheumatic, and seldom caused by caries of the teeth.

I have never seen curvature of the spine, club-foot, or other deformities of the skeleton. But it is probable, that when children are born among them with any such deformities, they are made away with immediately after birth. It is strange enough, and may serve as a trait in the moral constitution of these races, that the Indian always represents the spirit, called Gurupira, the terror of the woods, the product of his own superstition, and an enemy to man, with a club-foot, or with one growing forwards out of his chest. Lame and halt are occasionally seen: their ailments have always had a traumatic origin. Intentional limping, a result of civilization in our children, is unknown among the Indians.

Diseases of the organs of respiration.

They are comparatively speaking uncommon among the aborigines of America. They suffer very seldom from chronic lung disease, although now and then, galloping consumption is the consequence of acute chest affections, pleurisies and pneumonias. The open-chested build and the regular occupation of the Indian, who is hardened by regular exercise in the open air, and the mild pleasant climate, prevent the frequent occurrence of these diseases.

Gout.

Though well known as the chief disease among the red population in N. America, gout is here scarcely known, as the use of brandy has not yet spread itself extensively enough. This poison operates most injuriously on those communities of Indians, which though removed from Europeans, still have trade with them. Every expedition brings brandy and its melancholy consequences among isolated tribes and villages: we however trace the destructive effect of spirituous drinks, and especially of new brandy made from sugar, less here, than among the more civilized Indians along the coasts of Bahia, Pernambuco, Parnaiva, Maranhâo and Pará. There, where there is the largest population of civilized Indians, brandy has exerted its baneful influence over large masses of people. Besides the corruption of morals to which it has led, it has had a material share in causing the ever increasing mortality, in augmenting the strange sterility of the Indian, and in increasing the quantity of liver disease.

Hœmorrhoidal affections.

They occur in various forms, and are frequently connected with the chronic liver disease, which they usually precede. As a characteristic and very frightful disease of this nature, I must mention a complaint which prevails in the low damp districts of the provinces of Maranhâa, Piauhy, Pernambuco, and Bahia, and is called Doença do Bicho, or Bicho do Cù, and was described long ago by Piso as the scourge of the population. The coast Indians call it Teicoaraiba, i. e. *anus rubens.* It consists in relaxation, protrusion, and finally gangrene of the rectum, and if not at once checked by the most active measures, leads invariably to a fatal result. This fearful disease is oftenest observed at the termination of epidemics of dysentery. I have remarked a carcinomatous form of it in horses in the province of Piauhy.

Diseases of the organs of the senses.

From what I have already said regarding the senses of the Indian, and of his miserably narrow sphere of existence as compared with that of civilized Europeans, we might presume that he is not subject to many diseases of the senses, and such is in reality the case.

The black, brown, or exceedingly rarely dark blue eye of the Brazilian savage displays in its dark glance, the clouded dreamy sunkenness of the race. It is often destroyed by injuries—but gray cataract is not common, and green or black are still rarer. Inflammation of the eye in consequence of extreme exposure to light, and to the smoke of their huts, occurs in those districts, in which the red man retires into darkened hovels to avoid the intolerable swarms of musquitoes, as is the case on the Rio Negro, and on several tributaries of the Solimôes. But with this exception, the noble organ of vision enjoys, in the green glades of the forest, on the airy plains of the table land, away from the injurious stimuli of learning and of European civilization, never directed on the close type of a school book, or bent on a novel while the hands are employed in knitting,* never allowed the use of spectacles, of opera glasses or of microscopes,—a fortunate liberty, which can only improve its strength and soundness. What I have oftenest observed among Indians as well as negroes in these countries, is the *arcus senilis*, a circular thickening of a ring of the cornea round the pupil, and this, not as a consequence of advanced age, but of catarrhal inflammation.† From the use of bad diet, especially of salted fish on long water journies, the Indians are often attacked with slight inflammation of the eye, for which they commonly use the freshly expressed juice of the buds of the Ambaúba tree (Cecropia) as a wash. The ear suffers oftener than the eye among the autochthones of Brazil. I have seen several men and women quite deaf, or more than half so. In some I observed large scars from severe inflammation of the Parotid, and probably of the internal ear. They had come on at the termination of exanthematous fevers. The Indian takes little care of the delicate organ of hearing; he often has no covering to his head, and seldom wears

* Knitting, the eternal employment of German women.—*Tr.*

† We doubt much whether, there is ever a connexion between arcus senilis and catarrhal inflammation.—*Tr.*

a hat, so that the hot sun strikes directly on the external ear, which by night is either heated too much by close proximity to the fire, or catches cold from resting on damp leaves or sand. Hence catarrhal and rheumatic inflammation of the ear is common enough, chronic discharges from it are frequent. Here also people are quite aware of the fine sympathy between the organs which secrete the bile, and those which generate the bitter wax of the ear.(?) Erysipelatous forms of inflammation, and indeed the irritation of the sand fly, whose eggs are well known to produce most painful inflammation, frequently extend to the ear.

Mental diseases.

From these the Brazilian savage suffers very seldom; his dull senses, his brooding melancholy, and the absence of every thing that can awaken a higher and more refined spiritual life, readily explain how he remains a stranger to all those alienations of mind, which with us are caused by excited affections and morbid imaginations; indeed, if we except the momentary madness of drinking, and the rage of envy or of hate, there remains scarcely a passion, which could lead to derangement of mind in the Indian. But we occasionally observe cases of imbecility and of idiotism, which are probably caused by injuries of the head, or by internal diseases terminating unfavourably.

The only mental disorder, of which I have heard among the Indians, may be compared more readily with *lycanthropy* than with anything else, i. e. with that alienation of the mind, in which a man out of his wits from madness, rushes into the open air and imitates the voice and gestures of a dog or wolf, and becomes a wer-wolf, i. e. a wolf-man. Dobrizhofer gives a full account of the malady, and says that it only occurs among the tribe of Nakaiketergehès. I have however heard exactly similar accounts from missionaries and others on the Amazon. After the Indian has remained for some time pale, syllableless, wrapt up in himself, wandering about with confused staring look, or withdrawn from all company, he breaks forth suddenly some evening after sunset, with all the signs of ungovernable madness and blind thirst for blood, he storms through the village, and sets on every one that he meets, he rushes howling to the spot where the dead are buried, tears up the soil, and throws himself down, or madly loses himself in the desert. This disease returns every 8 or 14 days, and ends in complete exhaustion, or passes into fever. It is said to have been observed to be epidemic, and to occur not only in men, but also in women, and especially after continued debauchery, drinking, dancing and excitements of all kinds. The Indians believe that witchcraft is its cause. The missionaries always considered the removal of the person affected from his community, as necessary to prevent its spreading.*

I have now related the most important particulars of what I have had the opportunity of observing, or occasion to hear from trustworthy parties regarding the diseases of the Indians.

Diffusion of disease according to different localities.

All these diseases are especially those of the tropical man, the nomad, the hunter, the stranger to European civilization. They are in many districts endemic, and then the red man shares them in a greater or less degree with his neighbours of other races. It is natural that a country of the extent of Brazil should not have the same climatic constitution in all parts, and that local diseases should accordingly undergo certain modifications. If we view the whole of tropical Bra-

* Catlin mentions something very similar among the N. American Indians. The belief in wer-wolves was common among the Romans, prevailed throughout Europe for many centuries, and is not yet extinct in some districts. The European superstition however makes no difficulty as to the actual conversion of the man into a wolf. The lycanthropy of the red Indian is no doubt at times epidemic, like the dancing and leaping mania of the American Jumpers, &c.—*Tr.*

zil in this point of view, we may recognize in this vast country a triple character as to disease.

1. The immense basin of the Amazon with its northern and southern tributaries. This river valley, the largest on the surface of the earth, following the equator in its chief direction from west to east, and also in that of its most important tributary the Madeira, from the 19° of South latitude to the equator, partaking every where of a true equatorial climate, is a low damp land. The overflowing of the rivers, and of the endless lakes and ponds in connexion with them, endure on the average for two-thirds of the year. There is no dry season here as in the other divisions; thick forests, always green, and incessantly attracting damp clouds, alternate with plains only, in the higher lying districts. Throughout the whole year day and night vary little in length; cold winds never prevail. In the later months of the year there blows in the chief basin of the Amazon, the wind called *the general,* an East wind, which is generally without any unfavourable influence on the constitution, since it cools, without making people catch cold, and commonly diminishes the plague of musquitoes. Universal nature is here subject to that peculiar rest, that regularity in all the phænomena of terrestrial life, and to that beautiful harmony of the elements, which makes equatorial regions so attractive. The prevalent diseases correspond with these relations; feverish exanthemata, dysenteries, dropsies, obstruction of the liver, and of the portal circulation, and chronic inflammation of the liver prevail. All inflammations shew a venous or passive character; they are less strongly marked than in more southern climates; great failure of strength, and rapidly supervening colliquation render diarrhœas and dysenteries, which are often caused by catching cold, and by eating unripe fruits, especially dangerous. The infectious exanthemata spread with unusual violence. Dropsy in its various

forms, is the disease of which most Indians die; worm diseases in various complications are very frequent.

2. The physical conformation of the northern provinces, Ciará, Rio Grande and Paraiba do Norte, Alagoas, Pernambuco and Bahia is quite different. This large tract of country is perhaps the most healthy of all, but it is at present only inhabited along the coast by a few Indians, chiefly civilized offshoots of the Tupi race, and in the interior by a few small groups of tribes that have settled in it; it is a hot dry land, with less vegetation. The rainy season, which in the basin of the Amazon may be said to extend over the whole year, has its duration contracted here. It is often entirely absent for several years. The rivers, as compared with those of other districts, are poor streams. Their inundations are trifling, and have no such important effect on the vegetation and the general phænomena depending thereon. The land rises into hills or elevated table lands. It is much more exposed to the winds than the equatorial districts, and when they come from the sea coast, they often produce fever and diarrhœas; when they blow from the west or north-west, rheumatic and catarrhal affections and inflammations, especially of the eyes. The steady clearness and warmth of the atmosphere braces the nervous system. The dryness prevents the tendency to colliquation and putrid fever. This very favourable constitution of land and climate prevails almost every where. Only some of the larger rivers, especially the chief streams of the district, the Rio de S. Francisco and the Parnahyba, form an exception. In the neighbourhood of those rivers, and as far as the inundations and the pestilent effluvia connected with them reach, the chronic inflammations of the liver which have been already described prevail under the form of putrid and bilious fevers. They commence at the end of the inundations, and decimate the population in a fearful way,

he more because they never meet with judicious treatment. Ve see in these regions many individuals with fever cakes, who generally are at last carried off by dropsy or putrid fever. The Indians had formerly settled in large bodies along those treams, but like a few white colonists who afterwards mi-rated thither, perished by that malignant fever, (Malinas.) Along the upper Tocantin and on the Araguaya, which streams n this part of their course belong to this district, although heir lower parts agree in climate with the Amazon region, here are still numerous Indian tribes, among whom at this day he Malinas from time to time works fearful ravages. This eautiful land is on the other hand remarkably beneficial to ung affections. They are exceedingly rare, and only occur t one or two spots, which are comparatively speaking less avourably situated, and are high and windy. Pernambuco s remarkable in this respect; it is the Pisa of Brazil; and he salubrity of the climate for patients with diseases of the hest is well known in England, and hectic patients sent hence to Olinda often experience great relief, even after heir disease is far advanced.

3. The third well marked district for certain forms of lisease, embraces the high lying provinces of Minas and S. Paulo, the mountainous part of Bahia which agrees in haracter with Minas, the thickly wooded provinces along he coast, of Porto Seguro, Espiritu Santo, Rio de Janeiro, S. Paulo and S. Catharina. The high lying places along he coast of Bahia, for instance its capital, may come under his head, in as much as from their vicinity to the sea they re also exposed to the rapid changes of temperature which haracterise in general this division. This proportionately best peopled district, though now possessed of a large population only in its north-eastern forest parts, has a rue tropical climate, like the other districts already des-cribed. But it is deficient in that fixedness and uni-formity of climate, which makes the words—hot and damp,

sufficient to characterise the Amazon basin, and hot and dry, the north-eastern provinces. The latter of these climates the Brazilians call *clima agreste,* the former *clima mimoso.* In this part of Brazil then we have a high temperature during the dry, as well as during the damp season ; both periods alternate with each other with great regularity, and in both we find sudden lowerings of temperature, which have their influence on the general health, and often modify it in a very striking degree ; the elevated position of many localities, especially in Minas, which on the whole may be counted high land, the steep conformation of the coast Cordilleras, which seem thickly wooded through the greater part of this district, besides this the occurrence here of deep winding villages, there of wide-spreading table lands, in fine, the absence of extended river districts, and the preponderance of forest vegetation throughout the whole—all these circumstances unite to give this division of the country a separate character as to its diseases, which is made up of that of tropical as well as of extra-tropical lands. In consequence of this the catarrhal and rheumatic character is more marked, and is in a certain degree linked with the bilious. Violent catarrhs, diarrhœas that end in dysenteries, and inflammations of the bones, are here especially common. The strong winds which blow thither sometimes from the sea, sometimes from the interior of the land, the south and south-west, bring commonly acute muscular pains, pleurisies, and pneumonias. But here also diseases in which the liver and portal system are especially involved, are common, and a painful erysipelatous inflammation particularly of the lower extremities (Sarna) is one of the commonest evils. In Rio de Janeiro, Sarcocele and Hydrocele are almost endemic. The Indians of this district live in greatest numbers in the woods north of Rio Janeiro between the Rio Paraiba, Rio Doce and Rio Belmonte. Small-pox and measles have often made fearful ravages among them, and they seem to have suffered still more than their countrymen on the Amazon. Besides the greater vicissitudes of climate, this circumstance may be partly a cause of it, that being closely shut in by the ever-spreading white population, they take less active exercise than in a freer state.

I must allude only cursorily to extra-tropical Brazil, which embraces a part of the province of S. Paulo and of Rio Grande do Sul, and may be looked on as a fourth division as regards the character of disease. Its Indian population is, comparatively speaking, small, and it generally belongs to the Southern tribe of Tupis, the Guaranis, and has been more or less disturbed by the influence of the neighbouring Spanish missions, of the former Jesuit settlements. The character of its diseases approaches that of the districts last described, but the inflammatory rheumatic character is more prevalent.*

General result regarding the diseases of the Brazilian savages.

If we now combine into one point of view the outlines of the flying picture which I have sketched, the following will be found to be the essentially characteristic points:—

1. The Brazilian Indian has scarcely any disease, that belongs to him peculiarly.

2. He shares with the other classes of the population the diseases prevailing there through climatic influences. His system reacts against these diseases in an analogous way to that of the European, only with such difference as might be expected from his natural constitution: and the characteristic traits of his race are found in the diseases to which he is most subject.

3. In his proportionately salubrious land, the Indian knows no more than the European settler of the plague, of cho-

* We believe that no attempt has been made at a general classification of the climates of the continent of India.—*Tr.*

lera, of the yellow fever, of the frightful putrid fevers of the west of Africa, or of the *Vena medinensis.*

4. The disease introduced by Europeans, the small-pox, causes the greatest mortality, and the sterility* inherent in his race is increased by syphilis, which was originally unknown to him.

5. We may thence assume that the race of the red man is naturally a very healthy one: (its longevity is well known,) but this only as long as it is the exclusive possessor of its own country, and not disturbed by European civilization.

6. But, as things have changed since the arrival of the Portuguese, a constantly increasing rate of mortality has been observed. The only race of men, regarding which, one can from preceding facts lay down a general prognosis, is the American. In this prognosis, which pronounces the extinction of the red man, the aborigines of Brazil also share.

This melancholy view of things, against which the feelings of the philanthropist struggle, has but too much foundation in the state of medicine among the red race, for when we consider the matter a little more, it becomes quite plain, that the savage is in no condition to discover for himself the appropriate remedies for the physical evils from which he suffers. Then again he is, from his social condition, quite beyond the reach of any beneficial operation of the medical knowledge introduced from Europe.

* Dr. Lallemant attributes this sterility to the mere phlegmatic cold and indifferent nature of the red man. He has lately written regarding the diseases of the neighbourhood of Rio Janeiro, but we have not hitherto had an opportunity of comparing his accounts with those of Von Martius.—*Tr.*

(To be concluded.)

Description of an Electro-motive Engine, by Inspector General J. Macleod, *of the Madras Medical Service. Communicated by Dr.* F. Mouat. *Pl.* iv.

[*Note by Dr.* Mouat.—Mr. Macleod is well known in the Madras Presidency, as an able and excellent practical chemist and mechanic, who has devoted considerable time and attention to such subjects. The ingenious instrument described, which works exceedingly well, may be applied to a variety of useful purposes, and the power multiplied to any extent by increasing the strength of the battery, and size as well as number of the magnets. Few subjects connected with the arts have recently attracted more attention than the application of electro-magnetic power to supersede steam in its infinite uses and appliances. One of the greatest difficulties and barriers to its success has been completely overcome by Mr. Macleod, whose paper we have no doubt will attract considerable attention among those engaged in similar inquiries in Europe.]

The discoveries made of late years in electro-magnetism, more especially the extraordinary power imparted to soft iron by means of the galvanic current, have given rise to various ingenious attempts to apply the new agent as a motive power. All these attempts, however, appear to have been unsuccessful. (See Mechanics' Magazine, January 1844, page 61.) I have tried the arrangements of Devonport, Jacobi, Davidson and Taylor; and though small models or toys can be made to work by either of them, I am inclined to think that it could easily be explained, why they have not been found to answer on the large scale.

The space over which electro-magnets exert any considerable power being very limited, and by far the greatest portion being exerted close to the magnet, it is evident that none of this last can be sacrificed without the loss of a considerable proportion, if not the greater part, of the power, together with a corresponding waste of materials.

I do not find it stated at what distance from each other the rotating and fixed magnets were placed in Devonport's and

Jacobi's engines. The workmanship may indeed be so perfect as to bring them very close without actual contact. But the expansion and contraction of iron by change of temperature, renders it exceedingly difficult to adjust them so close as delicacy of workmanship might otherwise admit of. These disadvantages appear also to be augmented by enlarging and multiplying the parts composing the engine; and in proportion, the loss of power and waste of materials will be greater. However this may be, nothing short of actual contact can render the whole power available, which is evidently impracticable in the rotating engines.

These considerations naturally suggest the plan of causing the keeper to be attracted and repelled alternately, this obvious movement being made to act as a motive power. In this case, however, the limited distance at which the electro-magnet acts is by no means the only difficulty,—the adhesion of the keeper,* even when contact is broken, is another, which is not obviated by changing the poles. It occurred to me, however, that by means of the mechanical contrivance hereafter described, and availing myself at the same time of the *residuum power remaining for a moment in all electro-magnets*, that the keeper could always be separated from the magnet the instant it came in contact with it; that by using the contrivance, alluded to, the keeper never could adhere to the magnet, and thus the strokes could be repeated rapidly with the full power of the engine. This plan answers perfectly.

I informed Mr. Palmer of Newgate street, of the result of the above arrangement, in a letter dated 20th November 1843, and his reply is dated the 28th December following.

In my model there is no changing of poles, and the keeper can be made to strike the face of the magnet from 150 to 200 times in a minute, with its full force, when not loaded. The

* The clumsy and unscientific expedient of interposing slips of wood, or card, to prevent contact and sticking, is hardly deserving of notice.

keeper never adheres to the magnet; it is instantly repelled, and this rapid alternate movement is made to act on a fly wheel.

The annexed figure (II.) shows the manner in which the magnet A. and keeper B. are arranged. The keeper is a triangular prism, resting on two bits of brass projecting under the magnet. The movement is evident from the figure; the lower edge of the keeper never quits the magnet.

Both the magnet and keeper are electro-magnets; they are made to attract and repel by the same current without altering its direction. The mode of effecting this is as follows:

The magnet and keeper communicate with the battery alternately, and the motion of the keeper causes the current to pass from the one to the other.

Let us suppose that the magnet being in communication with the battery, attracts the keeper till they come in contact. If, at this instant the current is suddenly shifted from the magnet to the keeper, the latter is repelled by the *residuum of magnetism remaining for a moment in the latter*, both having then like polarity. When the keeper is thus thrown off, on arriving at the desired distance (or angle) from the magnet, it causes the current to be thrown on the magnet again, and so on alternately. It is absolutely necessary that this movement should be instantaneous, and be performed with the utmost precision and accuracy; conditions, it will be seen, very easily fulfilled, by means of the apparatus represented in the annexed diagram, Fig. I.

Mercury is not used in any part of this arrangement. It would not answer the purpose of interrupting and restoring the communication with the battery, because that manœuvre requires a degree of precision the use of mercury does not admit of. The mercury soon becomes an amalgam of copper, and *drags a tail*, which alone is sufficient to interfere with the movement; and this is more especially the case when the engine is large, and the electrical current powerful.

Fig. I. represents the poles of a magnet with its keeper; both being electro-magnets. That from which this figure is taken is a bar of soft iron, two inches square, and weighs about 80lbs. The apparatus by which the movement is produced and regulated, is placed as represented in the drawing. A. B. is a board firmly wedged or screwed between the arms of the magnet. C. D. a copper bar, which moves on a pivot at P. To this bar a permanent communication is made with one side of the battery, say the zinc side. The *copper* side communicates with both the magnet 1, and keeper 2, by the copper strap O. To the nut at E., the strap intended to communicate with the zinc side is screwed, and to E. is in like manner attached the wire from the keeper intended to communicate also with the zinc side. The bar D. strikes alternately E. and F. as it is acted upon by the keeper; which it does as follows:

It will be observed that one side of the magnet, and one side also of the keeper, are permanently connected with the copper side of the battery, by the copper strap O. Now, when the bar C. D. is made to touch E., the magnet receives the whole of the current from the battery; and when the same bar touches F., the current passes only through the keeper. Therefore, when the magnet is rendered magnetic, it attracts the keeper, which is then not magnetic; and when the current is instantaneously shifted to the keeper, it is suddenly repelled by the residuum remaining for a moment in the magnet, as already described.

The current is thus thrown alternately on the electro-magnet and keeper, and this is effected by the movement of the latter. It is absolutely necessary that the copper bar D. should remain in contact with E. during the movement of the keeper from its greatest distance, till it actually strikes the magnet. Let us suppose, that the copper bar D. is in contact with E.; the magnet will now attract the keeper, and when it arrives within, say the 20th of an inch of the magnet, it strikes the end of the long brass screw M. (passing through C. D.) which throws the copper bar C. D. upon F.; thus shifting the current from the magnet to the keeper. The keeper is now repelled, and as it reaches the required distance or angle, regulated by the screw L., to which it is attached by the chain S., it necessarily throws the copper bar D. back against E., shifting the current again to the magnet which attracts the keeper as before; and in this manner the movement is continued. The keeper is attached to the screw L. by twine or a chain, so as that it may not move the copper bar C. D. till it arrives at the required angle or distance.

The movement of the bar C. D. between E. and F. may easily be regulated by the screw F. It need not exceed the 20th of an inch, or it may be less; all that is required being to break metallic contact. The screw M. can easily be adjusted so as to make the keeper, when it comes in contact with it, shift the bar C. D. from E. to F.; but this adjustment must be accurately made, to insure regularity in the movement. As the keeper does not shift the current from the magnet till it is within less than the 20th or 40th part of an inch from actual contact, we shall find that actual contact does always take place before the keeper is thrown off by the magnetism induced in it acting upon the residuum remaining for a moment in the magnet.

When the keeper is not attached to the fly wheel, it strikes the magnet with great force and noise; but there is no noise when it is loaded or has work to do. It may be made to strike 150 to 200 times in a minute; and never adheres to the magnet.

With regard to the action of the keeper upon the fly wheel, it will be seen by the annexed figure that it is performed by a contrivance different from a crank. The crank can hardly be applied with advantage where the impulse is repeated several times during one revolution of the wheel. The motion of the fly wheel is produced by repeated pulls upon the rim of a small wheel fixed upon its axle. This is managed by means of the apparatus represented at Fig. III. A. is a steel toothed wheel fixed on the axle of the fly wheel, Fig. II. D. D. are brass cheeks moveable on the projecting sides of the steel wheel, and screwed together at F. C. is a double catch which freely allows the brass pieces D. D. to be thrown back, but when drawn forward by the keeper, catches the toothed wheel A., and thus causes the fly wheel to turn. E. is the pin to which the bar from the keeper is attached; it can be shifted further from, or nearer to the main axle, at pleasure. When the motion of the fly wheel is required to be reversed, the brass pieces D. D. are turned under the main axle, the catch being made to act in this position also, merely by pushing a spiral spring to the other side of it.

The action of the engine is instantly arrested by placing a thin slip of ivory between E. and C. D., and as quickly restored by withdrawing it. It is unnecessary to say that no impulse is required to renew the action.

There being no change of poles in these magnets, I find that a certain degree of permanent power is induced in the large bar. This is no disadvantage; on the contrary, it helps to repel the keeper when the current is shifted to it.

As the working power of the magnet is greatest when nearest to the keeper, and as the strokes are also quicker in this position, nothing is apparently gained by allowing the latter to recede very far from the former. The manner in which the power is applied to the fly wheel renders it unnecessary, and in this respect the arrangement differs essentially from the crank. The adjustment of the bar R., where it is attached to the keeper and fly wheel, as shown in Fig. II., enables us to regulate the length of the stroke at pleasure.

The model from which this description is taken consists of two electro-magnets, side by side, as seen at Fig. IV. They each act independently on the axle of the fly wheel, as already described. Several may of course be so placed. I have placed the bent end of the magnets next to the fly-wheel to enable me to work it by a longer rod, which more readily admits of reversing the motion by turning the apparatus at Fig. III. above or below the axle.

A very short rod would not readily admit of this. Of course a great deal more room would be occupied by placing the fly-wheel opposite to the poles of the magnet. Various modifications however of this, as well as of other parts of the arrangement, will readily suggest themselves. But the apparatus at A. B. Fig. I. with its copper bar, binding nuts, and screws, works in so satisfactory a manner, by the motion of the keeper, which it also regulates, that the principle will be found applicable, as I have found it, to a variety of modifications of that described.

It is impossible in this country to get apparatus of this description, finished with any thing even approaching the required degree of accuracy. The two electro-magnets described above, weigh about 80 lbs. each; yet so defective is their construction, that their lifting power is not one-quarter of what it ought to be, or what we find it in those made in England. The iron is common bar iron, and there is but one coil or strand of copper wire used, of about one-tenth of an inch diameter.

For these reasons, I omit all details of experiments made on the motive power of this arrangement. In fact, such details are unnecessary. All those conversant with the subject will readily be able to form a correct judgment of the principle on which the movement depends, and the means by which it is produced. It will easily be seen what proportion of the current from the battery or of the induced magnetism, is wasted by any peculiarity in the arrangement. As for the movement itself, it appears to be quite perfect.

With a view of obtaining a longer stroke, I have tried the magnets and keepers, one over the other, working as one magnet; but it did not appear that any advantage was obtained by this arrangement. I have no doubt, that a single magnet, with the same quantity of iron as in both, would be much superior to the combination alluded to. With a bar of iron *one foot* square, the stroke would probably be sufficient to work on a crank, if such should be preferred to the contrivance described. But I think the latter will always be preferred for electro-magnetic engines, when the stroke is several times repeated for one revolution of the fly-wheel. I have tried a screw paddle worked by the axle, which appeared to answer remarkably well.

As the poles are never changed in this arrangement, permanent steel magnets answer very well, the galvanic current being passed only through the keeper. It is a matter of economy and convenience. But it is probable, that as electro-magnets are much more powerful, they will always be preferred.

The galvanic arrangement employed, is the constant battery of Daniel. The zinc plates (10 inches by 5) are placed in thin leather cases, which are disposed as usual between plates of copper. All the zincs, and all the copper plates are connected together so as to produce the effect of one pair.

From Dr. Wight's Neilgherry Plants.

I.—RANUNCULACEÆ.

This is an extensive and beautiful family of plants, many of which, such as the Clematis, Ranunculus, Anemone and Larkspur, rank among the most admired favourites of the flower garden and arbour. Its species abound in extra-tropical countries, but are of such rare occurrence within the Tropics that, so far as I yet know, there are not above 12 or 14 found, truly indigenous, in the whole of the Indian peninsula, the flora of which amounts to probably not fewer than 5,000 species of flowering plants, of all descriptions, or it stands in the ratio of about 1 to every 400 species found within the same limits. The paucity of Ranunculacious plants, within the Tropics, may be further shown by comparing them with the Flora of the whole world: thus, assuming that there are 600 species of Ranunculaceæ, and that there are 80,000 species of flowering Plants, they then stand in proportion of one to every 133 species.

According to published lists, the Indian peninsula, within an elevation of 500 feet above the sea, can only claim one species (*Naravelia Zeylanica*) and that of rare occurrence within these limits. This plant, which abounds at the foot of the Hills, is an extensively climbing shrub, so nearly allied to *Clematis* as almost to require a Botanist to distinguish them. Such being the case, it naturally follows that the next in succession should be a *Clematis*, and such in fact is the case, *Clematis Gouriana* (Nos. 1 and 2) being frequent on the tableland of Mysore and also on the eastern slopes of the Neilgherries, at an elevation of between two and three thousand feet. None of the other species found on these Hills, except perhaps *C. Munronii,* which I found in the jungles below Sispara, descend much below six thousand feet of actual elevation, though all occur within a few hundred feet above that limit.

Continuing our ascent of the Neilgherries, the next species that presents itself is the *Clematis Wightiana* (No. 3) which abounds in the thickets about Kaity, and along the road from thence to Ootacamund. The *Anemone Wightiana,* begins to show itself occasionally about Coonoor, but is no where frequent until we have nearly attained the level of Ootacamund, where in the pastures, especially on moist ground, it becomes most abundant, but still ascends to the highest range of the Hills. The species of *Ranunculus* are of rarer occurrence, two species being generally met with in clumps of jungle, and the third (*Ranunculus reniformis,*) is sparingly scattered over the higher pastures on the more elevated hills, and in such situations, is well calculated to remind the European sojourner of the Butter Cups which so charmingly variegate the Hill-side pastures of our Father Land. It is also met with in swampy grounds about Ootacamund.

The number of truly native species on the hills, so far as yet found, amounts only to nine or perhaps ten. Thirteen are described in our Prodromus, but three of these I have since satisfied myself are introduced, namely the *Adonis* (Pheasant's eye) and two species of *Delphinuim* (Larkspur.) The remaining plant, excluded from the present list, is *Anemone dubia,* which I have ascertained to be a mere variety of *A. Wightiana.* These nine are referable to five genera, namely, *Clematis* 3, *Naravelia* 1, *Thalictrum* 1, *Anemone* 1, and *Ranunculus* 3. In still further proof of the extra-tropical character of this family I may mention, that Dr. Royle enumerates in his Illustrations of the Himalayan Flora, no fewer than 72 species of *Ranunculaceæ* found on the Himalayas and in Cashmere.

CLEMATIS. *Linn.*: *(Travellers' Joy—Virgin Bower.)*

Involucre none or resembling a calyx, and placed under the flower. Sepals 4-8, coloured, in æstivation either valvate or with their edges bent inwards. Petals none, or shorter than the sepals. Stamens numerous. Achenia several in each flower, terminated by a long tail. Seed erect.—Perennial plants with opposite leaves, which are simple, trifoliate, or once or twice pinnate, with a terminal leaflet.

This is a fine genus of beautiful climbing plants,—all the species of which seem well adapted for arbours,—and in Europe are much employed for the formation of these retreats, (hence I presume the old English names) as well on account of their rich foliage as for the profusion of their flowers, a feature long preserved by the beautiful silky hairs of the long feathery tail of their seed, (a rude idea of which I have attempted to convey in Plate No. 2), a mark which readily distinguishes this section from the rest of the family. The genus *Clematis* includes about 150 species which are scattered all over the world. The flowers are apetalous with petaloid sepals. Naravelia differs in having both Calyx and Corolla.

1. 2. Clematis Gouriana, *(Roxb.)* climbing: leaves pinnate or bipinnate; leaflets ovate-lanceolate, acuninated, cordate at the base, 3-or obscurely 5-nerved, entire or with a few coarse serratures: young branches angled, and peduncles, and oblong achenia pubescent: sepals revolute.—*W. and A. Prod. p.* 2.

This beautiful species flowers during the cool season. At this time, January, it is in full bloom in the jungles below Coonoor, where it may be seen climbing to the tops of the highest trees completely covering them with such a profusion of white flowers as almost to conceal the tree that supports them. In Mysore it is of frequent occurrence in the dense thickets surrounding most of the hamlets of that province.

3. Clematis Wightiana, *(Wall.)* climbing: leaves pinnate; leaflets not wrinkled, very villous and soft on both sides, coarsely serrated, cordate at the base, palmately 3-lobed, the middle lobe the longest, or divided again into 3 ovate-lanceolate segments: young branches, peduncles, and flat achenia, pubescent: sepals ovate, outside very pubescent, inside glabrous: filaments hairy. —*W. and A. Prod. p.* 2.

This species is less frequent than the preceding, but is abundant among the brushwood of clumps of jungle about Ootacamund; also on the road side above Kaity, and on that leading from Southdown round the foot of Elk Hill. In the latter station I met with it in the greatest perfection. It is readily distinguished by its soft almost woolly pale green leaves.

I may here remark that the colourist has represented them of too deep a green, for which, however, I can scarcely blame him, as I found it very difficult to obtain the proper tint.

ANEMONE. *Wind Flower.*

Involucre 3-leaved, distant from the flower, the leaflets variously cut. Sepals 5-15, petaloid, imbricated in æstivation. Petals 0. Stamens numerous. Achenia numerous. Seed pendulous. Herbaceous plants with a perennial root. Leaves radical, stalked, more or less cut or lobed. Scape, when branched, bearing involucres at each of its divisions.

Of this genus nearly 100 species have been described in recent Botanical works. They are for the most part herbacious with perennial roots, and, generally, can be at once distinguished by their flowers having no distinct calyx, the floral leaves being all petaloid:

hence it is called a petaloid calyx. By this mark as well as by habit, or general appearance, they are readily distinguished from their next neighbour in the Botanical system, Ranunculus, which has a regularly formed calyx and corolla.

Some of them are much cultivated in gardens, and under the operation of skilful horticulture have become so completely doubled, that all the stamens and pistils have been changed into petals. In this state, however monstrous in the estimation of botanists, they are certainly most beautiful objects and deservedly great favourites in the eyes of the florist: many of them, especially the *Anemone coronaria*, when in that state, being variegated with the richest tints. Under such a course of treatment it appears to me, the one here figured might be made to undergo that change, and become one of the most choice garden flowers to be met with on its native mountains. This change might probably be brought about by transferring roots to the rich soil of the garden, and preventing them flowering for a season or two, by the simple operation of stopping, a practice which has the effect of strengthening the root. At the end of the season when the leaves wither, they should be taken up and kept for a few weeks in a dark place, and again planted. As the roots are perennial, this practice would probably in a few seasons effect the desired change, after which they can be propagated by dividing the root. For obtaining new varieties, plants are raised from seed, taken either from single or partially double flowers, and treated as above, taking up the roots when the leaves wither.

4. Anemone Wightiana, *(Wall.)* clothed with silky hairs; leaves on very long petioles, tripartite; divisions very deeply 3-cleft; segments cuneate, deeply 3-lobed; lobes cuneate, irregularly inciso-serrated: involucral leaves subsessile, deeply 3-cleft; divisions 3-cleft; segments linear-oblong, cut and serrated; sepals 6-8, elliptic-oblong: achenia glabrous: style hooked, persistent. —*W. and A. Prod. p.* 3.

Frequent in pastures about Ootacamund, but also generally distributed over the hills. Flowering in May and June. Flowers white within purple exteriorly. During these months it is certainly one of the greatest ornaments of the hills. I have not heard of its being applied to any useful purpose, though it may not be destitute of useful qualities as some of them are known to possess these.

RANUNCULUS. *Butter-Cup. Crow-foot.*

Sepals 5, not free at the base, deciduous, imbricated in æstivation. Petals 5, rarely 10 or more, the claw furnished inside with a nectariferous concave little scale. Stamens and styles numerous. Achenia ovate, pointed, somewhat compressed. Seed erect—Herbaceous plants with annual or perennial roots. Leaves mostly radical; cauline ones placed at the base of the branches and peduncles.

This genus ranks very near the former in the Botanical system, agreeing with it in its herbaceous character, its perennial roots, the form of its flowers, and structure of its seed, but differs in having a perfect calyx and corolla, in place of a petaloid or corolla-like calyx, and the seed erect, not suspended in their cells as in Anemone. Like *Anemones* these plants frequent pastures, shady woods, and moist soils near water, and they equally, but more energetically, participate in the acrid properties of the family. Like them, under proper cultivation they become double, and in that state are equally prized as garden ornaments. Of those found on these Hills only one, *Ranunculus reniformis*, seems well adapted for the garden. It grows in open pastures, has thick fleshy roots, is naturally furnished with numerous petals, about 12, and, probably, treated as above, would soon shew a tendency to increase the number.

The *Ranunculus* when thoroughly doubled is a fine flower, especially when richly variegated. Formerly they were in much greater repute as garden ornaments than in the present day, when gardens are stocked with such a multiplicity of new flowers brought from all parts of the world, but I almost doubt whether the lovers of fine flowers have not sustained a loss in discarding them to so great an extent as they have done from the Flower border: and I should not be surprised, ere long, to see them again taken into favour when the fashion for the large and gaudy Dahlia and such like has somewhat abated, and that far more modest, but not less beautiful object, has resumed its place among the admirers of really fine flowers. Of this I, at all events, feel quite certain, that I have never on the Neilgherries seen a Dahlia that would bear comparison with Ranunculuses and Anemones I have seen in even second-rate Cottager's gardens in England.

5. Ranunculus Wallichianus, *(W. and A.)* erect, hairy: radical leaves roundish ovate, rounded or somewhat cordate at the base, coarsely crenated; lowest scape-leaf oblong, toothed, narrowed at the base into a petiole; upper ones nearly linear: petals (yellow) numerous, 10-13, twice as long as the patulous calyx: heads of fruit globose: achenia oblong, tumid, minutely dotted: style nearly straight.—*W. and A. Prod. p.* 4.

This species is generally met with in moist woods, is of a procumbent habit, with small flowers, flowering in May and June after the rains of the South-west monsoon have commenced. It is however found at other seasons, especially during rainy weather. Another species is found at the same season, and so much resembling this one, that, to the unpractised eye, it is not distinguishable, but is at once known by the seed, which, in this, is furnished with numerous little tubercles, in that, is quite smooth and without asperities of any kind.

II. MAGNOLIACEÆ.—*Champ, Champac.—Champany.*

The species of this family are for the most part large trees or shrubs, forming a remarkable contrast with those of the preceding family, and on this account apparently most unnaturally grouped almost side by side with it. And yet the ablest Botanists who have given their attention to the grouping of natural families, so as to form a series in which those most nearly associated by the structure of their flowers and fruit should stand nearest each other, have hitherto failed in discovering for it a more suitable place in the vegetable system, a fact not to be much wondered at, as in the structure of their flowers and fruit, the two families so nearly associate that, but for other circumstances, Magnolias might almost be looked upon as gigantic Arboreous Ranunculuses.

The bulk of this family are natives of North America, a few only being found in Asia, and none, so far as is yet known, in Europe or Africa. Several are found in China and

Japan, a few in the Himalayah range, three or four in Ceylon, and two or three on the mountains of the Indian peninsula. Generally they are distinguished by the fragrance of their flowers, which has led to the introduction and extended diffusion over India, of the Champac as a sacred tree, the flowers of which, when procurable, are offered by the natives at the shrines of their idols.

The tree here represented is the only one found on the Neilgherries, and there attains the size of a large timber tree, the wood of which however is only used in house building. Owing to its hygrometric properties it is not adapted for other purposes, as it swells and contracts, according to the moisture or dryness of the atmosphere, to an unusual extent, even after long seasoning. When formerly writing on this family in my Illustrations of India Botany, I considered this distinct from the plant there figured under the name of *M. Palmyensis*, better acquaintance with this one, has led me to doubt the correctness of the opinion there expressed, which was mainly formed on what I now find an incorrect figure and description.

MICHELIA. *Linn.*

Carpels arranged in a loose spike, of a consistence between leathery and fleshy, 2-valved, opening from the apex downwards. Seeds several (3-8), externally fleshy.—Leaves entire, petioled. Flowers axillary, generally fragrant, usually of a yellow colour.—*W. and A. Prod. p.* 6, *No.* 1.

This genus which is the only one of the family found so far south in India, consists of large trees or considerable shrubs, and may I believe generally be met with, where abundant, in flower nearly the whole year ; but on the Hills are in greatest profusion during the rainy season. The flowers are usually rather large, frequently with a tinge of yellow, very fragrant. Those of the Neilgherry species are nearly white.

M. Nilagiræa, *(Zenker.)* Leaves elliptic oblong, tapering to a point at both ends, glabrous; stipules and spathes silky petals from 9 in three rows, stamens numerous shorter than the column of fructification, ovaries numerous about 4 ovules in each: carpels warty, one or two seeded.

A large tree found frequently in the clumps of jungle about Ootacamund. There are several very fine ones in the thicket immediately adjoining the Church, the branches of one or two of them overhanging the road.

III. MENISPERMACEÆ.

This curious family consists, with few exceptions, of twining shrubs, and is nearly confined to Asia and America, a few have been found in other tropical countries. One is found above 3,000 feet of elevation on the Himalayas, and one in Siberia These I believe are about the only exceptions to its tropical character, doubtless others are found beyond the tropics, but still in warm latitudes where frost is scarcely known. The one here represented has the widest range of elevation of any I have met with in the Peninsula, extending from the plains to Ootacamund, where it is found in almost every thicket. One other species I have found on the Hills and only there, but so rare that I have only once seen it, and then not in good flower, otherwise it would have been a more appropriate representative of the family for this work.

The order is in many respects peculiar, and seems hitherto to have nearly set at defiance all attempts of Botanists to find a suitable location for it in the natural arrangement of the vegetable kingdom. I here retain it in the situation allotted by the late most accomplished Botanist, Prof. DeCandolle, though satisfied in my own mind it is not well chosen, from feeling convinced that premature and partial reforms are productive of greater injury to science, than the errors they are intended to remedy.

Intense bitterness, more or less combined with narcotism, is the prominent quality of the order, as evinced by the well known Columbo root, and the notorious Cocculus Indicus, in which the bitter principle of the family is combined with a less innocent narcotic property, which it is said London Brewers impart to their porter.

CLYPEA.

Diœcious. Calyx of 6 sepals in a double series, with 3-6 close pressed bracteoles. Corolla none. MALE. Stamens united into a central column, dilated at the apex, bearing several 2-celled anthers; cells opening horizontally, placed end to end, and forming a ring round the top of the column. FEM. Ovary solitary. Stigmata 3 (or rarely 6 ?) Drupe obliquely reniform ; nut compressed, wrinkled round the margin. Seed solitary, uncinate. Albumen fleshy. Embryo terete, of the same shape, and about as long as the seed.—Twining shrubs. Leaves peltate. Panicles axillary, both male and female without cordate bracteas.—*W. and A. Prod. p.* 14, *No.* II.

This genus is one of four or five appertaining to this family found in the Indian Peninsula, and is easily distinguished from its congeners by its male flowers, the stamens of which are united into a single column forming at top a large capetate anther which opens round the upper margin for the transmission of the pollen. The flowers of this like those of the preceding order belong to the ternary form, that is, are composed of one or more whorls, each having three leaves. In this instance three such are shown in the diagram, fig. 8, while the centre ring may be supposed to consist of either one or two such verticles. In Cocculus there are two whorls of stamens, each having a scale at the base; in this there are only three scales (fig. 3) surrounding the column, hence it seems probable that one whorl only unites to form the compound stamen.

CLYPEA *hernandifolia.* (W. & A. :)—Leaves ovate, rounded or scarcely truncate at the base, mucronulate, upper side glabrous, under slightly hairy : panicles about equal to the petioles, umbelliform ; rays umbelliferous ; pedicels very short : polliniferous ring 6-celled.—*W. and A. Prod. p.* 14.

Frequent twining among underwood, in the clumps of jungle about Ootacamund particularly in low moist situations—It is equally frequent in similar situations on the Pulney mountains, but also occurs on the plains in moist shady jungles.

IV. BERBERIDEÆ.—*Barberry.*

This is a small family of finely flowering shrubs, natives of the temperate regions of both the Northern and Southern hemispheres. In the Indian Peninsula two species certainly occur, a third is said to be found in the Coorg jungles, but on that point there still seems room for doubt. Both are found on the Neilgherries, the one here represented being by far the handsomer of the two. Other nine genera are referred to the order, but this is the only one found in Southern India. The peculiar distinguishing mark by which this family is separated from the rest of the vegetable kingdom is the curious anthers, which open like the lid of a snuff-box to give exit to the pollen, combined with a very perfect flower. The cinnamon tribe (*Laurinæ*) have similar anthers, but very incomplete flowers in comparison with those of *Berberideæ*, and are in consequence far removed from them in our linear series of natural orders, but, notwithstanding, they have many points in common, showing a closer relationship than might at first sight be suspected—among these are the ternary arrangement of the flowers, the valved anthers, and single superior ovary.

The filaments of some, if not all the species of this genus are endowed with a peculiar irritability, which causes them when touched at a certain point near the base, to contract elastically and strike the anther against the style, and in that way scatter their pollen on the stigma. This property exists in both the Neilgherry plants. The properties of the wood are mildly astringent and bitter, and in the Upper Provinces an extract is prepared by boiling the wood, which is highly esteemed by the natives on account of its medicinal qualities. In Upper Bengal the fruits of two species are dried like raisins in the sun, and sold as kistmisses in the bazars all over the country.

BERBERIS.—*Barberry.*

Sepals 3-4-6, deciduous, in a double row, accompanied externally with petaloid scales. Petals hypogynous, equal to the sepals in number and opposite to them, or twice as many ; often furnished in the inside with an appendage at the base. Stamens hypogynous, equal in number to the petals and opposite to them : anthers bilocular, the cells opening elastically with a valve from the bottom to the top. Ovarium solitary, unilocular, containing 2-12 ovules, which are erect, or attached laterally to the inner margin, and forming there one or two rows : style sometimes lateral, short : stigma orbicular. Fruit baccate or capsular, indehiscent. Albumen fleshy or horny. Embryo straight, in the axis of the albumen : radicle pointing to the hilum : cotyledons flat.—Leaves alternate, without stipules.—*W. and A. Prod. p.* 15, *No.* I.

The species of this genus, amounting to about 50, are nearly all shrubs, or at most small trees armed either on their stems or leaves with numerous thorns. In those with thorny stems the thorns are considered a modified state of the leaves in which the parenchema or dilated portion is displaced, and the ribs or veins have become indurated. Some Botanists propose dividing it, removing the plant here figured along with some others to form the genus *Máhonia*, which however only differs in the petals wanting two glands at the base, which the others have, a character considered altogether insufficient for the purpose. On this account the older name is here preserved. All the plants of this section of the genus are very handsome shrubs. The one figured is common on the hills, and when growing in favourable situations attains the size of a small tree. A pale yellow dye is extracted from the wood of both the Hill species, a third species belonging to the Mahonia division, with drooping racemes of flowers, is, I am told, found in Coorg, and which I think I once saw on the Pulney Mountains, but not then in flower. The Pulney plant differs in habit from this in having diffuse rambling branches.

Berberis (Mahonia) Leschenaultii (*Wall.*)—Leaves pinnate; leaflets about six pair, ovate, nearly equal in size, slightly cordate at the base, repand with 6-8 thorny teeth at each side, about 5-nerved at the base; lower pair of leaflets close to the

As this is a true congener of Nuttal's genus *Mahonia*, I preserve that as a subgeneric or sectional name. The plant is found in almost every clump of jungle about Ootacamund, flowering during the South-west monsoon, but may generally be met with in stem : racemes elongated, slender; bracteoles at the base of the pedicel oblong, obtuse: petals with two distinct glands; filaments without teeth: berry globose, crowned with the evident style and stigma.—*W. and A. Prod. p.* 16.

flower at other seasons, though more rarely, the fruit ripens during the dry season, and when fully ripe acquires a bluish purple colour.

V.—CRUCIFERÆ.—*Cabbage Tribe.*

This large and most useful family of plants, supplies man with many of his most esteemed esculents, among which may be named the whole tribe of cabbages, turnips, rape, mustard, cress, scury grass, radish, horse radish, &c., and to the flower garden, wall flowers, stocks, candy tuft, honesty, and many others. But though it thus abounds in both useful and ornamental plants in the temperate regions of the globe, it scarcely merits a place in this work, 3 or 4 insignificant species being all that are found here which the one figured is the best looking of the set. Such being the case, it seems useless to dilate on a family that can possess so little interest for the lovers of the wild flowers of our Blue-mountains. Though thus rare, even in the temperate climate, the family is a large one, including little short of 1,500 species. A few however are found in warmer climates, the most curious and interesting of which is the so-called *Rose of Jericho (Anastatica,* literally resurrection flower) a native of the sandy deserts of Arabia, the ends of the branches of which contract during dry weather, and form a ball which may be taken up and kept in that state for years; and at the end of that time, if the roots are immersed in water will re-expand, the flowers open, and in a few hours the whole plant appear as if it had never been out of the ground.

The family derives its name from the Latin word *Crux crucis,* a cross, with reference to the four petals spreading in opposite directions, so as to form the appearance of a St.

Andrew's cross, and by this mark they may always be known at a glance. They have besides six stamens, four long and two short, whence Linnæus derived his name Tetradenamea, that is, four powers, in allusion to the four long stamens.

CARDAMINE.—*Ladies' Smock.*

Calyx connivent or somewhat patent, equal at the base. Petals with a claw; limb entire. Stamens distant, without teeth. Siliqua sessile, linear, elongated, compressed; valves flat, nerveless, somewhat smaller than the incrassated replum.* from which they usually separate elastically. Style short, or none: stigma nearly simple. Seeds ovate, without a border, forming a single series: podosperms slender. Radicle applied to the edge of the cotyledons (o=).—Leaves petioled entire, lobed, or variously divided, often different on the same individual. Flowers white or rose-coloured.—*W. and A. Prod. p.* 19.

The species of this genus are very numerous, and where they abound, very ornamental; as, for example, the *C. pratinses* of English meadows, which, in spring, appear in such numbers as to whiten the fields where they grow, so as to give the appearance of bleaching greens; whence, it is supposed, it derived its English name of "Ladies's Smock." The one here figured does not possess that recommendation, as it usually occurs but thinly scattered in woods, and may generally be found in flower during wet weather at all seasons.

Cardamina Babbonice (Persoon).—Leaves trifoliolate; leaflets, hairy on both sides, particularly on the nerves beneath, petioled, ovate acuminated unequal at the base, irregularly and sharply toothed, terminal one sometimes 3-lobed or divided into 3 leaflets similar to the others: siliqua erect.—*W. & A. Prod. p.* 20.

VI.—FLACOURTIANEÆ.

This is a small family of trees and shrubs, but on the limits of which considerable difference of opinion exists among Botanists, a subject on which much might be said were this the place for such disquisitions. Suffice it therefore to say, that there are two nearly related families (Bixaceæ and Fla-

* *Replum* is the frame surrounding the dissepiment, from which the valves fall off, and to which the placentæ are attached.

courtianeæ) which many Botanists consider quite distinct, but which others combine to form one large one. The preponderance of opinion is on the side of those who keep them distinct, but they, on the other hand, differ among themselves as to the genera that should be respectively referred to each, a fact which seems to indicate a degree of affinity quite consistent with their union and re-division into sub-orders, the course which Professor Endlicher has adopted in his Genera Plantarum. Mr. Bennett (Plantæ Javanicæ Rarioris) has in a long and very elaborate article, under *Phoboros rhinanthera,* undertaken to throw more light on the subject, and to reconcile the differences existing among Botanical writers on these two families: but after a copious adduction of evidence on all sides, has forgot to sum up, and, consequently, has left the question involved in about as great darkness as when he commenced. I learn however from a careful perusal of that article—1st, That Mr. Brown coincides with Dr. Blume in considering the genus *Hydnocarpus* as forming the type of a new order, to which the latter Botanist has given the name *Pangiaceæ,* derived from *Pangium* an old generic name of Rumphius.—2nd. That he agrees in opinion with those Botanists who think the two families ought to be combined, a view in which I can scarcely coincide, on his own showing, as he states the ovary of Flacourtia has several cells, with central ovules, while those of all the other genera have one-celled ovaries and parietal ovules, as in the accompanying figure. For this reason I conceive the order *Flacourtianeæ* should be retained, even though limited to the single genus *Flacourtia.* But supposing this difficulty got over by finding the partitions more or less inconstant, I cannot help thinking the association of numerous plants having dry dehiscing capsules with others equally numerous having indehiscent baccate fruit, one that ought, when possible, to be avoided.

Mineralogy of Southern India. By Captain J. CAMPBELL, *21st Regiment, M. N. I.*

I fear that the subject of petrology in India will hardly be considered an interesting one, except to the man of professed scientific attainment, or to the tyro who may be seeking information. To the first, the publication of the crude remarks of my note-book will afford an opportunity of identifying the various rocks, which I have met with in Southern India; while to the latter, the various notes and extracts from the published works of authors, will serve as an index to books, where he can procure more complete information, and where the subject can be fully studied. I shall not attempt to classify the rocks, but give the names in the irregular order as I find them entered; as any more perfect attempt at arrangement, would lead to a consideration of the principles of the science of "Descriptive Petrology," a subject on which I purpose hereafter to hazard some remarks, after the manner of Dr. Macculloch's work on "Rocks."

Black Diallage.

This beautiful rock is well known in Southern India as forming the famed pillars of Sultan Tippoo's tomb at Seringapatam. Buchanan Hamilton first called it Hornblende Rock, to which it bears some resemblance, and the error which he committed has been copied by a number of careless observers, who could not plead the want of leisure, and the pressure of business of collection, which is a sufficient excuse for Buchanan's mistake; and some hasty and prejudiced men have got in a rage at their blunders having been pointed out. The remarks of both Capt. Newbold, 23rd Regt. M. N. I. and myself, shewing that it was not Hornblende Rock, appeared simultaneously in the Madras Journal of Science; but I believe priority is properly due to Capt. Newbold, who visited the locality before me, though I was not aware at the time of my visit that he had been there.

The characters of the rock are as follow. Colour: bluish, lead coloured black; with the polished surface jet black nearly, shewing very little of the speckled appearance of black granite, except where the surface is wetted. Fracture: irregular and granular, shewing to the lens some minutely lined tabular crystals of Hornblende, and small pearly coloured splintery crystals of felspar. Structure: much the same as black granite, aggregated, of confused imperfectly fibrous and radiating crystals of a lead colour, mixed with similar crystals of pearly felspar. Structure: something resembling that of actinolite: Streak whitish. Infusible by the most intense heat, a few minute specks only intermixing slightly, but becomes whitened: is more brittle than black granite.

In looking at the pillars of Sultan Tippoo's tomb, I suspected at once that they were not made of black granite, from the absence of the speckled appearance. On enquiry I found that no one could point out the quarries from which the stone had been brought; but I received credible information, that the Sultan was very fond of it in architecture, and that a considerable quantity had been brought at various times. I therefore went off, hammer in hand, to examine the Sultan's old palace, long since used as the gun-carriage manufactory, where the fine moulded bases under the wooden pillars of the Durbar attracted my attention; and on cleaning one, with a coarse cloth and water, from the dirt and whitewash which coated it, I found it to be formed of the identical stone of the famous pillars. My hammer therefore speedily procured me a specimen, and from the ease and readiness with which it snapped off, I was at once convinced of the correctness of my former guess. I have not been able to identify this rock with any similar one described by authors as having been found in Europe, and Macculloch's definitions are not very precise. Serpentine by Macculloch is not classed as forming a compound rock of any kind; and as this rock is decidedly compound, I have preferred considering it as a compound of Diallage; because Macculloch (" Rocks," page 648) says, that Diallage occurs in Shetland of a black colour, and forms a compound rock with felspar, of a brown colour. As Macculloch most likely never saw the Diallage rock of Shetland polished, it is very probable that there is little difference in the colour of the fracture, which he calls dark grey and brown, and I have called bluish, lead colour black, so as to maintain some ideal resemblance to the colour of the fracture of black granite. To prove the composition of a compound rock is a difficult matter, unless it can be freely examined in sites: this I had no opportunity of doing; but Capt. Newbold visited Tauvicairy, where the stone is said to have been quarried. I have not his remarks at hand to refer to; but from some specimens sent me by Dr. Cole of Madras, I may be allowed to doubt, if he saw the real rock; as those specimens, though very small, seemed to be a variety more like Serpentine, and certainly much more Magnesian than the black Diallage. Chemical analysis also of a compound rock is not a certain guide; but as it affords considerable assistance I publish the following quantitative analysis, though with some diffidence, as the analysis of a Magnesian rock is not an easy job, while our means in India are very imperfect, and I have not yet had leisure to make a good one. The rock, powdered, was a " grey white" colour. The analysis, heated red-hot, lost 3-40 per cent. of weight; but ignited for fifteen minutes more, lost 4-73 per cent. It had been found that caustic potash did not decompose the analysis readily, therefore mixed with carbonate of soda, and ignited; dissolved in muriatic acid, evaporated to dryness, &c., acidulated, and water added, and filtered to separate the silica. The filtered solution was precipitated by excess of ammonia, and allowed to stand a night to separate manganese: it was then filtered, and evaporated to near dryness, diluted again with water and decomposed by carbonate of potash, according to Dr. Thomson's method, to separate the magnesia; but this was not satisfactorily done. The magnesia after weighing was super-acidulated with sulphuric acid, and then dissolved in water; a few flocks remained, either lime or some lead, from the acid not being quite pure. The precipitate of ammonia was boiled with caustic potash to take of alumina, which was again separated after filtering, by muriate of ammonia. The ferruginous residue left on the filter was re-dissolved in muriatic acid, and precipitated afresh by ammonia, and an attempt was made to suspend manganese by an excess of muriate of ammonia, but it was not proved satisfactorily that the analysis contained manganese. The iron was considered to be in the state of protoxide. Several analyses were made, but they were all imperfect in one point or other, and an attempt to separate manganese by benzoic acid also failed: however, the subjoined proportions may be considered as a tolerable approximation:—

Silica, ...	48.93
Magnesia, ...	29.31
Protoxide of iron, ...	9.23
Alumina, ...	6.29
Water, ...	4.73 and volatile matter.

As the analysis was infusible, it is not probable that it contained an alkali, and the loss is within the limits of a quantitative analysis.

Salem yellow Wood-stone.

This is a very beautiful mineral, and I believe quite new in petrology, for I have been unable to find any notice by authors of a similar one. I think the name is quite as good as any coined one, and the only objection may be in the use of the word 'wood-stone,' as it has no resemblance to the mineral generally so called. In my earlier notes I find it called 'Salem yellow woody mineral.' I have not seen it in sites, but found my specimen, a piece of about 18 inches long, and exactly like a piece of a branch of a tree, in a nullah in the Salem magnesia formation. I think Mr. Fisher of Salem told me he had seen it in sites in Mr. Heath's chromate of iron mines. The outer surface of the specimen was water-worn in the nullah, and the smooth surface thus produced and the brownish tint it had acquired, made the resemblance to a bit of old wood almost perfect, and in consequence I told the lascar with me to split it. Its characters are,—Specific gravity: light, not much heavier than water. Colour: a buff yellow. Structure: continued fibrous-like wood, not thready like amianthus, but rather box-wood, breaking short off. Hardness: can be scraped smooth with the knife, like hard chalk; and the scraped surface smooth. Contains extraneous matter (ferruginous?) between the fibres, in parts. Adheres strongly to the tongue, like a bit of new tobacco pipe; hygrometric power great. It is associated with statactitia iron ore (vide), the reedy marks, in the sides of which seem to be caused by the fibrous structure of this mineral, and suggest the idea of its having been squeezed in a pasty state through fissures. The best analysis, which I have had leisure to make, is subject to the same objections as before; but I give it for want of a better. A portion of the mineral picked as free from iron as possible, scraped down with a knife, triturated in an agate mortar, was tough and cohered like chalk. It was fluxed in a silver crucible with caustic potash, as carbonate of soda had very little effect on it. In boiling the muriatic solution, a precipitate of white flocks appeared, which again disappeared when the solution became concentrated, but did not again re-appear after diluting and again boiling. This gave rise to the idea, that the mineral contained titanium, but in a fresh analysis the precipitate on boiling did not appear. In two analyses the characteristic blue colour of copper appeared in the ammoniacal solution, from which the iron and alumina were precipitated; but it was doubted if the copper had not been taken up from the silver crucible, which might not be quite pure. The analysis contained no lime. The following is a tolerable approximation to the composition:—

Silica, ...	40.11	(and Titanic acid ?)
Magnesia, ...	39.15	
Iron, (peroxide,)	6.84	
Alumina, ...	0.53	
Copper, (oxide,)	0.50 ?	
Water, ...	13.50	volatilized by heat.
	100.63	

The iron was supposed to be in the state of peroxide, as yellow ochres, &c. are thus coloured. No reliance can of course be placed on the quantity of water, as the mineral was hygrometric, but the other numbers have been computed from the weight of the ignited analysis.

Naggery black Pot-stone.

This is another magnesian mineral, from the Naggery hills, north-west of Madras, given to me by Mr. Fisher of Salem. It is cut into snuff-boxes, &c. by the natives of the place. I have no account of its geological associations. Characters are—Colour: lead coloured black, much the same as black granite: Structure, imperfectly granular, and homogeneous: fracture, imperfectly conchoidal; imperfectly granular to lens: appears a little speckled. Lustre magnesian, and bluish. Streaks bluish white. Smell: sulphurous. Spec. grav. much less than black granite. Tough, and with difficulty broken: hardness but little more than steatite, or pot-stone: feels rough, but perceptibly greasy. I do not find that I have attempted to analyse it.

Binary Granite.

A granular aggregation of white quartz, and resplendent or glistening felspar. The crystals of each mineral being each perfectly formed, and totally distinct, so as to be easily recognised by a lens; yet cohering after the peculiar manner of granite rocks. Is a graduation from the prevailing Hornblendic granite of Southern India, and is generally found associated with micaceous varieties. Is found near Ryacottah, and is so tough as to require blasting to separate the blocks. Has a perfect cuboidal cleavage, and if polished would form a very beautiful building stone.

Pegmatite.

A binary compound of crystalline quartz and felspar, more or less saccharine. It differs from binary granite in the felspar, not forming resplendent crystals, but having an arenaceous or an earthy appearance. It forms extensive beds in the schistose series of rocks of Southern India, but has no regular cleavage, and is generally so loose in aggregation as to break readily to pieces, and sometimes crumbles down, so as to be used as a road-making material. The term Pegmatite was first used by the French geologists, as applied to binary granite; but, as Dr. Benza has used the term in the same sense as I have now defined it, I have therefore preserved it. Dr. Boase, (Primary Geology, page 203,) uses the term as synonymous with graphic granite, and classes it with the schists of Cornwall, with which he says it graduates. Dr. Macculloch (Rocks, page, 340) describes it as a variety of "red primary sandstone," but his theoretic distinction I do not allow to be correct, unless people choose to consider my "schistose series" as being of derivative origin; but in itself or its associations, the structure of the rock is totally different from the "coherence" of the composing materials of the secondary sandstones. In Southern India, it seldom is found without some slight admixture of Mica or Hornblende.

Eurite.

This is a French term, and applied to the Weiss-stein or white-stone of Werner. It was first used in Indian petrology by Dr. Benza, but he has not been very precise in his application of the term: and though I have visited much of the localities described by him, I am unable to define the rock to which he intended to apply it, as he seems to have used it for pegmatite when it was very white, and for binary granite when it was too far distant for him to perceive the crystalline structure of the felspar. Dr. Boase (Primary Geology, page 203,) defines the difference between pegmatite and eurite to "be according to the size of the grains; the former being large and crystalline, the latter, small and intimately blended or actually combined."

Graphic Granite.

This rock is rather rare: it occasionally occurs among the porphyritic series. It is a variety of granular quartz porphyry, being composed of contorted lamina of quartz embedded in a granular paste of felspar, or in compact felspar. The lamina of quartz are contorted into fantastic shapes, something like the characters of the Nagaree dialect. Dr. Macculloch's definition also applies well to the Indian rock. "The quartz and felspar, which compose it, are aggregated in lengthened parallel prisms. The prismatic structure therefore is seen in one direction; while, in the reverse, the peculiar appearance, whence the term is derived, becomes visible. That appearance is produced by the cross section of the quartz prisms. These are frequently triangular, occasionally hexagonal and flattened; and in a few rare instances, the two minerals form alternating laminæ."

Saccharine Felspar.

The only work in which I have met with this term was in a work called, (I think) Journal of Popular Science. The name is suggested by the resemblance of the mineral to close-grained loaf sugar. It is soft enough to be scraped with a knife. Fracture: earthy granular; melts before the blow-pipe. I have not analysed it, and am unable to state whether it contains potash or soda. It occurs in Southern India in the porphyritic series, and found embedded in large masses, divided into prisms by cracks. In the hill of Palicondah, near Vellore, it is very common; it is never associated with quartz rock, but generally occurs where euritic granite forms hills of any size.

Schorl quartz Porphyry.

This is a rare and very beautiful rock in Southern India: it is composed of crystals of black schorl, embedded in a paste of homogeneous and translucent quartz. As I believe it is not known in Europe, at least it has not been defined by any author I have met with, it is therefore one of those rocks for which I have been obliged to invent names. To avoid loading the science with mere unmeaning words, I have proposed to take Dr. Macculloch's definition of "Porphyry," in a generic sense, as a rock composed of crystals of one mineral, embedded in a continuous non-crystalline paste of another. Thus the definition of this rock becomes "Black schorl in quartz porphyry;" and by dropping the preposition, and as I know of no schorl in India which is not black, we have "schorl quartz porphyry," which is surely a practical defining term, sufficiently convenient for use, without requiring any great jaw-deflecting exertion. It is easily distinguished from hornblende by the appearance of the crystals, which are of a jet black colour; neither lined on the surface, nor imperfectly tabular. The fracture of the crystals, irregular and conchoidal, and resplendent and shining. They are very brittle, and yield easily to the knife: melt very easily before the blowpipe, and intumesce in a peculiar manner, by which they can at once be recognised, even when very minute indeed. This rock is very different from what Boase calls "schorl rock," which he distinctly defines to be an *aggregation* with "*crystals of quartz*," is found South of Paulwole, about twenty-five miles South of Ryacottah, and in the "Trap Dyke formation of Mallapanbetta" (which vide hereafter,) in which it forms beautiful rocks with crystals of schorl, an inch nearly in thickness. It seems also to have been mentioned by Dr. Heyne, as found near Hurryhur in Mysore. Of its associations in India I do not know much, but I think it belongs to the porphyritic or schistose series.

Schorl felspar Porphyry.

This is a rare rock, and I do not know much about it. I have only met with it forming part of the mass of the Ryacottah rock, in the veins of hornblende felspar porphyry, from which, like the last, it is easily distinguished by the behaviour of the crystals of schorl before the blow-pipe flame. It is composed of black schorl in saccharine felspar.

Schorl Rock.

I believe I may put this down in the list of those I have seen in Southern India; but as I have not any specimens at hand, I am unable to define its character, and as I cannot find any record of the examination of them in my notes, I must state what I recollect. The rock is found in mass in a deep nullah at south-east end of the (Mallapanbetta Trap dyke formation,) and almost exactly resembles black granite, except perhaps in being a little more lead-coloured and more brittle, and the structure of very minute aggregated crystals. When properly examined, it might prove to be a " black schorlaceous granite." I have never seen it in any other locality, and in consequence I suppose the specimens have been forgotten, among other pursuits.

Clay-stone.

Not common in Southern India, but occurs occasionally among the porphyritic series, and sometimes associated with white quartz; and it graduates into wacké. Fracture: dull and earthy, or imperfectly granular, or imperfectly conchoidal, or imperfectly splintery. Is harder than wacké, and differs from laterite in not being cellular; in being finer and more regular in structure, like the fracture of a brown spar; and being much heavier than an earthy rock, and a solid stone. From wacké it differs in being hard and firm, and not coarse earthy. Ure defines it as soft and easily broken, in which he differs from Macculloch. Might be called "Ferruginous clay-stone," as all the specimens are highly ferruginous, and coloured red from peroxide of iron: and then the connection with rubble or red chalk, and red ochre, would be established.

Silicious Schist.

Not common: found only among rocks of the porphyritic series on the Topoor ghaut. Fracture, even: small grains of quartz visible in it. Is infusible. Colour, bluish black. Is Lydian stone, according to Thomson's and Ure's definition; but differs from flinty slate, in not having a slaty fracture. According to Brooke's, is flinty slate; is called black jasper by some writers. Macculloch separates two kinds, apparently much the same, into flinty slate, and a quartzose variety of argillaceous schist, which he argues have a different geological position. It seems to be a silicious variety of basalt, as some varieties of basalt do not melt easily before the blow-pipe, and only imperfectly intumesce a little, and turn white, in consequence perhaps of being silicous.

Felspar Porphyry.

Is formed of large crystals of felspar, embedded in a crystalline base of resplendent felspar. The embedded crystals are often of very large size, and sometimes of a beautiful flesh colour, which gives the rock a very handsome appearance. The felspar is characterised by being infusible, or very nearly so, before the blow-pipe, and even in a smith's forge it is hardly melted; in which it differs materially from the felspar of European petrologists. In character it does not seem to agree with the felspar porphyry, described by Bakewell; because he describes the paste or base as being formed of *compact* felspar (compact earthy felspar.) It graduates into pegmatite and graphic granite. It is a common rock in the porphyritic or schistose series, in which it forms extensive beds; and it is characteristic of this formation, for it never forms hills or mountains, or any extensive formation of elevated points. Occurs as wall-sided dykes in the schistose series near Anchetty, west of Ryacottah, and in Congoondy, and also on the top of the Naiknairy ghaut. I may assert, I believe, that wherever I have seen it, it is accompanied with evidences of igneous action, slides, injections, dykes and metamorphic action on the adjacent rocks. I cannot help thinking it probable, that the enormous masses and formations of porphyry " said to be found in Norway," are not of felspar porphyry, but of porphyritic granite, like the Yailgerry hills of Salem perhaps. Felspar porphyry never has a cleavage, and is never used as a building stone in Southern India.

Quartz Rock

is found in great profusion in beds and dykes in the schistose series, and is commonly used for fluxing into glass with the mineral carbonate of soda, by the bangle maker. It is sometimes found embedded in granite, in irregular masses of 3 or 4 inches thick, but is not common. It is sometimes found forming small hills, but is always cracked, and so separated by irregular divisions, that a solid piece, more than 4 inches thick, can seldom be procured. The varieties it forms are—semi-transparent, rose, smoky, fat, milk, saccharine, wax; but of all these, milk quartz most commonly occurs. Is found as veins, contorted, vertical and horizontal, both in the ferraceous series and in the beds of the schistose series; but though the veins are sometimes of considerable width, (tabular veins) yet they are always separated into cracked prismatic pieces, with the irregular surfaces exactly answering to each other, (i. e. in sites.)

Granular Quartz Rock.

Formed of an aggregation of small crystals of white quartz, with a small quantity of black mica, forming an imperfect lamination, and the whole cohering rather loosely, or not, of a very firm structure. It is very rare, and forms a small hill near Arnagherry, west of Salem, not far from the banks of the Cavery. A similar rock is called quartz rock by Bakewell, and classed as mica schist, and as primary sandstone by Macculloch.

Limestone.

This is not a correct name for this rock; but as limestone of any kind is very rare in Southern India, as a formation (excluding kunkur of course) among the primary rocks, it will do very well for the present, while no distinctions by definition are required. It is properly a perfect granite ; of a firm, solid, durable structure; and possessing a perfect cuboidal cleavage, and might serve as a building material. It is a binary granite, formed of quartz and of carbonate of lime in acicular crystals, confusedly aggregated. The lustre is a beautiful pearly white, and so perfectly resembles binary granite, that I was only induced to try it with an acid, in consequence of a marked peculiarity in the appearance of the crystals, which I am unable to define. It occurs in blocks at the southern end of the Tally Mally, in the southern extremity of the Salem district, close to the Cavery. I have not seen it in sites. Ainslie seems to allude to this rock, but does not mention where it is found. I have not met with a definition of any similar limestone by European petrologists. This rock is readily disintegrated by muriatic acid, leaving the crystalline grains of quartz separated.

Wacké,

is properly applied to a soft earthy rock of the Trap family, or a basalt; but as I cast aside all such theoretic distinctions, I apply the term to a similar mineral occuring extensively in my schistose series in Southern India, and which seems to form the subsoil from which the earth of some of the most fertile tracts is derived. Its fracture is sometimes even, and sometimes irregular, according to its hardness. In hardness, it is intermediate between dried earth and that of clay-stone. In colour—red, when ferruginous: whitish, when magnesian: reddish brown, when hornblendic. Is sometimes tuffacious. Forms the matrix of the magnesia formation of Salem, and then contains magnesia. Becomes silicious, and graduates into clay-stone when in contact with quartz rock. Is commonly intersected into rhomboidal masses by joints like trap. Is sometimes cretaceous, which is not extraordinary, as trap is also generally associated with kunkar.

Magnesite,

or more properly, the magnesia formation of Salem, is a far-famed locality: it does not *form* hills, as is asserted in some European publications, though it is sometimes found *in* hills. At Salem it occurs as an extensive series of dykes, injected veins, and reticulated veins, through other rocks. Capt. Newbold has published an account of this formation, and had I any hope of being able to visit the locality, and give up a few weeks to its examination, I would not now have noticed it. Unfortunately, while in the district, my official duties prevented more than a few morning visits. I am unable to state the extent of the formation, but believe it cannot be less than 25 square miles. It is white, hard, and compact. Lens shews no granular structure. Hardness: variable, from the toughness of a trap rock to nearly as soft as chalk. Fracture: generally conchoidal, sometimes earthy. The hardest kinds do not effervesce with acids, but the softer do. The wacké which forms its matrix, is slightly indurated when in contact with the thickest dykes. It shews all the signs of igneous action, injections, and squeezings, &c.; and is frequently very much contorted. Asbestiform minerals abound in association with it; and chromate of iron and statactitic iron ore are found embedded in the dykes. In this meagre account of so interesting a locality, I have suppressed all remarks, except what I am certain of; it is several years since I have been able to visit the place.*

Pot-stone Steatite,

is common among the beds of the schistose series, and is commonly used for writing pencils on slates by the native bazar men. It does not form, however, any extensive beds, except near Shoragamally, north-west of Salem, where it is quarried to make cooking vessels for the brahmins, who prize it much. I have, however, never been able to visit the locality.

* The magnesite of Southern India was first brought to notice by Dr. MacLeod, now Inspector General of the Madras Medical Service. Dr. MacLeod exemplified its importance as an element in cements in which the property of hardening under water is required, and also recommended its use in medicine as a substitute for the artificially prepared carbonate of magnesia, which it equals in purity. The difficulty of reducing so hard a mineral to a sufficiently fine powder by any known mechanical means, is the only obstacle to the use of this mineral for the purpose adverted to. Dr. MacLeod himself, and many years afterwards Lieut. Ouchterlony and others, transmitted large samples of this mineral to England with a view of having it tried there in chemical manufactures, but other sources of magnesia nearer home, particularly from sea-water, were found upon the whole to be cheaper. (See vol. ii. p. 284.) Recently it has been used in the Laboratory of the Honorable Company's Dispensary, Calcutta, for the manufacture of Epsom salts; (See vol. v. p. 442,) but receiving no encouragement the object was abandoned.—Ed.

Note.—As an appendix to the above excellent paper, we beg to annex the following list of Minerals in the Mysore territory, furnished to the Committee for investigation of the Mineral Resources of India, by Mr. Gilchrist, Madras Medical Service. The Minerals enumerated have been forwarded to the Committee, and form a part of its collection.—Ed.

From Major General M. Cubbon, *Commissioner for the Government of the Territories of the Rajah of Mysore,*

To the Secretary to the Government of India, Foreign Department, Fort William, dated Bangalore, 16*th October*, 1844.

Sir,—With reference to a letter addressed to me on the 25th January 1841, at the desire of Lord Auckland, by Mr. Assistant Surgeon McClelland, Secretary to the Committee for the investigation of the Mineral Resources of India, I have the honor to acquaint you, for the information of the Right Honorable the Governor General of India in Council, that I have despatched to Calcutta, viâ Madras, a cabinet of mineral specimens, collected by Mr. Assistant Surgeon W. Gilchrist, attached to the Public Cattle Department of the Madras Government, situated at Hoonsoor within this territory.

2. The accompanying copy of Mr. Gilchrist's list of the minerals forwarded in the cabinet, includes several specimens of the Chromate of iron, about which I was particularly desired to obtain information.

3. The package has been forwarded to your official address.

I have the honor to be, Sir,
Your most obedient servant,
M. Cubbon, *Commissioner.*

Bangalore, 16*th October*, 1844.

A.

1. Quartz rock, (White.)
2. Quartz rock, (Smoke grey.)
3. Granular quartz.
4. Crystallized quartz, (on Chert.)
5. Granular quartz, (Agglutinated.)
6. Silicified wood, (From Pondicherry.)
6. Silex pebble, (From desert of Suez.)
7. Silex and magnesia.
8. Flinty slate.
9. Flinty slate, (Variety.)
10. Flinty slate, (Decomposing.)
11. Chert.
12. Chert, (Variety.)
13. Chert, (Variety.)
14. Chert,
15. Chert, (Decomposed.)

16. Chert,
    (With specular iron ore.)
17. Prase,
18. Quartz and prase.
19. Semiopal.
20. Jade.

B.

21. Mica,
    (White.)
22. Mica,
    (Black.)
23. Mica,
    (Slate.)
24. Talc.
25. Talc,
    (Passing into pot-stone.)
26. Talc,
    (Passing into pot-stone.)
27. Pot-stone,
    (With talc.)
28. Pot-stone,
    (With chlorite.)
29. Pot-stone.
30. Pot-stone,
    (Passing into asbestos.)
31. Asbestos.
32. Pot-stone,
    (Variety.)
33. Pot-stone,
    (Passing into hornblende.)
34. Hornblende.
35. Hornblende,
    (Slate.)
36. Hornblende,
    (Slate.)
37. Pot-stone,
    (Passing into actinolite.)
38. Actinolite.
39. Actinolite,
    (Slate.)
40. Compacted actinolite.

C.

41. Chlorite.
42. Chlorite,
    (Slate.)
43. Earthy chlorite.
44. Crystalline chlorite.
45. Felspar.
46. Flesh-colored felspar.
47. Compact felspar.
48. Felspar porphyry.
49. Felspar porphyry,
    (With talc.)
50. Glassy felspar.
51. Felspar,
    (Decomposing.)
52. Foliated felspar.
53. Albite.
54. Albite,
    (With hornblende.)
55. Albite and quartz.
56. Magnesite.
57. Magnesite,
    (Passing into semiopal.)
58. Clay slate.
59. Clay slate.
60. Clay slate.

D.

61. Kunkur,
    (Mamillary.)
62. Magnesia and limestone,
    (With hornblende.)
63. Shell limestone,
    (From Western Coast.)

64. Magnesia and limestone,
(Conglomerate.)
65. Magnesia and limestone,
(With quartz.)
66. Magnesia and limestone,
(With hornblende.)
67. Granular limestone.
68. Limestone,
(With chlorite and garnets.)
69. Coralline limestone,
(Western Coast.)
70. Magnesia and limestone,
(Water-worn appearance.)
71. Limestone tufa.
72. Limestone,
(With chlorite decomposing.)
73. Kunkur,
(Common.)
74. Silicious tufa.
75. Silicious tufa,
(Variety.)
76. Magnesite,
(Passing into semiopal.)
77. Silicious pot-stone.
78. Silicious pot-stone,
(Decomposing.)
79. Quartz,
(Passing into semiopal.)
80. Kaolin.

E.

81. Granite,
(Quartz, felspar, and black mica. The rock of which the large statue at Shrogoonah Bellagolah consists.)
82. Granite,
(Talc, felspar and quartz.)
83. Granite,
(Chiefly crystallized felspar.)
84. Granite,
(Felspar, attenolite, and quartz.)
85. Granite,
(Chiefly of quartz.)
86. Granite,
(Felspar and decomposed garnets.)
87. Granitic porphyry,
(Felspar, rose quartz, (Nn. Dn.) and hornblende.)
88. Granite,
(Red and white felspar and chlorite.)
89. Granite,
(Garnets, felspar, and quartz.)
90. Protogine,
(Chlorite, hornblende, and red felspar.)
91. Protogine,
(Chlorite, quartz, and felspar.)
92. Pegmatite,
(White felspar and quartz.)
93. Granite.
(Chlorite, hornblende, felspar and quartz.)
94. Graphite granite.
95. Graphite granite.
96. Granite,
(Rose quartz, white quartz, and a little felspar.)

97. Granite,
(Granular quartz, granular felspar, and a little hornblende.)
98. Granite,
(Foliated structure, quartz, felspar and black talc.)
99. Granite,
(Granular felspar, quartz, and a little black talc.)
100. Granite,
(Granular quartz, hornblende, and a little felspar.)

F.

101. Granite,
(Passing into hornblende rock, foliated felspar, talc and quartz.)
102. Granite,
(Crystallized hornblende and felspar.)
103. Granite,
(Augite, adularia and very little felspar.)
104. Granite,
(Felspar and light-colored hornblende.)
105. Granite,
(Chiefly hornblende, with a little felspar.)
106. Granite,
(White felspar, talc, and hornblende.)
107. Granite,
(Chiefly large crystallized hornblende, a little felspar, and a little quartz.)
108. Granite,
(Passing into hornblende rock.)
109. Granite,
(Passing into hornblende rock, consisting of compact felspar with hornblende, and a few garnets.)
110. Hornblende rock.
111. Granite,
(Fine crystallized hornblende, felspar, and garnets.)
112. Granite,
(No. 111, decomposing.)
113. Hornblende rock.
114. Hornblende rock,
(With garnets.)
115. Augite.
116. Concentric hornblende.
117. Hornblende rock,
(Decomposing on one side.)
118. Foliated hornblende rock.
119. Augite rock.
120. Light green hornblende,
(Crystallized.)

G.

121. Crystallized hornblende,
(With a little chlorite.)
122. Crystallized augite,
(With a little chlorite.)
123. Crystallized augite,
(Felspar decomposing, and quartz.)
124. Hornblende rock,
(Hornblende quartz and felspar.)

125. Hornblende augite rock,
(With vein of felspar and quartz.)
126. Hornblende slate.
127. Hornblende rock,
(Consisting of compact and crystallized hornblende.)
128. Augite rock.
129. Granular hornblende rock.
130. Hornblende rock,
(Passing into pot-stone.)
131. Basalt.
132. Hornblende rock.
133. Basalt,
(Decomposing into lithomargic earth.)
134. Basalt.
135. Hornblende porphyry.
136. Hornblende porphyry,
(Decomposing on one side.)
137. Augite rock,
(Nearly compact.)
138. Light green hornblende,
(Nearly compact.)
139. Augite rock,
(Nearly compact.)
140. Augite rock,
(Nearly compact, rhomboidal structure.)

H.

141. Concentric hornblende rock.
142. Augite rock,
(With adularia.)
143. Hornblende rock,
(Decomposing outside.)
144. Syenite.
145. Augite rock,
(Granular structure.)
146. Lithomargic earth,
(The debris of basalt.)
147. Augite rock.
148. Syenite.
149. Augite,
(Coarsely crystallized.)
150. Silicious pot-stone,
(With crystallized needles of tourmaline.)
151. Basaltic porphyry,
(From Nagpore.)
152. Felspar porphyry,
(Paste felspar, embedding with crystals of felspar, and green-colored crystals of green tourmaline.)
(Seringapatam.)
153. Felspar porphyry,
(Containing foliated crystals of red felspar.)
154. Granular augite or hornblende,
(Decomposing.)
155. Laterite,
(Western Coast.)
156. Laterite,
(Western Coast.)
157. Laterite,
(Northern division.)
158. Laterite,
(Western Coast.)

159. Laterite,
(Consisting of granular quartz, and specular iron ore.)
160. Laterite,
(Specular iron ore, and quartz.)

I.

161. Sandstone,
(British.)
162. Green sandstone,
(British.)
163. Iron sandstone,
(Western Coast.)
164. Sulphureous clay,
(Western Coast.)
165. Coal, (British.)
166. Iron sandstone,
(Western Coast.)
167. Iron sandstone,
(Coarse granite. Western Coast.)
168. Iron ore,
(In chert.)
169. Iron sandstone.
170. Stalactitic iron ore,
(Northern division.)
171. Iron glance.
172. Radiated iron ore,
(Western Coast.)
173. Iron ore,
(Western Coast.)
174. Magnetic iron ore,
(Rhomboidal structure.)
175. Magnetic iron ore,
(Course granular.)
176. Specular iron ore.
177. Chromate of iron,
(Coarse grain.)
178. Chromate of iron,
(Fine grain.)
179. Chromate of iron,
(With granular hornblende.)
180. Glance iron ore,
(Cellular structure.)

J.

181. Garnets.
182. Obsidian.
183. Lydian stone.
184. Porphyrytic Lydian stone.
185. Bottle-green hornblende,
(With chromate of iron.)
186. Silicious clay-stone.
187. Friable sandstone.
188. Sandstone,
(English.)
189. Very coarse grained iron ore.
190. Augite, rock,
(Augite adularia and felspar.)
191. Adularia,
(Compact augite with foliated adularia.
192. Supposed to be granular quartz,
(Colored green with chromate of iron.)
193. Granite,
(Consisting of augite, felspar and quartz.)
194. Clay slate,
(British.)

195. Granular talc.
196. Felspar,
(Passing into kaolin.)
197. Granite,
(Consisting of felspar, quartz, black talc, and tiemolite.)
198. Pegmatite.
199. Augite,
(Nearly compact.)
200. Foliated hornblende.

K.

201. Lithomargic earth,
(The debris of basalt.)
202. Lithomargic earth,
(The debris of hornblende rock.)
203. Granite,
(Seringapatam.)
204. Granite,
(Quartz and hornblende.)
205. Granite,
(Quartz, somewhat striated hornblende, felspar.)
206. Granite,
(Quartz, felspar, and black mica.)
207. Granite,
(Felspar, quartz and black talc.)
208. Granite,
(Felspar, quartz and talc.)
209. Granite,
(Felspar with a little quartz, and a little talc.)
210. Granite,
(Felspar, rose quartz, and hornblende.)
211. Granite,
(Hornblende granite.)
212. Hornblende rock,
(With a large portion of iron ore.)
213. Hornblende,
(Passing into chlorite.)
214. Granite,
(Hornblende granite; variety.)
215. Granite,
(Hornblende granite; variety.)
216. Pumice stone,
(Straits of Malacca.)
217. Ochre.

Abstract of labours in Rational Pathology since the commencement of the year 1839. By Professor Henle *of Zürich.**

Pus in the blood.

Pus cannot be recognised in the blood, because its globules are not distinguishable from those of lymph. Although Gulliver found the pus globules large, more irregular, generally darker-coloured, and more numerous, and often hanging together in clusters, while he always found the lymph globules swimming singly and detached, yet these characters are not certain; for the size of both kinds of globules varies according to the stage of their development, and according to the thickness of the plasma, and indeed smooth and angular globules occur near each other in both fluids, and Henle has often seen lymph globules clustered together in healthy blood, and their number vary much. (It is greatly increased by loss of blood.) Donné says, that blood containing pus is turned into a jelly by ammonia, like pus itself: but this is only the case when the number of pus globules is very great; and it seems likely that this may also be the case, when there are many lymph globules present. L' Héritier has proved Mandl's method of distinguishing pus-containing from pure blood, by the softness of the fibrinous coagulum to be insufficient. Yet there is no doubt of the occurrence of pus in the blood (Pyæmia,) and we know too that it cannot pass into uninjured vessels; and people have thus come to the conclusion, that it is formed within the veins themselves by their participating in the inflammatory process.

According to this explanation, the pus globules, when mixed with the blood are supposed by their large size to block up the capillaries, and set up a new inflammation. (Secondary and metastatic abscess). But many facts are opposed

* Abridged from the Zeitschrift für Rationelle Medizin of 1844, and translated for the Calcutta Journal of Natural History.

to this mechanical explanation: for instance, absorption of pus into the pulmonic circulation ought always to produce abscesses in the lungs; and the capillary circulation ought to be obstructed by an excess of large lymph globules, as well as by pus, and we thus find ourselves thrown back on the old humoral pathology. Thus Stannius and Pirogoff ascribe to the pus globules an irritative action on the coats of the veins, Engel compares them to the minute fungi of fermentation, and assumes that they have the power to convert the blood into a state of purulent fermentation. But every view of the action of the pus globules on the blood must remain hypothetical, till their presence in it is proved.

I.—*Inflammation and regeneration of special textures and organs.*

a. Bones.—In well-set fractures of bones that are rich in vessels, consolidation takes place without any exsudation between the periosteum and the bone, simply by exsudation from the broken surfaces (Lambron). Heine's preparations of regenerated bones have refuted Miescher's opinion that their re-production proceeds only from the substance of the bone, in as much as whole bones excised along with their periosteum have been reproduced, although in an imperfect manner. Klencke observed the formation of new diaphyses in the hollow bones of doves through the medium of the soft parts. The regenerated osseous substance was hard, white, and less vascular than ordinary bone. Textor confirms Heine's observation, that the compact part of the hollow bones is easily reproduced, but not the articular extremities: he found in their place in the larger joints a kind of meniscus, to which bands from the bones and muscles in the neighbourhood were attached. Karawajew also observed the complete reproduction from the periosteum of an excised piece of rib, some inches long. *Unhealthy inflammations and* *suppurations* leave, according to Rokitansky, various impressions on the bones. *Syphilis* produces thickening of the osseous texture, with increase of thickness and weight in the flat bones, along with an uneven knobby surface, and in case of ulcers a round depressed scar, puckered in a radiating form. *Scrofulous* inflammation is characterised by spongy softening, enlargement of the cells, and thinning of the walls : the suppuration takes place from the laid-bare and expanded cellular tissue, and when the process penetrates deep, forms a honey-combed sinus, when bone is thrown out in the form of velvety foliated exostoses. The *cancerous* degeneration is distinguished by the absence of softening, of new formation of bone, or of induration in the immediate neighbourhood of the corroded spot. *Arthritic* inflammation of joints causes enlargement and flattening of the knee-pans, levelling of the surface and edges of the ends of the bones, osseous vegetations of a shelly stalactitic form in the neighbourhood, loss of the cartilages, and a gypsumlike polish of the laid-bare medullary substance (by the deposition of a chalky earth, said by V. Specz to contain about 8 per cent. of lithic acid.) On the long bones, thickening of the cortical substance and warty or shelly vegetations are characteristic.

b. Cartilage.—Liston distinguishes three kinds of ulcerative destruction,—from disease and swelling of the synovial membrane; from swelling and vascularity in the tissue between the bone and cartilage; and from suppuration and inflammation of the cartilage itself. Albers speaks of inflammation of the ossified or unossified epiglottis. Rokitansky and Henle do not believe in inflammation of normal sound cartilage, and think it is destroyed only by the effects of inflammation in the neighbouring tissues. Klencke thinks, contrary to the opinion of all, that cartilage is capable of regeneration.

c. Muscle.—According to Klencke's experiments on the regeneration of muscles, membrane is alone produced in the place of the muscle removed, and it contains much lime, does not re-act from galvanism and mechanical irritants, but contracts in cold water, and when dissolved in acetic acid is not precipitated by ferrocyanide of potass.

d. Serous membranes.—The conditions for the production of the so-named hæmorrhagic exsudations of Lännec, are according to Rokitansky partly general, (as the tubercular diathesis) partly local, (at times simple inflammation, or repeated inflammation in some imperfectly organised false membrane, from the imperfect or too delicate structure of the new vessels.) This exsudation forms a coagulum, which may be more or less thick and consistent, adherent to the walls of the cavity, rich in colouring matter, or white, within which the red effusion is kept fluid. The coagulum changes into a resisting leathery layer, which becomes at most only partially organised: the enclosed fluid grows brown or yellowish, and clear, and its secondary deposits get the consistence of a kind of pulp; re-absorption is rare: death usually results quickly from exhaustion; in the most favourable cases, after the re-absorption of the fluid, a breaking down of the periphery of the coagulum takes place, inside which is found a rusty-coloured or yellow layer. In the peritoneum hæmorrhagic exsudations assume a black and blackish-blue colour from the action of the gas contained in the bowels (Melanosis stratiformis.) Of the so-called milk spots in the heart, Skoda and Kolletschka distinguish two sorts—those *on* the serous membranes are the effects of pericarditis, the others *under* them are caused slowly by repeated determination of blood to the part. Paget considers it impossible to determine whether these spots are situated above or below the serous membrane, and considers them to be always the result of inflammation, because adhesions in the form of fine threads between the large vessels are found along with them. Paget considers pericarditis to be a very common disease, for out of 58 bodies he found traces of it in 11. He thinks that it often occurs (though overlooked) in many acute diseases, and in typhus.

e. Arteries.—Their redness from imbibition is to be distinguished from that from inflammation, by this, that it is chiefly confined to the inner coat (the epithelium), and ceases entirely in the middle one. Levy observed inflammation and its effects in the umbilical artery in 14 out of 15 cases of new-born children who died of tenesmus. Schöller remarked a case of inflammation of the umbilical artery without trismus.

f. Veins.—The progress of inflammation in veins otherwise sound, is not (according to Pirogoff and Reumert) so rapid, as is commonly supposed: Stannius thinks it doubtful whether from constitutional causes apart from local irritation, inflammation of individual branches of veins can develop itself. Hetherschij found all the veins of the lower half of the body after puerperal fever filled with a soft, yellowish-red, dry, pus-like mass mixed with normal blood: he believes that this coagulum was not the product of the inflamed coats of the veins, but only deposited in them. Stannius has observed the complete re-absorption of obliterated veins along with a thrombus, (in which also small vessels were observable.) Of cases of inflammation of particular veins, there have been observed, phlebitis of the sinuses of the dura-mater in consequence of purulent otorrhœa, and phlebitis of the vena portæ.

g. Brain and its membranes.—Kellie and Abercrombie think that, from the slight compressibility of the brain and the fixedness of the cerebral parietes, no universal increase or diminution of quantity in the contents of its blood-vessels can take place, and therefore, that in cerebral congestions there can only be an alteration in the proportions of arterial and venous blood. To this Cohen opposes the facts of the flattening of the convolutions, in cases of water in the ventricles, and of the brain being overfilled with blood, and reminds us that in many cases the over-compressed brain, when once extracted, cannot be made to return within the cranium. Yet he admits, that positive overfilling and real compression of the brain by blood or serum are not so often indicated as people imagine, and that we are not always to assume absolute overfilling of the brain with blood, when after sudden death in cerebral cases, the veins of the pia-mater are found distended with blood, for this is also the case after bleeding to death. He considers, therefore, that the actual injury to the brain in irregularity of its circulation, is not caused by compression from absolute excess of blood or of serum, but by the proportionate excess of the one over the other, and hence it follows, that for the integrity of the brain a certain quantity of blood is necessary. Durand-Fardel describes a peculiar kind of inflammation of the brian, which comes on with the symptoms of apoplexy: the pathological characters are: extensive redness and swelling of the convolutions, superficial softening of the grey substance, and adherence of the duramater. He explains the want of inflammatory symptoms by the compression to which the brain is subjected by the swelling of its convolutions. Gluge considers inflammatory congestion of the cerebral membranes to be proved, only when fibrine has been effused, which then appears in the form of whitish spots or false membranes: suppuration is a rare result of meningitis. According to Engel, however, the exsudation of the arachnoid is sometimes fibrinous, sometimes serous, purulent, and even bloody. The flakes in serous exsudations consist of pus globules. According to Gluge, the existence of numerous blood points in the white substance indicates that there has been congestion. Engel and Henle think that a uniform redness of the cerebral substance indicates it. Toughness of the cerebral substance, particularly the white part, has been observed by Nasse and Albers after congestion of the brain in typhus: the white substance was firm, shining on its cut surface, and poor in blood. Disputes continue regarding the inflammatory character of hydrocephalus acutus, and the hardening and softening of the brain: several of the later writers will not admit that hydrocephalus A. is inflammatory. Cohen can discover in the exsudations no character of inflammatory secretion : Gluge considers the effusion of fluid an increased secretion of the normal cerebro-spinal fluid : Scharlau thinks the same is caused, not by increased effusion, but by diminished absorption : Vogt looks on the effusion of fluid as comparatively unimportant, and thinks hydrocephalus a process analogous to the softening of the brain in adults, and which takes place either in the brain itself or in the arachnoid ; but he considers rammolissement, and also acute hydrocephalus as consequences of a chronic process of inflammation, which he terms liquescent, venous, or typhous ; he looks on rammolissement as an organic maceration caused by previous changes of the firm part and of the serum, from the effect of chronic inflammation. Durand-Fardel declares the red softening to be always acute, the white to be chronic. Eisenmann, on the other hand, thinks the red discoloration is only a peculiarity of the first stage of softening, which easily passes by. He lays down four stages:—1st, incipient softening, with redness of the cerebral substance ; 2nd, the substance becomes pulpy, the red colour passes into yellow, and disappears finally ; 3rd, cavities form in the cerebral substance, filled with a milk-like fluid, the cortical substance becomes a gray pulp ; 4th. cicatrization : on the surface, the yellow and at a later period colourless flattened spots are the cicatrices, in the interior, the fallen together walls of the cavities, after the absorption of their fluid contents. He considers inflammation to be the proximate cause, and that it produces a serous effusion, which weakens the cerebral substance. Gluge considers that rammolissement is in most cases of an inflammatory nature, as he found in the softened places inflamed globules among the fragments of the cerebral tubules. Yet these globules were also found just as much in other as in inflammatory effusions, especially in effused and coagulated blood. Probably they are blood globules directly metamorphosed, which are at first red, but latterly by some peculiar chemical process become yellow, and at last colourless; yet they may also be produced in other ways as they occur in exsudations that contain no blood globules. It seems probable, that the peculiar shade of colour of the softened brain arises from these globules. In the yellow flattened spots into which the cortical substance becomes changed, Henle has observed besides the different kinds of inflamed globules and vessels, other peculiar fibres (of effused fibrine) and certain small flattened spots (of a fatty substance). Valentin describes two species of rammolissement, a coloured, and a colourless: in the latter the brain globules are soft and without form, the nervous tubuli varicose frangible and easily falling into globule-shaped fragments (which are very likely often mistaken for inflamed globules, as by Gluge and Bennett.) In the coloured form, something new is added to this simple degeneration, namely a quantity of broken-down granular globules, whence the colouring arises. They are like the pigment cells, with this difference, that the included granules are brown and less highly coloured. But as the pigment cells differ from the exsuded corpuscles in containing fat, Henle thinks that the destroyed nervous fibres themselves supply the material from which the globules are formed. Gluge produced softening of the brain in rabbits, by running needles into the cerebral substance; but in this case blood was always effused, so that it is not yet proved that softening and the production of inflamed globules are the results of pure inflammation. All softenings have this in common, that they are caused by the maceration of the cerebral substance in exsuded or extravasated bloody fluid. Carswell describes an additional form of rammolissement, the result of atrophy or of gangrene in the other soft parts, and the consequence of deficient nourishment, by the closure of the vessels leading to the brain. In hardening of the brain, Gluge found the primitive fibres quite altered, and of irregular form, as if compressed.

h. Nerves.—Their regeneration takes place, according to Valentin, as follows:—The exsudation between their ends is first converted into cellular tissue, in which there is then deposited in streaks, an oily, at first yellow, but at a later period white substance, which unites the extremities of the nervous fibres, while it proceeds from either end. If no union takes place, the ends of the nerves grow thin, become transparent, and adhere by means of fine cellular tissue to the neighbouring parts : the primitive fibres lose their contents, and the sheathes continue in the form of thin weak fibres. According to Nasse, the newly formed nervous fibres are rather narrower than the original ones. The shortest time in which sensibility has been restored along the course of a divided nerve, was 8 weeks, according to Günther and Schön. It is remarkable that only nerves of the same class unite again (Bidder). The newly formed nervous fibres are longer in being able to respond to the influence of the will, than to mechanical or galvanic irritation.

i. Alimentary canal.—After the use of tartar emetic, Marion de Procé has observed a pustular eruption, not only in the lower part of the æsophagus (like Rokitansky,) but also in the pharynx and throat, with the mucous coats of the stomach and small intestines in places reddened and injected. Hodgkin regards as a sign of fresh acute inflammation of the mucous membrane of the stomach after poisoning, a number of scattered small, almost opaque, whitish spots deeply seated in the mucous coat. Briquet and Cruveilhier describe a chronic inflammation of the follicles of the stomach and intestines : the mucous membrane was otherwise normal, but studded with small swellings (from a few lines in diameter to the size of a pin,) which in some places were flat, lens-shaped, and white, in others had pedicles, were egg-shaped, reddish, or violet-coloured, without any opening, but filled with a thick mucous fluid : no doubt this was a fungous alteration. As to the perforating ulcer of the stomach, which, according to Rokitansky, occurs more frequently than is commonly supposed, Dahlerup disagrees with him in many respects, and says that it occurs oftenest in the coats of the stomach about its cardiac extremity: he thinks round form is caused by the action of the muscular coat, which retracts on all sides after it is perforated. Cruveilhier and Mohr think the ulcer consists in inflammation and ulceration of the glands of the stomach; Rokitansky, in an acute red softening, or a sloughing, which kills the mucous membrane; Siebert calls attention to the connexion between these perforating ulcers and diseases of the brain and spinal column. *Perity philitis,* or abscess of the iliac fossa on the right side, happens occasionally, according to Grisolle, as a consequence of inflammation of the cœcum or of the vermiform appendix. It occurs commonly in men, in women chiefly after child-birth, when they do not suckle. The pain attending it is at times felt in distant parts, in the whole lower part of the body, and in the groins: from pressure of the pus on the nerves, the legs become benumbed or the seat of deep lancinating pains: pressure on the veins causes œdema: suppuration generally supervenes, and the pus makes its way out through the skin, the alimentary canal, or the bladder. Riedel has met with a case of a communication between the cœcum and ileum through the vermiform appendix.

k. Salivary glands.—Of inflammation of them, Cruveilhier distinguishes three varieties:—1st, inflammation of the excretory ducts and the granules of the gland (which most commonly extends from the centre to the periphery); 2nd, of the interstitial cellular tissue; 3rd, of their veins. He never saw suppuration of the parotid without simultaneous gangrene, a fact explained, according to him, by the close texture of the gland.

l. Liver.—Becquerel considers cirrhosis, or granulated liver, to be a hypertrophy of the yellow substance, caused (in consequence of habitual congestion) by the infiltration of a plastic material, which afterwards contracts, and thus causes atrophy. According to Hallman, there are imbedded in a fibrous mesh-work, in some places granulations of rather large liver cells with a few drops of oil, in others free fat cells. The fibrous tissue consists partly of closely packed cells, partly of firm thin fibres. The increased quantity of these fibres in cirrhosis accords with the increased quantity of lime in the liver (it contains 5 times as much.) J. Vogel reduces the structural alterations of the parenchyma of the liver to four forms :—1, deposition of fat; 2, filling of the cells with deep yellow or saffron coloured granules ; 3, deposition of irregular masses of a brown pigment between the liver cells; 4, deposition of masses of small intensely dark granules (pigment) between them : Henle cannot however regard these alterations as characteristic signs of cirrhosis, (i. e. that condition in which the liver is small, hard, lumpy or granular, and pervaded by a whitish grey cellular tissue in bands:) he thinks that in this affection, the peculiar characteristics of the parenchyma, and the formation of the accidental fibrous bands (which he regards as an important point of the disease) ought to be considered separately. In this fibrous tissue, Henle recognizes either cellular tissue, or numerous interlacing layers of flat parallel fibres with granules and granule fibres, (like the fibres of organised muscles, poor in blood vessels, and with a constant tendency to contraction.) The yellow granulations are the remains of the substance of the liver: beyond this point, we need microscopic observation to shew the real degree and cause of the alterations in the structure of the liver granules: the glandular cells are rich in fat, and become in part entirely converted into bladders of fat, or new fat cells are developed between them : from them is derived the yellow colour of the liver in cirrhosis. The two actions concerned in the cirrhotic process, deposition of fat in the gland cells, and formation of fibrine do not bear any necessary relation to each other : the deposition of fat at times occurs alone without atrophy, or contraction of the yellow spots, (for instance in the fatty liver in which Hallman and Valentin found the same alteration of the cells as in cirrhosis.) The fatty degeneration is, however, no more a peculiar disease of the liver than diabetes is of the kidneys, but a symptom of a diseased state of the blood, the excess of fat in which the liver cells have to separate. According to Rokitansky, the parenchyma of the liver granules in cirrhosis may be of very various structure, either quite normal, or as it is found in the fatty, atrophic and nutmeg liver, so that the cirrhosis is an accidental combination: the new fibrous tissue is the really important degeneration, and probably the result of inflammatory exsudation. Exsudation may, according to Becquerel, be the result of venous congestion and stagnation of the blood, from excessive extension of the secreting canals, in consequence of blocking up of the secretions. Bright's disease which often occurs along with cirrhosis, arises probably from the same cause, namely heart or lung disease. Pain is a rare symptom in this disease as is icterus, but œdema of the feet and dropsy of the belly are seldom absent. As to shades of color in the liver, Henle says, that the division of the liver into red and yellow substance does not correspond with any actual difference in tissue, and least of all that of investing capsule and acini*. It arises solely from a peculiar division of the blood vessels. In the axis of each lobule of the liver there is a venous twig, (of the vena Hepatica): at its periphery these are arterial twigs, (which accompany the vena portæ) communicating with each other by capillary vessels, which pervade the lobule, and are wider towards the axis than towards the periphery. According then as the blood is uniformly diffused, or retained more in the venous or in the arterial parts, so is the colour of the liver uniform, or marked by yellow and red spots. As the blood usually at death passes from the arteries into the veins, the centres of the lobules are commonly red, the periphery yellow, but the reverse may also be the case.

* This is merely Kiernan's account.—*Tr.*

m. Pancreas, according to Claessen, the symptom of acute pancreatitis is, a slight kind of drawing together pain, united with remarkable anxiety, which bears no proportion to the violence of the accompanying stomach symptoms. The tongue is moist and clean or with a white coating; the fever trifling. Resolution and induration of the organ have been observed as its sequelæ, never suppuration or gangrene. This inflammation does not appear to arise, as some have supposed, from the use of mercury, or from the suppression of the salivary flow, indeed the sympathy between the pancreas and the salivary glands has been assumed without warrant. Chronic inflammation shews itself by pain, copious dejections and vomiting of watery and slimy fluid (coming from the stomach) loss of appetite, excessive thirst, obstinate constipation and falling away.

n. Organs of respiration. Angina externa comes on, with or without slight fever, or with a feeling of lassitude and rheumatic pains, as a hard swelling, but neither hot, red nor painful in the submaxillary, parotid, or laryngeal region especially of the left side. As it increases, difficulty of speaking and of swallowing occur, but without any inflammatory symptoms in the mouth or lining of the air passages: there is in addition fever with nightly exacerbations. The terminations are, resolution, or death with the symptoms of putrid fever by suffocation, either before or after evacuation of the contents of the swelling. The fluid evacuated is ichorous. Either gangrenous destruction of the cellular tissue (of the muscles and nerves in the neighbourhood, not of the salivary glands) or infiltration of it with lymphatic albuminous fluid, are found after death, or both. Henle sees in this inflammation an excellent example of obstructed action in the absorbents; but this obstruction is distinctly related to the rheumatic process; its most usual exciting cause is exposure to cold. Hennemaen names as *epiglottitis chronica exsudativa,* a disease, in which from time to time a whitish crust of inflammatory exsudation, of the form of the epiglottis (?) is expectorated with a violent cough that often lasts for hours, and with excessive difficulty of breathing preceding it.—The seat of pneumonia, according to the consent of most modern authors, is in the mucous coat of the minutest lung-cells, and the granulations of hepatised lungs are formed by the filling of these cells with exsudation: on this account they are largest in full grown and in emphysematous lungs.

o. Kidneys.—Bright's disease is, according to Henle, a morbid action exactly similar to that of cirrhosis of the liver: in both, elementary granules, fat, and cellular tissue in its various stages of development, are found between the elementary parts of the glands, in both is the gland at first thereby swollen, and becomes afterwards atrophic, and granular by their contraction. Of both, there is an acute and a chronic form: the first of these appears to differ from pure congestion and inflammation of the kidney only in degree and in extent, and perhaps also in the source of the exsudation, in as much as it is thrown out chiefly by the arterial portion of the capillary system in pure inflammation, chiefly by the venous in cirrhosis and in Bright's disease. The various forms of Bright's disease described by different observers, are only stages of the same affection.

p. Eyes.—Although many writers speak of alterations of the *corpus papillare* of the conjunctiva in blennorrhœa of the eyes, yet Engel and Henle prove that they do not take place. What has been called hypertrophy of it, consists in the plastic matter, deposited upon and in the tissue of the conjunctiva, becoming organised. Nasse calls attention to a form of inflammation of the cornea in women who are nursing, which at first attacks only one eye, and is remarkable from its tendency to form ulcers: he thinks that it is caused by impoverishment of the blood, (anæmia from excessive secretion of milk, like keratitis in animals whose blood has lost its fibrine.) Schröder van der Kolk regards a chronic and exsudative inflammation of the choroid as the cause of glaucoma: the exsudation is deposited between the choroid and the retina, and displaces the latter: thence the amblyopia. Sichel explains the green colour of glaucoma, by supposing that the bluish choroid is seen, through the lens and vitreous body, deprived of its pigment. The crystalline lens is reproduced (according to Pauli, Löwenhardt, Textor and Valentin) in animals, and in man after the operation for cataract: the new formed substance resembles exactly the normal*.

q. Skin.—According to Rosenbaum, cutaneous eruptions are diseases of the glands of the skin, especially of the hair follicles: but papulæ and pustules occur on parts of the cutis and on mucous surfaces, where neither hair nor hair follicles occur (as on the palm of the hand, the glands, and the conjunctiva) many papular eruptions, such as lichen, psosiaris, &c. do no doubt proceed from the hair follicles.

II.—*Miasmatico-contagious Diseases.*

Of late years two chief theories regarding contagion have been advocated. The one seeks to explain the action of infectious matter (like that of ferment) by its chemical and physical properties. The other (the parasitic theory) regards the infectious matter as an organic existence, having an independent life of its own, with the power of propagating it.

Chemical theory.—This rests on the principle "of the transposition of atoms by being shaken." In certain bodies the molecules are supposed to be kept together so very

* The general result of the numerous experiments, which have been made in the transplantation of the cornea from the eye of one animal to that of another, appears to be this—that there is not much difficulty in getting the transplanted cornea to become attached in its new position, and that in a few rare cases the cornea remains transparent for a day or two, but that in the end it always becomes opaque, or quite useless for vision. A recent writer on this subject in Dr. Finch's Journal, does not appear to be aware that this operation was practised on the human subject, at least seven years ago.—*Tr.*

weakly, that every mechanical alteration by warmth, friction and contact with indifferent bodies, causes such a disturbance among their molecules, that they separate, and then form anew, fresh and more natural combinations. Substances, when in motion and in the act of transposing their molecules, are supposed to communicate their motion to other substances, just as ferment or putrefying matter does to sugar, the elements of which then form more simple combinations, such as alcohol and carbonic acid. Although Liebig now tries to add new positive weight to this theory, it is in fact a repetition of the old doctrine, that the spreading of fermentation and of contagion are analogous processes. On sufficient consideration this theory has been found utterly untenable—as little tenable is Naumann's chemical theory of contagion. Winther tries to make out ammonia to be the actual matter of contagion, while Liebig regards that substance as only the medium of the gaseous form of contagion. But all chemical theories have a radical defect: they are not even hypotheses; they do not explain facts, but hidden conjectural phænomena, and lay down the necessity of the operation of causes, which after all may not operate at all. It is indeed often assumed, but it never has been proved, that contagion always reaches the blood: it is just as uncertain that it is afterwards thrown out of it, as it is certain that pustules, papulæ, &c. are not the secreting organs of contagion, but the result of inflammation of the skin. A theory of contagion, that makes pretension to the character of a philosophic hypothesis, must begin not by assuming the mutual action of infectious matter and blood, but with the phænomena of contagions and contagious diseases, that is with the operations of contagious matter, which are real and appreciable by our senses, and this method conducts us to the other theory.

Parasitic theory.—Holland looks for the parasites in the animal kingdom (especially among insects), and regards illness as the consequence of a kind of poisoning by them. Henle, on the contrary, from his discoveries in fermentation and putrefaction, and regarding the muscardine of silk worms, is led to the conclusion, that infusoria and the lower forms of plants are the sources of contagion, and cause disease by the presence of their germs in the body: it is therefore necessary to determine the existence of contagion and miasma, their forms and organisation, and the course of miasmatic and contagious diseases. Henle divides the diseases to which a miasmatic or contagious origin is ascribed, into the three following groups:—1. *Pure miasmatic disease* (intermittent fever): in it miasma has not been detected either in or out of the body: it does not wander, but remains fixed in certain localities: there are no proofs, that it is inorganic, rather than a physical agent. 2 *Miasmatico-contagious diseases* (such as small-pox, measles, scarlet fever, typhus, &c.) arise from miasma (i. e. from something injurious in the air,) and also from contagion (i. e. something injurious derived from a sick body.) The miasma and the contagion of the same disease must be identical in their nature, (for like effects have like causes): the contagions of all these diseases are transient, and therefore it is probable that what is called the miasma (or infecting material of these diseases) is only a transient contagion, or vice versâ. 3. The *purely contagious diseases* (syphilis, itch, &c.) which never occur from miasma, have a contagion which is not transient. The cause of miasmatico-contagious diseases, appears as contagion or miasma, according as its origin can or can not be traced from a sick body. The fixed contagion of purely contagious diseases is infectious matter, contained in a solid or a fluid substance taken from the diseased body, commonly mucus or slime. It is thus, properly speaking, not contagion itself, but only the vehicle of it. The process by which it is prepared is the ordinary one of inflammation. The vesicles, pustules, &c. which contain the pus are the ordinary results of inflammation of the skin.—The physico-chemical properties of contagions shew, that their matter must be organic. From the way in which they act, it follows that the matter of contagion is alive, and indeed endowed with individual life, and that it bears to the diseased body the relation of a parasitic organisation. Contagions, as is proved by the course they run, and by the phænomena of the illness produced by them, possess two properties which do not belong to any formless or dead matter: the power of multiplying themselves on food, and by the assimilation of foreign organised bodies, and a certain power of periodical development limited by certain conditions, (they either run a chronic course, or they have a fixed succession of stages.) The spreading of contagions on the diseased body is thus either limited or unlimited: all contagions have a mode of propagation, which corresponds with that of higher organisations. We do not need to assume *equivocal generation*, if we admit that the germs of infectious matter may lie, out of the diseased body, as the germs of the lower organisations do, out of fermenting and putrefying substances, in a state capable of development, and only wanting favourable conditions for their propagation. These conditions appear to be: external ones, such as certain atmospheric relations: and internal ones, such as changes in the body, which render it fit for the support of parasites. In the same way, the conversion of merely miasmatic into contagious diseases, if the fact were once indubitably proved, could be explained without the aid of *equivocal generation*. Purely miasmatic disease, such as ague, catarrh, diarrhœa, &c. would be the means by which the human frame is rendered capable of receiving the infectious matter, which when once taken in, is propagated in the form of contagion. Thus it is only the origin of infectious matter and of contagion that remains hidden; but this is the case with all organisations, nay with all matter.—It remains now to examine, whether contagion be conditionally or absolutely independent, (of vegetable or of animal origin.) We may consider as endowed with relatively independent life, the elemental forms of organisations, which inherit the power of nourishing and of propagating themselves, only as parts of an organic whole, though they do not instantly die on separation from that whole. Many reasons make us suspect, that the contagious organisations belong to the lower kinds of plants and animals, (in short, have an absolutely dependent life of their own). Thus the origin of epidemic diseases can often be traced to circumstances, which favour the development of the lower animal and vegetable organisations; for instance, the destruction of organic substances, in overfilled or ill aired spaces. The means, which favour, impede, or destroy the action of the infectious matter, are the same which are favourable and destructive to the life and reproduction of the known lower organisations. Of late years an infinite number of such low parasites has been discovered, occurring in plants as well as in animals and men; and on comparing the action of contagions and miasmas with the consequences of the formation of parasites in the lower animals, we are struck by many analogies: from this comparison the following results may be deduced:—1. Purely contagious diseases are caused by parasites whose germs do not maintain themselves in the air, or in a dry condition (itch); those parasites may be considered as a middle grade, which cannot maintain themselves for a long time dry: in short, those diseases which are infectious, through the medium of air it is true, but only in the immediate neighbourhood of the patient, (glanders, consumption). To produce epidemics, a contagion must be motionary: but every motionary contagion does not necessarily produce epidemics, only one, for which the constitution has a general predisposition (for instance the contagion of Tinea.) 2. Miasmatico-contagious disease occurs in individual cases and epidemics, purely from miasma: in such cases the parasite lives and grows, but does not form any fruitful germs within the diseased body. The degree of contagiousness is also dependent on the place of growth of the parasite, and on the way in which it is thrown off. The contagiousness is smaller, if the parasite vegetates in the bowels, than if it be on the skin or in the lungs. 3. Diseases are chronic, if the power of propagation of the parasite is not limited; acute, if after a certain time it forms germs, and if the body in which these germs are formed does not offer a bed adapted to their further development. 4. Predisposition, is the capability of a body to form a nursing bed for the parasites, without the capability of resisting their action. For every parasite does not make the body on which it lives unhealthy: on the contrary, nature is able to render this, as many other injurious influences, innocuous through habit, or to compensate for them by nourishment. Contagions have, like all organisations, specific preferences for particular soils and climates. Some like a healthy body (most acute miasmatico-contagious diseases:) others prefer a weakened and reduced one (aphthæ.) On the whole, the attraction and the development of parasites appear to be favoured by a congested state of the surface, on which they most usually spread, perhaps on account of a partial separation of them from the surface being caused by congestion, as the parasite of dysentery and cholera by diarrhœa, of typhus by gastric fever, of influenza by sneezing. As for entozoa, so for contagions, there is a predisposition according to the age and kind of animal: and in both the want of such predisposition may be limited or unlimited. Contagion can become milder by germinating in different families, or by repeated inoculation, without losing the power of re-appearing again in full force under favourable circumstances, (small-pox). The destruction of the parasitic bed when the disease is over, reminds us of the succession of different kinds of animals and vegetables in infusions, in which each kind after a time exhausts the bed fitted for its production, or rather for its nutrition. 5. The miasmatico-contagious diseases are distinguished into local, (if the parasite has no disposition to spread beyond the points of inoculation, or if it is tied down to certain parts of the body,) and general. In the latter, the following conditions may occur :—*a.* the parasite spreads over the whole surface of the body or over the greater part of it: *b.* it may not be the parasite itself, but the diseased condition of the skin induced by it, that spreads by continuity and by sympathy : *c.* the parasite passes into the blood, and through it into all organs: *d.* the parasite, in the place in which it is fixed, may act on the blood circulating through that spot, and so at last get into the general circulation : *e.* the symptoms of a disease of the whole system manifest themselves by means of the sympathy of the nerves. 6. In relation to the seat or germ-beds of contagion, parasites may be divided into three classes—*a.* parasites of the inner and outer surface of the mucous linings and of the skin : to this belong itches, tinea, and most miasmatico-contagious diseases; their passage into the blood is possible, but not necessary: *b.* parasites of the fluids; here the blood and the secretions are the vehicles of contagion; the eruption is wanting or is unimportant : to this belong hydrophobia and possibly the plague : *c.* parasites which grow on the skin as well as in the fluids, which begin by germinating on the skin, but usually pass into the fluids, as glanders and syphilis. 7. The course of contagious and miasmatico-contagious diseases is as follows: The parasite is taken up by the mucous membrane or injured skin ; if the quantity taken up be small, then follows the stage of latent contagion, during which the parasite grows and multiplies. Neither does a skin parasite disappear in the blood, to be deposited afterwards on the skin, nor does a blood parasite remain inactive till the disease breaks out, (as people believe of hydrophobia). When the operation of the parasite is powerful (in the beginning of epidemics) death often occurs rapidly, and perhaps by sudden alteration of the blood, or by suffocation from irritation of the minutest bronchi.—The skin parasites cause mortification or inflammation, the latter of which is more or less superficial, and appears as diffused hyperæmia or as an exanthema, according to the nature of the surface and the quantity of the exsudation. Inflammation propagates itself by continuity, partly by the increase of the parasites themselves, partly by sympathetic excitement. Only in glanders and syphilis does the contagion propagate itself by lymph and blood. The humoral pathology, which acknowledges only this last mode for the origin and spreading of contagion, overlooks the question, why the contagion should be deposited from the blood exactly at and near the points of inoculation. All diseases of the whole system, i. e. affections of the nervous centres, Henle considers to be the consequence either of local inflammation or of a change in the blood caused by the abstraction of nourishment from it, by the parasites which it contains. The development of contagion is dependent on the fixed stages of miasmatico-contagious disease, which again are chiefly the result of external and of accidental circumstances. Metastases are caused by the development of parasites and of exanthemata internally, under circumstances which are unfavorable to their development externally.

Supposing, however, that the hope of discovering parasites, i. e. fungi or infusoria, in the eruptions and the contagions of man may never be realized, yet the hypothesis of the parasitic theory, the assumption of an invisibly small organisation too minute to be distinguished from the animal elements, remains far better, than the assumption of a chemical substance, which is not indicated by any re-agent and cannot be analysed. The contagion of the parasitic theory is not indicated in every case, but it agrees in its operations with those of analogous bodies, and explains the symptoms of disease: the contagion of the chemical theory is nowhere indicated, it varies from all other known bodies in its supposed operation, and does not explain the phænomena of disease.

a. Pocks.—Schönlein agrees with those who consider the varioloids to be eruptions specifically different from real small-pox: but Conradi and others have clearly proved by facts, that this is not the case. As to the question whether cow-pox is of the same origin as the small-pox of man, the results of Wedekind, Sunderland, Numann, and others, who tried to produce cow-pox by means of the atmospheric contagion of small-pox, are all contradictory. The identity of variola and of vaccine must, no doubt, be granted; but it is still doubtful, whether the pox in cows was at first and is still produced by contagion of small-pox only, or whether it can develop itself independently in the animals. By inoculating variolous matter into the udders of cows, Ceely and Thiele produced an eruption, which when inoculated back into men, appeared to be a powerful vaccine. Indeed the virus of small-pox may be altered to vaccine by inoculating with variolous lymph mixed in warm cow's milk, after it has lain for a few days between plates of glass secured by wax: if the experiment be continued, after the fifth reproduction, fever will cease to attend its inoculation; and after the tenth reproduction, we may inoculate in the ordinary way from arm to arm. Gruby has discovered microscopic beings in the papulæ and vesicles among the elements of the pus—pox-animalcules. They consist of a globular or conical body and a fine neck with a small hook, which they keep constantly moving, while they bend their neck backwards and forwards, and at times pull it back entirely. They are as large as molecular corpuscles, and Henle suspects that they are perhaps only such.—Sheep-pox. Several ewes in lamb were inoculated, almost all the fœtuses had pocks, and some of the sheep produced lambs covered with pocks: pox in sheep appears to have the same antipathy to the itch as human small-pox has.

b. Measles.—When Catona inoculated with the fluid of the vesicles of measles mixed with blood, or with the tears during the height of the eruption, the inoculation took effect in all but 7 out of 100 patients: a red ring formed round the point of inoculation, which afterwards disappeared suddenly, and on the seventh or eighth day after the insertion of the virus, fever came on with the usual premonitory symptoms, and two or three days later the exanthema followed. In scarlet fever and in measles, Helfft declares that he has found the cells of the thrown-off epithelium of the mucous membrane, not only in the urine, but also in the excrement: according to him, the spreading of the exanthema, and the process of desquamation stand in inverse relation to the urinary and to the digestive organs. Sebastian observed the simultaneous and regular course of measles and vaccine in one individual, while in most cases the vaccine remains quiet till the measles have run their course.

c. Pemphigus.—Scharlau thinks, that he has proved by inoculation the contagiousness of this disease among new-born children.

d. Typhus.—In the two forms of disease which have been described under the names of typhus (*T. contagiosus exanthematicus, petechialis,)* and of typhoid fever, (*Fievre typhoide T. abdominalis,)* Davidson sees only two varieties of the same species. He endeavours to point out the analogy between typhus and other exanthematous diseases. According to Valleix, typhus is distinguished from similar and especially from typhoid diseases, by a characteristic eruption (numerous, irregularly grouped, roundish, dark red or violet spots, from the size of a pin head to that of a pea, not projecting, and not disappearing under the pressure of the finger, while in typhoid fever only a few, rare, coloured spots, slightly projecting, and readily yielding to the pressure of the finger appear in small number and only on the belly,—by the almost entire absence of affections of the higher senses—by the comparative slightness of the cerebral symptoms—by the absence of abdominal complications at the outset (ulcers of the bowels,) and by their small number and slight intensity. According to Valleix, typhus ought for the present to be reckoned among essential fevers, since no constant local injury is found. Rochoux observed besides the petechiæ in typhus, a measle-like erratic exanthema in the form of scattered points always followed by desquamation: the exanthema of typhoid fever consists of small round elevations, which last for six or eight days. As an essential difference between typhus and typhoid fever he cites the propagation of the former by infection, which he positively denies to typhoid, (while Berland accords it.) Those who look on a primary alteration of the blood as the immediate cause of fever and of other exanthematous diseases, are supported by the results of the investigations of Andral and Gavarret. Winther deduces all the symptoms of typhus from fluidity and congestion of the blood. According to De Renzi, typhus-blood is very rich in blood corpuscles (generally without a nucleus) the colouring matter dissolved in serum, the placenta incomplete and soft; there is a deficiency of fibrine. Forget concludes from his researches—1, an appreciable alteration of the blood is not universal: 2, the blood seldom appears to be altered in the earliest stage: 3, the blood is the oftener found altered, the more advanced the disease is: 4, the degree of alteration, if there be any such thing, does not bear any definite relation to the period of the disease: 5, it is not coincident with the putrid and typhous symptoms, which may occur with or without it: 6, the different kinds of alteration do not appear to be connected with the fixed forms of the disease: 7, the degree of alteration is not in proportion to the intensity of the disease: 8, nor to the number of times that bleeding has been employed. As a cause of the slowness of hearing and of the deafness in typhus, Pappenheim discovered inflammation and suppuration in the mucous membrane of the drum of the ear. According to Engel the disappearance of a typhus epidemic may be predicated from the corpses: at the commencement, while it prevails strongly, we find the ulcers almost solely in the stage of infiltration or of sloughing, before its disappearance open ulcerations and even scars are found. Dysentery is also an indication of the breaking up of a typhus epidemic. Vegetable parasites (minute fungi) have been observed by Langenbeck, Hannover and Bennett, in typhus patients and in their corpses.

e. Dysentery.—Rokitansky lays down four degrees or forms of the dysenteric process. 1. The first, is characterised by swelling, redness, and softening of the mucous coat of the large intestine, especially the folds of the mucous membrane, and by a serous exsudation in the form of a fine miliary vesicular growth, after which the epithelium desquamates in a clay-like state. 2. In the second degree, the mucous membrane is softened like a jelly, wart-like or fungous protuberances appear, which consist of serous inflammation of the submucous cellular tissue (according to Siebert, the formation of these protuberances commences with degeneration of the mucous glands, which grow black, and are surrounded with a chamois-yellow circle of the size of a lentil.) 3. In the third degree, the protuberances are more compressed, so that the inner surface of the bowel seems studded with large glands. The mucous membrane is in part converted into a black slough, or has disappeared entirely. 4. In the fourth stage, the mucous membrane has degenerated into a black, friable, as it were carbonised mass. The lymphatic glands of the mesocolon are in a marked degree swollen and injected, but without containing, as in typhus, a specific firm product. The dysenteric process always gradually increases in violence from the valve of the colon downwards towards the rectum. The true dysenteric process occurs, according to Rokitansky, also in the mucous membrane of the uterus, but only after delivery. Some chronic diseases, especially tubercular ones, seem to prevent the occurrence of dysentery; its predisposing causes are, mucous discharges from the bowels, gout, rheumatism, hæmorrhoids, ague. Cruveilhier as well as R. have remarked the resemblance of dysenteric degeneration to the corrosion of mucous membranes by acids.

f. Aphthæ.—Taupin comprehends under the name of *stomatitis gangrænosa* pseudo-membranous and ulcerated aphthæ, and gangrene of the mouth: but it is only the first that can be epidemic or contagious. He considers the chief predisposing cause to be the impure damp air of hospitals; it belongs especially to the period of life between five and ten years of age. The degeneration commonly begins at the free edges of the gums, and seldom on the cheeks. Taupin, therein differing from Guersent, never found the mucous membrane sound under the slough, but always ulcerated. In these false membranes many observers have remarked minute fungi. Besides them other microscopic elements have been observed indicative of an inflammatory process; elementary granules, exsudatory corpuscles, inflammatory globules, and at a later period fibres standing together in groups, running into short points at both ends, with long drawn-out granules, which lengthen into indistinct fibres: between them, irregular masses of finely granulated or of fibrous substance—probably of fibrine.

g. Ophthalmias.—From the researches of Cederschjöld, a discharge from the generative organs of women appears to be one of the most frequent causes of *ophthalmia neonatorum*, since the proportion of children with diseased eyes to those with healthy ones, born of healthy mothers, is as 1 : 18; of those born of unhealthy mothers, as 1 : 7. The Egyptian or contagious ophthalmia is, according to Eble, on the whole identical in nature with catarrhal conjunctivitis: he declares for its primitive origin, and considers the most important cause of its production to be the congregating of too many people in a narrow space. As to contagiousness, he thinks that it is contagious to a limited extent, that infection from a distance (i. e. by the air of a room filled with patients) is more common than from actual transference of the secretion; it is most frequent when the disease is violent and at its greatest height. Pieringer, in order to cure pannus, made many attempts to produce blennorrhœa by inoculation, and arrived at the following results. The contagion is fixed, its vehicle the mucus-like secretion of the conjunctiva: it is only in the second and third degrees of the disease that the mucus is positively infectious; as the secretion gets thinner, so does its infectiousness diminish: eyes already diseased are infected less easily than sound ones: the virus of the mucus is not preserved for more than three days after its removal from the body. The re-action from its introduction comes on in from six to twenty-four hours. The application of ice and the washing out the eye within three minutes after the introduction of the matter, protects against its action. Deconde, who says he has always produced in animals ophthalmia by introducing the matter of gonorrhœa, thinks that by injections of argent. nitr. into the urethra, the discharge immediately loses its contagious power. In like manner a solution of chloride of lime is stated to destroy the infectious power of the gonorrhœal secretion and of the mucus of contagious ophthalmia, but only if it be well mixed up with the secretion, or dropped in a few minutes after its introduction into the eye, not if it be dropped in before it.

h. Tinea.—In this disease, we need no longer talk of pustules, and least of all of pustules filled with matter, for the scabs are formed simply by the growth of fungi. Schönlein, Langenbeck and Fuchs discovered fungi in several species of *favus* and of *alphus*: Gruby has given a good account of these fungi, whose seat is the tissue of the epidermis. There is no doubt of the contagiousness of tinea, yet several unsuccessful attempts have been made to propagate it by inoculation of the fungi.

j. Itch.—It cannot be propagated by the inoculation of fluid matter from the itch pustules, any more than by its scabs.

k. Syphilis.—Ricord's results as to inoculation have been confirmed by several observers in the main points. Hauck rejects the designation of *fluor albus syphiliticus*, as leucorrhœa never produces syphilitic sores, if there be not at the same time syphilitic ulcers deep in the vagina or at the neck of the uterus. Castelnau, like Ricord, finds the ulcers of secondary syphilis not inoculable, but considers inoculation altogether to be an uncertain diagnostic sign, since even fresh chancres are not always to be propagated by inoculation. Donné's *Trichomonas vaginalis* was repeatedly found in the vagina of syphilitic patients by Henle, as were fungi in the mucous lining of the walls of the vagina.

l. Hydrophobia.—Breschet has ascertained, that the disease can be inoculated back to dogs, from men and other animals who have got the disease by the bite of mad dogs, not spontaneously. He thinks also, that he has observed that the poison loses much of its strength in the third and fourth generation. The consequences of infection usually display themselves between the 20th and the 30th day after the bite, at times not till after three months. It would also appear, that the poison is present in the blood, even during the latent stage of the contagion, for two ewes that had been bitten, gave suck to their lambs for fourteen days after it had happened, and four weeks afterwards the ewes became mad, and were followed by the lambs nine or ten days after.

**m. Disease of jaws and hoofs in cattle.*—Although the actual contagiousness of this disease has not been proved by inoculating back from man to animals, yet repeated experiments prove the injuriousness of eating milk, butter or cheese

* ☞ See note at p. 250.

procured from cows affected by this disease. It produces a phlyctœnulous pustular eruption round the mouth, and ulcers inside it, colic and diarrhœa, and at times eruptions on the hands and feet. Almost all calves suckled by diseased cows died of diarrhœa. Touching the diseased secretion, produces, according to Siebert, an *erysipelas bullosum* at the point of contact.

**n*. *Lung disease of cows*—(contagious pleuro-pneumonia). It is contagious, as Hertwig proved it to be, who produced it by inoculation with blood and with the secretion of the nose, as also by mere juxta-position with healthy cows.

**o*. *Gangrene of the spleen.*—There are still disputes whether the eating of the flesh of an animal suffering from this disease is infectious, but there is no doubt of its general contagiousness.

p. *Glanders.*—Its contagiousness, at least in the acute form, is generally acknowledged: views are more discordant regarding the chronic one. Magendie goes the length of considering the two distinct, and does not consider the chronic form to be infectious. Hering proves, that chronic glanders communicated from a horse to a donkey usually runs a very acute course. In the way of experiment it has been undoubtedly proved, that glanders can pass from horses to other animals of different genera, although the action of the poison inoculated is slower and less certain, than in the solid unguli. Cases of the accidental infection of men have also been observed, and Rayer has introduced glanders into his system of pathology. The local symptoms are a kind of carbuncle, along with the well known affections of the lymphatic glands: if the disease becomes universal, then it resembles a good deal the so-named reabsorption of pus. Glanders in man can be inocu-

* *m*, *n*, *o*. The translator is not acquainted with the English synonyms for these names.—*Tr*.

lated back to animals. As to the nature of the contagion, some facts lead to the suspicion, that it may be caused by a vegetable parasite. Langenbeck observed a filiform fungus in the discharge from the nose of a horse sick of glanders.

Note.—We thought at first of adding notes, and of making some remarks on this translation; but it is so condensed, and contains so much matter on so great a variety of subjects, that the task of annotation would have been unsatisfactory as well as laborious. We have preferred giving it without comment, as a good exposition of the most modern continental views on many interesting points in medicine, and more especially of the opinions of what may be termed the natural-historical school. We shall merely remark, that few practical men have any faith in Liebig's plausible theoretical views regarding disease and the action of remedies; indeed he has damaged himself by the extremely confident way in which he has applied his theories to sciences with which he was imperfectly acquainted. Nevertheless we hope soon to have an opportunity of giving a more detailed account of his views, than this paper affords, and also to indicate from time to time the most recent opinions in physiological medicine, which has of late acquired a degree of interest and of consequence, never before possessed by it. As to the parasitic theory, it deserves at least the praise of much ingenuity.—J. M. P.

A few remarks on the Diseases of Seamen in the year 1844. *By* John Macpherson, M. D.

The following table of cases treated in the Howrah Hospital, exhibits a fair view of the diseases most common among the seamen frequenting this port. On a general survey of it, it is apparent that cholera and dysentery are the two most fatal diseases. Fever, generally of a remittent type, is the most common complaint, and at times adds largely to the mortality, though it has not done so of late. Hepatitis is by no means so common, as many suppose. The rareness of primary affection of the organs of respiration and of circulation is remarkable, as also the infrequency of acute rheumatism, considering the great changes of temperature to which seamen are exposed. Syphilis is usually very mild, and scurvy is very rare, and commonly slight. We believe that there are no means of ascertaining with any approach to accuracy, what the actual loss of life among Europeans visiting this port may be: but it is undoubtedly much greater than is ordinarily supposed; nor shall we wonder at this, when we consider the reckless habits of sailors, the loaded state of their bowels so frequent after a long voyage, their sudden and excessive indulgence in unripe fruit and poisonous spirits, on arriving in the river; their frequently having to work under a midday sun, their wandering through the bazars in the daytime, their indulgence in every species of excess on shore, and their returning on board at night to lie on a damp deck, deterred by its closeness from entering the forecastle:—add to this, the sudden changes of temperature (at times amounting in the course of a short north-wester, to 10° Fahrenheit,) and that at some seasons many vessels lie in shore exposed to the most nauseous effluvia from the mouths of sewers; and we shall not be surprised at the production of disease.

We wish that we could say that, when produced, it was promptly treated; but it is unnecessary here to enter upon that ungrateful subject.

In comparing the proportion of deaths to admissions, it is to be remembered that the cases are always more advanced, and usually more severe, than those admitted into military hospitals.

Return of cases of Seamen treated in the Howrah Hospital in 1844.

	Jan. 1st, 1844, Remained.	Admitted.	Total.	Relieved or cured.	Died.	Transferred.	Remained, Dec. 31st, 1844.
Fever, ...	0	127	127	126	0	0	1
Spleen, ...	0	1	1	1	0	0	0
Small-pox, ...	0	4	4	2	2	0	0
Cholera, ...	0	17	17	7	10	0	0
Dysentery, ...	0	29	29	23	4	1	1
Diarrhœa, ...	0	10	10	10	0	0	0
Dyspepsia, ...	0	7	7	7	0	0	0
Obstipatio, ...	0	3	3	3	0	0	0
Colica, ...	0	0	0	6	0	0	0
Inflammation of bowels, ...	0	2	2	2	0	0	0
Worms, ...	0	2	2	2	0	0	0
Hæmorrhoids, ...	0	2	2	2	0	0	0
Hepatitis, ...	0	9	9	9	0	0	0
Jaundice, ...	0	2	2	2	0	0	0
Excess, ...	0	13	13	13	0	0	0
Delirum-tremens, ...	0	7	7	7	0	0	0
Cephalalgia, ...	0	13	13	13	0	0	0
Coup de Soleil, ...	0	1	1	1	0	0	0
Apoplexy, ...	0	1	1	0	1	0	0
Epilepsy, ...	0	3	3	3	0	0	0
Dementia, ...	0	1	1	0	0	0	1
Heart disease, ...	0	2	2	2	0	0	0
Lung affections, ...	0	6	6	6	0	0	0
Rheumatism, ...	0	13	13	12	0	0	1
Scurvy, ...	0	5	5	4	0	0	1
Cachexia, ...	0	1	1	0	0	0	0
Syphilis, ...	0	38	38	35	0	0	3
Stricture, ...	0	1	1	1	0	0	0
Cutaneous diseases, ...	0	4	4	3	1	0	1
Concussion, ...	0	1	1	0	0	0	0
Contusions and Sprains, ...	0	10	10	10	0	0	0
Fractures, ...	0	1	1	1	0	0	0
Wounds, ...	0	2	2	2	0	0	0
Musquito-bites, ...	0	7	7	6	0	0	1
Scalds, ...	0	2	2	2	0	0	0
Ulcers, ...	0	5	5	5	0	0	0
Boils, ...	0	2	2	2	0	0	0
Abscess, ...	1	0	1	0	1	0	0
Inflammation of leg, ...	0	1	1	1	0	0	0
Inflammation of periosteum, ...	0	3	3	3	0	0	0
Inflammation of eye, ...	0	3	3	3	0	0	0
Odontalgia, ...	0	2	2	2	0	0	0
Otalgia, ...	0	1	1	1	0	0	0
Total, ...	1	370	371	341	19	1	10

Mortality:—Fever 0; Small-pox 50 per cent.; Cholera 60 do.; Dysentery 14 do. On whole 5.2.

Table shewing the relative proportion of cases of Fever, Cholera, Dysentery, and Hepatitis among Seamen in 1844.

	Fever,	Deaths.	Cholera,	Deaths.	Dysentery,	Deaths.	Hepatitis,	Deaths.
January, ...	4	0	1	1	0	0	0	0
February, ...	1	0	0	0	1	0	0	0
March, ...	7	0	1	1	3	0	0	0
April, ...	0	0	13	8	5	0	1	0
May, ...	3	0	0	0	2	0	1	0
June, ...	6	0	1	0	1	0	1	0
July, ...	5	0	0	0	7	2	1	0
August, ...	24	0	0	0	4	2	2	0
September, ...	25	0	0	0	1	0	1	0
October, ...	10	0	0	0	3	0	1	0
November, ...	35	0	0	0	1	0	0	0
December, ...	7	0	1	0	1	0	1	0
Total, ...	127	0	17	10	29	4	9	0

N. B.—This table indicates only the *relative* diffusion of diseases, i. e. their proportion to each other during the month. In April, when cholera was epidemic, no fever case was admitted. In July and August, Dysentery was most prevalent, and most fatal.

Table shewing the ages of patients.

14 and under 20, ...	75
20 and under 30, ...	181
30 and under 40, ...	79
40 and under 50, ...	28
50 up to 56, ...	8
Total	371

Remarks.—110 more seamen were admitted in 1844 than in 1843. The general mortality of 1843 was 7.7 per cent.—of 1844, 5.2.

Fevers.—It is exceedingly difficult to make the common division of fever into continued and remittent, in any satisfactory way, and it has not here been attempted.

The fevers of 1844 were generally of the common Bengal remittent type, in nine cases out of ten with cerebral congestion, and of a mild character, as might have been presumed from the fact, of no fatal case having occurred during the year. As far as treatment can be supposed to have been influential in producing the small mortality in 1843, 1.7 per cent., and the absence of fatal cases in 1844, the favourable results are attributable to the very sparing way in which general blood-letting was practised, to the free use of local bleeding and blistering, and to the early exhibition of quinine.* In October and November there was a good deal of gastric irritability, and the acuteness of pain in the loins complained of by the patients was unusually great. In one instance, after a slight attack of remittent fever, the spleen was affected, but it was found that the patient had formerly suffered from ague at Gravesend. Intermittent fever, as has been remarked by others, appears to be unusual among the seamen frequenting this port.

Small-pox.—A few cases were admitted, when this disease was so prevalent in the earlier part of the year: all the men had been vaccinated when children, yet it will be seen that the proportional mortality was very great. Though it did not occur in a hospital patient, it may not be out of place to mention here a curious fact which fell under my notice in a private patient. There was a single well-marked small-pox pustule fully developed on the hand, at the time when the premonitory fever commenced, and before there was a trace of any eruption elsewhere.

Cholera.—It is a very rare thing to have an opportunity of treating this disease in its earlier stage. A sailor usually lies on the damp deck for some hours during the night, before his comrades are aware of his illness; and then a few more hours are lost by the miserable system of sending for the doctor who has contracted to attend the ship. When a man is really dying, it is thought time to send him ashore. Of the ten fatal cases, seven died within nine hours after admission. In one instance, the exciting cause appeared to have been the drinking two table spoonsful of cream of tartar in water; in another, the exhibition of an emetic on board ship. No satis-

* The character of the fevers must have altered much, for the mortality for the four years ending with 1840, averaged 8 per cent. per annum.

factory report can be given of any mode of treatment adopted in this hospital. The hot-bath system has been tried pretty extensively within the last two years, chiefly in cases in a state of collapse, but it was only in one instance that it appeared to be of decided benefit, and in that case it is difficult to determine how much was due to the other remedies employed. There were two cases, which exhibited well the low typhoid symptoms which frequently follow the acute stage of cholera. In the first case, the efforts of the system were able, after a long struggle, to produce a healthy re-action; in the second they proved inadequate. An account of the last is subjoined.*

	Diet.	
April 10*th*.—G. Manship: ætat 34. Had cholera three days ago, from which he is recovering slowly. Tongue furred and brown, a good deal of thirst: motions frequent and watery: cuticle raised from the abdomen, which is raw. Pulse very weak.		*R*. Pil. Plumbi Acet. c. Opio. Duo. s. s. Inject. Opiat.
11*th*.—Has had constant vomiting during the night, of greenish fluid: has passed copious fluid stools, chiefly of bile: complains only of weakness and of vomiting.	Sago and brandy.	11*th*.—Haust. Acid. Hydrocyanic. dil. Prore nata repet. Merid. *R*. Pil. Hydrarg. Ext. Hyosc. *aa* grs. v. Tertiis horis.
Vesper.—Has only vomited twice since the morning: is excessively languid, with some congestion of the head.		*Vesper*.—Applic. Empl. Lyttæ Nuchæ.
12*th*.—Has still bilious diarrhœa: no vomiting.		12*th*.—P.
Vesp.—No purging since morning: in the same languid state: some vomiting of green fluid.		
13*th*.—Passed an immense quantity of bilious-looking stools: is excessively exhausted, with some difficulty of breathing: no vomiting. Tongue cleaner.		13*th*.—Mistura Cretæ, cum Tinct. Kino, post singulas dejectiones.
Vesp.—Vomiting and purging both stopped: excessively languid.		Haust. Ammon. et Spir. Æther. Nitr. 2 dis horis.
14*th*.—Had only one motion last night: voice stronger.		14*th*.—Rept. Mist. Cretæ prore nata et pil. h. s.
Vesp.—No vomiting: has had one stool: improving.	Sago.	
15*th*.—Stationary.		15*th*, *Vesp*—Applic. Empl. Lyttæ.
Vesp.—Has some cough, and great difficulty of respiration.		Repet. pil. h. s.

* We have been informed, that after the appearance of a few cases of cholera on board ship, the practice of keeping the ports facing the east always shut, was adopted, and no more cases occurred.

	Diet	
16*th.*—Chest relieved: tongue white, and coated.	Lemonade.	16*th.*—Repet pil. h. s.
17*th.*—In the same languid state: motions scanty and dark.	Low diet.	17*th.*—*R.* Ol. Ricini, ʒvi. Tinct. Opii, ♏ xv.
Vesp.—Ditto: motions more natural.	Soda-water 3 bottles.	*Vesp.*—Repet pil. h. s.
18*th.*—Complains only of languor and thirst: is slowly convalescent.		18*th.*—Infusi Gentian. haust bis in die s. *Vesp.*—Rept. pil. h. s.
19*th.*—Ditto: heaviness about his head.		19*th.*—Applic. hirud viii. temps.
Vesp.—Head slightly relieved, but excessively weak: pulse quick: skin feverish: motions yellow and watery: sore of the blister on the abdomen large and painful.		Radatur cæsaries. *Vesp.*—Repet pil., h. s.
20*th.*—Feverish symptoms abating.		20*th.*—Haust efferv. ter in die.
22*nd.* Gradually improving; but from excessive debility has sores on his hips: his face covered with spots of a flat pustular eruption, with an inflamed border.	Half diet. Wine 3 measures.	22*nd.*—P. Haust. Quinæ, ter in die.
23*rd.*—Exceedingly low, and more of the ruppia-looking spots out: the sores and the eruption are so painful as to prevent his getting any rest.		23*rd.*—*R.* Tinct. Opii, ♏ l. h. s. s.
25*th.*—Improves on the whole; but is covered from head to foot with boils.		25*th.*—P.
28*th.*—Many of the boils have ulcerated, and form nasty deep sores.		26*th*—Ol. Ricini, ℥vi. Applic. Lotio Cupri Sulphat.
30*th.*—Excessively weak: sores spreading, but not unhealthy.	Beer 2 pints.	30*th.*—P.
May 4*th.*—Improves a little, complains of debility. Motions healthy.		*May* 4*th.*—Pergat. in usum Quinæ.
9*th.*—Sores gradually improving, but he continues exceedingly low: tongue dry in the morning.		9*th Vesp.*—Omittr. Haust. Quinæ.
Vesp.—Has some fever: tongue brown and dry.		*R.* Hydrarg. Chlorid. Pulv. Antim. *aa* grs. iij. h. s.
11*th.*—Sores healing, but continues in a low state resembling typhus.		11*th.*—Liquor. Ammon. Acetat. Misturæ Camphoræ, *aa.* ℥i. Ter in die Repet Pulv. h. s.
12*th.*—Remains excessively low, and his head has been wandering much.	Omit extras.	12*th.*—P. Applic. Empl. Lyttæ Nuchæ.
13*th.*—As yesterday, complains of nothing, but is quite delirious.		13*th*—Infric. Unguent. Hydrarg. *Vesp.*—Hydrarg. Chlorid. grs. v.—h. s.
14*th.*—Continues in a state of low delirium: symptoms of effusion within the cranium: the second blister applied to the head rose well.		14*th*—P. et Hydr. chlorid. grs. iij. Tertiis horis.
Vesp.—Lower: moribund.		
15*th.*—Less jactitation, and appears rather more sensible: gums not affected: had three glasses of wine.		15*th.*—P.
Vesp.—Worse and lower: died in the night.		

Sect. Cadav.—Viscera all quite healthy: no trace of disease. *Brain remarkably firm.*

Remarks.—Manship was thus admitted on the 10th April, suffering from bilious diarrhœa. On the 11th, his head was congested: on the 15th, there was congestion in the thorax: 19th, the head again became affected, along with febrile symptoms: 22nd, the system began to throw out boils, which kept him low and weak. May 9th, symptoms resembling typhus supervened, under which he succumbed on the 15th. There was no effusion within the cranium, though the symptoms during life seemed to indicate it. The firmness of the cerebral substance was, I fancy, what some authors have described, as hardening of the brain after typhus.

Dysentery.—The worst and most fatal cases of this disease were all admitted from one ship in dock, which had a particularly debauched crew. As the incipient stage is usually past before men are sent to hospital, general depletion and the means commonly employed to check the onset of the attack, are frequently inapplicable. Indeed, as dysentery is essentially an inflammation of a mucous not of a serous surface, it may be doubtful whether local be not often as effectual as general depletion. As to the use of calomel, which is so commonly employed at its onset, the general feeling of the profession seems to be against its employment at a later stage*, and indeed it is difficult to conceive what beneficial influence it can exert on an ulcerated surface.

Accordingly the usual treatment in the Seaman's Hospital is the free exhibition of sugar of lead and opium, and it appears to answer well. As much as from nine to fifteen grains of sugar of lead, combined with small quantities of opium, (one or one-half grain of opium to three of sugar of lead) are given within the twenty-four hours; and this treatment is continued for several days, along with the free use of leeches and opiate and sugar of lead enemata, with purgatives every other morning, and milk diet. Perhaps in no disease is it more important, that the patient should not remain on board ship, where his diet is sure to be neglected, and in none is attention to it so imperatively demanded. Indeed, such is the value of milk diet, that we can readily believe that the albumen of eggs, of late years confidently brought forward by writers both in France and in Germany as a cure for it, may be a

* See a practical paper of Dr. Goodeve's in the Transactions of the Medical and Physical Society.

very useful adjuvant in the milder forms of the disease which prevail in some parts of Europe.

But to return to the sugar of lead treatment, it is unnecessary to enquire here, what shares the opium and the lead relatively bear in the curative process; but that the sugar of lead plays an important part we have no doubt, and we have employed it combined with hyoscyamus very advantageously in some chronic cases. This mode of treatment has been tried very extensively among natives, and appeared to be very efficacious, and convenient, as avoiding the chance of salivation. It would seem to be particularly adapted to that insidious form of hæmorrhagic dysentery, of which several cases have of late occurred in middle aged men, characterised by the pouring out of immense quantities of blood from the mucous surfaces, indeed compared by some to flooding in child-birth, but of which no well marked case has occurred in the Howrah Seaman's Hospital.*

We have written at this length about sugar of lead, not as advocating any exclusive mode of treatment, or meaning to assert its superiority over that most admirable remedy, sulphate of copper, or over various others; but having lately met with a paper, in which, owing to its alleged bad effects when given in small quantity in a single case, its total disuse was recommended, we thought it as well to record that we have used it in large doses in some 300 cases both in Europeans and in Natives, without any of those disagreeable constitutional effects which are attributed to its employment.

Of course after the dysenteric symptoms have begun to subside, various alteratives are useful in aiding the bowels to

* There is no distinct account of this form of dysentery in Raleigh's book: his hæmorrhagic form being quite different. Twining describes it, but does not seem to regard it as the consequence of chronic disease. Several cases of it were related to me by the late Dr. Garden, who has so recently been removed from us, when at the height of professional eminence in Calcutta. Strong sense, high principle, never-tiring, ever-zealous friendship, were some traits of a character, which was most esteemed, where best known.

regain their healthy tone. Scybala, or hardened fæces, are hardly ever met with, and in the course of 1843 and 1844 no hepatic complications were observed.

An abstract is given of the post-mortem appearances in two cases, which differ a good deal from those usually met with. In the first, the small amount of disease in the colon was remarkable; in the second, the small intestines and stomach were partially involved.

J. J——, Ætat 16, died after eight days' illness. Sect. cadaver.

The small intestines and the colon, externally healthy and pale: very slight inflammation of the mucous coat of the transverse colon, which contained a lumbricus, *but showed no tendency to ulceration:* from the descending colon along the sigmoid flexure to the end of the rectum, the intestine was one mass of thickening and ulceration, in many places yielding to the finger. Liver healthy.

J. L——, Ætat 25, died after eleven days' illness. Sect. cadaver.

Colon enormously distended with flatus, and concealing from view the other viscera; its inner coat and that of the cœcum studded throughout their whole extent with thick-set deep ulcers, which had in some instances almost penetrated their walls: small intestines in many spots inflamed externally, and with some lymph effused on their surface: healthy internally. Stomach small and shrivelled up, with patches of red, but no ulceration on its mucous surface. Liver sound.

Hepatitis.—The cases among seamen were all either chronic or sub-acute, and easily relieved. An iron-founder was admitted into hospital, who had burst an abscess of the liver into his lungs, while he was at work, at which he continued for some days after that occurrence. He died about six weeks after with all the symptoms of phthisis, and on post mortem examination his right lung was found completely disorganised, and on the superior surface of the right lobe of the liver were the remains of a superficial abscess which was rapidly healing, having a base about the size of a crown piece. The rest of the liver and the remaining viscera were quite healthy. No doubt had his lungs been stronger, he would have recovered; though no tubercles were observed, yet he was of a well marked strumous diathesis.

Cephalalgia.—Several of these cases were merely incipient fevers, and were checked by the ordinary means. Some allusion was made in the H. S. Hospital report for 1843,* to several obscure cases of cerebral mischief. The following case is a specimen of them: they are of a very puzzling character, and seem to resemble the earlier stage of the cases of disorganisation of the brain, recorded by Dr. Green in his Hospital reports.

J. Turner.	*Diet.*	
Aug. 12*th.*—Pale and worn-out looking: has been subject to severe headaches for the last two months, and has been bled three times for them: first attacked on coast of Africa fifteen months ago: general health good. Pulse natural: never received a blow on his head.		*Aug.* 12*th.*—Hirud. xvi. temps. Pil. Calom. *c* Coloc., h. s.
		13*th.*—Haust. Purgans. *Vesp.*—Pil. Hydrarg. Ext. Hyosc. *aa* grs. v., h. s.
14*th.*—Head much relieved, but has still constant beating pain in it.	Low.	14*th.*—Empl. Lyttæ nuchæ.
		15*th.*—Haust. Purgans.
		16*th.*—Applic. Empl. Lyttæ capit.
17*th.*—Head rather better.		
18*th.*—Complains of pain and constant beating on the top of his head.		18*th.*—Haust. Purgans.
20*th.*—More swimming in his head.		20*th.*—Seton. Pil. Calom. *c* Coloc., h. s.
		21*st.*—Pil. Calom. *c.* Opio, bis in die.
25*th.*—Salivated, but no material change in his head: seton discharges freely.		25*th.*—Pil. Hydrarg. Pil. Rhei, *aa* grs. v., o. n.
28*th.*—No change.		28*th.*—Ol. Ricini, ℥i. repet. pil. altern. noct.
29*th.*—Mouth continues sore.		29*th.*—Omitt pil. h. s.
		13*th.*—Repet. Ol. Ricini. *R.* Potass. Iodid. grs. ijj. bis in die.
Sept. 14*th* —In the same state: mouth well.	Low.	14*th*, *Vesp.*—Hirud. xiv. temps.
15*th.*—Complains of having had violent beating in his head last night.	Spoon.	
16*th.*—Had last night one of the fits of which he complains; in them his head becomes quite giddy, and there is violent pain: no convulsions or falling down, during the fit. Pulse slow.		16*th.*—Haust. Purgans. P. Rad. Capill. Empl. Lyttæ capiti.
17*th*—Slept better: bowels costive.		17*th.*—Pulv. Jalap. *c* ʒi. s. s.
		18*th.*—P. in usum Potass. Iodid.
19*th.*—Head continues the same, complains of faintness and difficulty of breathing.		19*th.*—Antimon. Potass. Tart. gr. ¼ quater in die. Omitt Alia.

* In Dr. Finch's Journal.

	Diet.	
22nd.—Better: bowels costive.		*22nd.*—Haust. Purgans. *Vesp.*—Pulv. Ipecac. P. Digital. *aa* grs. iii., h. s.
26th.—Has been better under the use of nauseating medicine till to-day, when his head is worse.		*26th.*—Hirud. vi. temps. P.
Vesp.—Has fever: temples throbbing.		*Vesp.*—Hirud. xii. capiti. Pil. Calom. *c* Coloc.
27th.—Less heat of head: tongue coated.		*27th.*—Haust. Purgans. Mist Salin. *Vesp.*—Pil. Hydrarg. Extr. Hyosc. *aa* grs. v., h. s.
28th.—Ditto.		*28th.*—Pulv. Jalap. Co ʒi. Infric. Unguent. Antimon.
Merid. Much worse, with pain in head, and difficulty of breathing. Great oppression at the præcordia.		Merid. Hirud. xvi. temps. *Vesp.*—Empl. Lyttæ capiti; Hydr. chlorid gr. iv. tertiis horis.—V. S. ad ℥ xvi.
29th.—Head better, and pulse quieter; but complains much of difficulty of breathing: tongue loaded: bowels open. Coagulum soft, still some difficulty of breathing.		*29th.*—Vini Ipecac. Tinct. Hyosc. Spirit. Ammon. Aromat. *aa* ℥ss. Mist. Camphor. ℥xij. M. ft. Mistura, &c.
Vesp.—Difficulty of breathing relieved: skin and head still rather hot: bowels not open. Tongue dark and coated.		*Vesp.*—Enema purgans. Pil. Hydrarg, Extr. Hyosc. *aa* grs. v., h. s.
30th.—Pulse quiet: skin cool: bowels only open once.		*30th.*—Pulv. Jalap. *c* ʒi. s.s. Repet. pil. Calom. *c* Coloc., h. s. Enema purgans.
Oct. 1st.—Vomiting came on last night, and he has complained of constant sickness since. Tongue thickly coated: bowels not open: pulse quiet: no heat of head: cramps in legs.		*1st.*—Ol. Tigl. ♏iii., s. s. Sinapism abdom. Pil. Hydrarg. Extr. Hyosc. *aa* grs. v., h.s.
2nd.—Symptoms again relieved, but his head has been wandering a good deal for a day or two; cannot sleep.	Spoon.	*2nd.*—Tinct. Hyoscyam. ♏xl. Mist. Camphor. ℥iss., s.s.
Vesp.—Very restless.		*Vesp.*—Morphia Acet. gr. i. h. s.
3rd.—Slept well last night, and is cool this morning. Tongue remains much coated.	Milk.	*3rd.*—Haust. efferv. ter in die. *Vesp.*—Morphia Acet. gr. ss. h. s.
4th.—Tongue much cleaner, the same otherwise.	Half.	*4th.*—Omitt. Medic.
13th.—Has been much better since the weather has been cooler.		
20th.—Improves gradually. Ship going, discharged.		

Remarks.—The bowels were throughout excessively costive: local applications seemed at first to give temporary relief. Putting him under the influence of mercury, did no good, nor did the seton. The iodine was not continued long enough to be of any use, as it seemed to disagree with him. No satisfactory reason can be assigned for his getting so much worse from the 26th to the 3rd. The morphia operated very favourably in quieting his incessant restlessness. The symptoms will no doubt all return.

Apoplexy.—The patient was admitted insensible, and died in half an hour. Post-mortem examination shewed only enlargement of the liver, which was of a light colour and fatty. There was nothing in any degree abnormal in the contents of the cranium.

Rheumatism.—The cases were chiefly chronic and articular; one was gonorrhœal, and another was accompanied with secondary symptoms.

Abscess.—The fatal case was a huge deep-seated abscess in the thigh of a boy convalescent from fever, which had separated all the muscles from their attachments to the femur. There was considerable difficulty in getting at the seat of the abscess, and on its contents being evacuated, he sank.

Inflammation of the eye.—The cases were, one of ordinary conjunctivitis, one of syphilitic iritis, which came on six weeks after a trifling sore on the prepuce had been healed, and one of concussion of the globe with extravasation of blood into its chambers, from a bottle being thrown at the head. Though there is now no difference in the appearance of the two eyes, save a slight irregularity of the iris, all useful vision is destroyed.

Lumbrici are common in seamen, but they do not appear to be more frequent in diseases of the digestive organs, than of others.

March 22*nd*, 1845.

Report on the Collection of Fossils from Southern India, presented by C. J. Kaye, *Esq.*, F.G.S., *and the* Rev. W. H. Egerton, F.G.S. *By Professor* Edward Forbes, F.L.S.

(From the Quarterly Journal of the Geological Society, No. 1.)

In the descriptive catalogue accompanying this report, and referring to the remains of invertebrate animals in the valuable collection of fossils from the South of India, presented to the Society by Mr. Kaye, and increased by an extensive series of specimens collected in the same localities by Mr. Egerton, 168 species of Mollusca are enumerated, 156 of which, as far as can be ascertained, are undescribed forms. There are also a number of species of Radiata.

The results of their examination may be briefly stated as follows :—

1st. The three deposits, viz. Pondicherry, Verdachellum, and Trinconopoly, described by Mr. Kaye, are *Cretaceous*, inasmuch as there are characteristic known cretaceous fossils in the collections from all of them, whilst no fossils of any other system occur. The nearest allies of the majority of the new species are cretaceous; and among the genera and subgenera are many which, as far as we know, are confined to or have their chief development in the cretaceous system. The three deposits are connected with each other zoologically by the associations of certain species common to two of them, with others found in the third.

2nd. Two of the three deposits, viz. Verdachellum and Trinconopoly, are of a different epoch of the Cretaceous era from the third, Pondicherry. The two former have several species in common (and those species among the most prolific in individuals), which are not found in the third. In them are found almost all the species identical with European forms. In several of the genera, of which there are many species, the forms are altogether distinct; although, judging from the evidence afforded by mineral character and association of species, the conditions of depth and sea-bottom at the time of the deposition of the strata seem to have been the same. The difference therefore must have depended on a representation of species by species *in time* and not *in depth.*

3rd. The beds, apparently contemporaneous, viz. Trinconopoly and Verdachellum, may be regarded as equivalent to the upper green sand and gault; the European species they include being either characteristic upper green sand and gault forms, or else such as occur in those strata. The new species they contain are either closely allied to known upper green sand or gault species, or peculiar to the Indian beds.

4th. The Pondicherry deposit may be regarded as belonging to the lowest part of the Cretaceous system. In it almost all the fossils are new. Such as are analogous to known species are allied to fossils of the lower green sand of English geologists and Neocomien of the French. In the genus most developed in this deposit, viz. Ammonites, three-fourths of the species belong to those subgenera especially characteristic of the " Lower Neocomen" of the Mediterranean basin; whilst, of the remainder, as many representatives of

Oolitic fossils occur as of upper green sand. The resemblance between the Ammonites of this part of the collection and those of Castellane, in the south of France, is very remarkable, though the specific identity of any of them is doubtful. Having seen no account of the Conchifera of the Castellane beds, I cannot say how far the analogy is borne out among the bivalve Mollusca among the Indian species, of which there are many very peculiar forms.

5th. Considered in regard to the distribution of animal life during the Cretaceous era, this collection is of the highest interest. It shows, that during two successive stages of that era the climatal influence, as affecting marine animals, did not vary in intensity in the Indian, European, and American regions, whilst the later of the two had specific relations with the seas of Europe, which are absent from the earlier. The cause of this remarkable fact is not to be sought for in a more general distribution of animal life at one time than at another, but rather in some great change in the distribution of land and sea, and in a greater connection of the Indian and European seas during the epoch of the deposition of the upper green-sand, than during that of the lower. To this cause must also be attributed the peculiar tertiary aspect of the Indian collections, depending on the presence of a number of forms usually regarded as characteristic of tertiary formations, such as Cypræa, Oliva, Triton, Pyrula, Nerita, and numerous species of Voluta, the inference from which, since not one of the species is identical with any known tertiary form, should not be that the deposits containing them are either tertiary or necessarily connected with tertiary, but that the genera in question commenced their appearance earliest in the Eastern seas, which, when we recollect that in those very seas at the present day, are found the great specific assemblages or capitals of those genera, whilst they have either disappeared or have few representatives in the seas of other geographical regions, is exactly what we should expect, *à priori*, to find. This fact would go far to support the theory, that genera, like species, have geographical birth-places as well as geographical capitals.

The fact, that of the few species found in the Indian cretaceous beds which are common to the same beds in distant regions, the majority are such as range through several deposits of different ages, supports the probability of a law which I have elsewhere indicated, viz. that *the range of the geographical distribution of species is usually correspondent to the range of their distribution in time.*

The probability of the proposed law, that the *marine fauns of distant localities, under similar conditions of climate, depth, and sea-bottom, maintain their relations rather by the representation of forms by similar forms, than by identity of species, is also borne out by the examination of these collections.*

These inferences can be only put forth as provisional, until a thorough examination of the deposits described by Mr. Kaye in their stratigraphical relations be made, and the fossils of those localities which he did not visit have been still further examined on the spot. To the palæontologist his collections are invaluable, as the specimens are in so fine a state of preservation, as to permit of an examination of their minute structure.

The descriptions of fifteen of the Trinconopoly species in the catalogues were furnished to Mr. Kaye by Mr. George Sowerby.

[*Note.*—With regard to this report, it was also intended that it should have been accompanied by a descriptive catalogue of the fossils, and by figures of new species, and it is in so far, therefore, incomplete. It is published in this place as an indication of the important results actually arrived at by the study of these interesting fossils.—Ed.]

On the Permian System as developed in Russia and other parts of Europe. By Roderick Impey Murchison, *Esq., F.G.S., V.P.R.S., and* M. E. de Verneuil, *Hon. Mem. Geo. Soc. of London.*

(From the Quarterly Journal of the Geological Society, No. 1.)

On the part of his associates, M. de Verneuil and Count Keyserling, and himself, Mr. Murchison has previously explained in the Proceedings of the Geological Society the nature of the various deposits which constitute the subsoil of European Russia. As in all other parts of the world which have been adequately examined, the Silurian rocks are those which contain the earliest forms of animal life, and in Russia they are overlaid by Devonian and carboniferous deposits, each of which is there singularly well defined by its organic remains and regular superposition.

In common with many other geologists, Mr. Murchison was formerly of opinion* that the above-mentioned three systems constituted the whole Palæozoic series, but the examination of Russia and Germany has led him to include also therein the next group in ascending order, or that to which he had assigned† the name of Permian.

When two or more conterminous formations are shown to have a community of fossils, it has recently been deemed essential to group them under one name; and following the practice of assigning to any such newly classed group a geographical name derived from the region where the strata are best developed, the term "Permian" was employed. This system was first proposed to embrace the deposits known in Germany as the Rothe-todte-liegende, Zechstein, Kupferschiefer, &c., and in England as Lower New Red Sandstone, Magnesian limestone, &c.

In communicating some of the results of a journey in Poland and Germany during last summer, Mr. Murchison, one of the authors of the present memoirs, states that his object is to show that his first view concerning the inferior limit of this system is correct—to extend its upper limits, and from the distribution and character of its organic remains to demonstrate that it is of palæozoic age.

Near Zwickau in Saxony, and Waldenburg in Upper Silesia, productive coal-fields (in the latter country recumbent on carboniferous limestome) are unconformably surmounted by red conglomerate, sandstone and shale (the rothe-todte-liengende), which in those countries, as in Thuringia and Hesse Cassel, pass conformably upwards into Zechstein or its equivalents. The same relation of a lower sandstone to the Magnesian limestone are, indeed, well known in England, and have been pointed out in detail by Professor Sedgwick. Seeing that these two deposits are so intimately associated, few, if any, geologists would wish to disunite them; but the question arises, what is the uppermost limit of this group. In Russia,

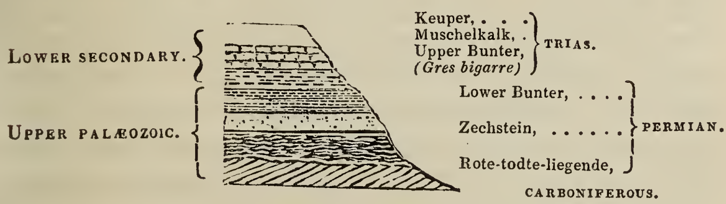
* See "Silurian System," p. 46. *et seq.* In England Professor Phillips has, however, some time maintained that the fossils of the magnesian limestone ought to be grouped with the inferior strata.

† See "Letter to M. Fischer Von Waldheim, Sept. 1841;" Leonhard's "Jahr Buch," part i. p. 91, 1842; "Phil. Magazine," vol. xix. p. 418.

beds of limestone identified with the Zechstein and Magnesian limestone by their organic remains are overlaid by a great thickness of marls, sands, and conglomerates, containing some of the same types of life as the lower members, particularly the plants which are very closely allied to and are in some instances identical with the vegetables of the carboniferous era. It became therefore desirable to ascertain whether similar palæozoic features were to be found in other parts of Europe. Now in Thuringia and Hesse Cassel, the Zechstein is, in numerous localities, conformably surmounted by red and spotted sandstones, in which no traces of fossils distinct from those of the Permian era are observable, the only land plant found in them (the *Calamites arenarius*) being inseparable from well-known carboniferous forms. This overlying sandstone being perfectly conformable to the Zechstein, may, it is conceived (like the overlying sandstones of Russia), be classed with that rock. In making this suggestion, the authors disavow the intention of derogating in any respect from the Trias of German geologists, also a tripartite system, and of which the muschelkalk is the centre, with certain red and mottled marls and sands beneath, and the keuper sandstone above. The Triassic system does not contain a single Palæozoic form, whether animal or vegetable, whilst the fauna and flora of the Permian are both so connected with the carboniferous and inferior systems, that they evidently constitute the last remnant of the same era. In the whole geological series, therefore, no two systems are more completely separated than the Permian and the Trias, the one forming the uppermost Palæozoic stage, the other the base of the secondary deposits.

After showing that the " Grès de Vosges," as described by M. Elie de Beaumount, is one of the arenaceous equavalents of the Permian system, and after alluding to its development in the neighbourhood of Strasburg and in other parts of Europe, where it is well separated from the Trias, attention is directed to the fact, that as far as researches had yet gone, the Trias is always conformable to the Permian, whilst the " rothe-todte-liegende," or base of the latter, is frequently unconformable to the carboniferous rocks on which it rests, and out of whose detritus it has often been formed. These phenomena, say the authors, prove that the most marked distinctions between the fossils of succeeding formations cannot be referred to physical revolutions of the surface; for in the examples cited there is a sequence of congeneric remains, where the succession of the strata has been powerfully interrupted (Carboniferous to Permian), and a total change of fossils where the contiguous formations are conformable (Permian to Trias.)

These relations are expressed in this diagram :—



The Permian fauna is then considered, and is said to exhibit the last of the successive alterations which the Palæozoic animals underwent before their final disappearance. The total number of Permian species known to the authors in different parts of Europe (without reckoning certain ichthyolites not yet named, and a few doubtful forms of shells) is 166, of which 148 are characteristic of the system, 18 only being found in the subjacent Palæozoic rocks. The Brachiopods being viewed as the shells of most value in determining the durations of the ancient rocks, it is stated, that 10 out of the 30 Permian species are common to this system and the carboniferous. After some observations on the species of Productus, Spirifer, Orthis, Terebratula, Lepæna (Chonetes), which have lived on from earlier periods, it is remarked that no form of the Pentamerus, a genus peculiarly characteristic of the Silurian strata, has yet been found in the Permian strata, whilst the Brachiopod most frequent in the latter is the Productus, a genus very abundant in the carboniferous or conterminous deposits, but unknown in the Silurian. Among the Conchifers (26 in number) the Modiola is very characteristic of the Permian system, both in Russia and England; and though the large species of Axinus so well known in England has not yet been found in Russia, its place is there taken by two other species of the same genus. The Avicula is also a good Permian shell, the *A. Kazanensis* being the best type in Russia, whilst the *A. antiqua* is there common to this deposit and the carboniferous.

The Gastoropods, so abundant in the carboniferous era have undergone great diminution before the formation of the Permian strata, and had great difficulty in accommodating themselves to new conditions; still more so the Cephalopods, for the forms of Goniatites, Nautili, and Orthoceratites, so very common in the preceding epoch, are almost unknown in this system, a fragment or two of one genus (Nautilus ?) alone having been found in all parts of Europe. This scarcity of Cephalopods at the close of the Palæozoic series has a remarkable parallel in a subsequent geological period; for as these animals were reproduced in vast abundance and under many new forms in the Triassic, Jurassic, and Cretaceous systems, so towards the termination of the last of these we perceive a second and similar disappearance of the greater number of the shelly Cephalopods. The extreme reduction of the Gasterpods at the close of the cretaceous periods, as indicated by M. Alcide D'Orbigny, is also pointed out as an additional feature of analogy to the Permian changes. Trilobites, so eminently characteristic of the Silurian system, and which dwindle away to a few small species in the carboniferous system, are unknown in the Permian of Western Europe, and in Russia are only represented by a species of Limulus. Fishes, on the other hand, are numerous in proportion to the other Permian classes, 43 or 44 species being named, and several from Russia being yet undescribed; these are all, with one exception, absolutely peculiar to the stratum in which they occur, thus confirming the truth of the generalisation of Agassiz, that these vertebrata mark with great precision the age of the stratum in which they are found. Lastly, the Permian beds of Russia, like the Dolomitic conglomerate of England and the Kupferschiefer of Germany, contain bones of the codont Saurians, indicating the earliest appearance of animals of that high organisation, and their direct association with Palæozoic shells and plants, some of which are undistinguishable from true carboniferons species.

After thus following it back *in time*, the Permian fauna is next considered in horizontal extension or *distance*, the fossils of Russia being compared with those of similar age in western Europe. The number of species collected by the authors in Russia is 53, or about one-third of the total number of the whole European fauna of the period, and of these 32 are peculiar to Russia, a large number when the recency and rapidity of the survey of the authors is adverted to; and when it is considered that 33 species only were found by Professor Sedgwick in deposits of this age in England, and 41, according to the recent tabular view of Geinitx, is the total number known in Saxony where the Zechstein is very fully elaborated. Like other formations of synchronous age when at great distances from each other, the Russian succession of Permian strata cannot be brought into a detailed analogy with that of western Europe. Instead of occupying a fixed place like the calcareous beds which represent the Zechstein, they inosculate with great thicknesses of fossiliferous grit, whilst Saurians and fishes with certain *Producti* and *Modiolæ*, as well as most of the plants, unquestionably occur in conglomerates, tufaceous limestone, and marls, which overlie the beds which contain Zechstein or Magnesian limestone fossils. In Germany, the Protorosaurus belongs to the Cupfer-schiefer which is below the Zechstein, whereas in Russia all the cupriferous and sauroid beds are above that rock.

In analysing the species common to the Permian system of Russia and the rest of Europe (by stating the number which have lived on from the carboniferous to the Permian, and the diminished proportion of the latter), Russia alone is appealed to, and three only of the Permian *species* of that country are found to descend into the Palœozoic rocks. The authors, therefore, infer that these results necessarily prove the existence of a relation between the greater or less duration of species and their propagation or extension to distant parts, thus confirming a law previously announced by one of them.

Some detailed observations then follow on the species in each class found in Russia, and Mr. Lonsdale is cited as having assured them that although the Permian corals are evidently Palæozoic in their generic characters, there is not a single species which is identical with a carboniferous form; and it is also remarked that of 20 species of Brachiopods found in Russia, 8 are peculiar to that country.

Lastly, deriving their knowledge of the specific character of the plants from the examination of M. Adolphe Brogniart, aided by Mr.

Morris, who had previously examined them, it appears certain, that whilst all the forms indicate a continuation of vegetable life of the same nature as that which prevailed during the carboniferous era, there are a few species *(Neuropteris tenuifolia Lepidodendrom elonyatum,* and *Calamites Suckovii)* which are identical with carboniferous plants, and not one which can be compared with a triassic plant.*

The results of the inquiries of the botanists, the authors conclude by remarking, are therefore completely in accordance with those of the palæontologist. They clearly prove that the Permian system is the uppermost stage of that long Palæozoic series, which, commencing with the lowest Silurian rocks, presents a connected succession of animal and vegetable life, the last traces of which passed away with the termination of the strata under review. Until Russia was explored, the upper member of these ancient rocks had scarcely afforded a trace of terrestrial plants. Neither in the British Isles nor in Germany had there been found more than one or two species of land plants in deposits of this age, not one of which has yet been fully identified or described. Now in reference to the Russian species, such of them as had been previously alluded to by other writers were placed by some in the carboniferous rocks, by others in the New Red Sandstone.† Our sections, however, have shown that neither of these views is correct; and as the Russian plants to which we have called attention, occur for the most part in strata distinctly *overlying* beds containing the fossils of the Zechstein, it is clear that certain red sandstones, marls and conglomerates, above that rock, belong to our Permian group, are wholly distinct from the Trias, and are truly Palæozoic.

We repeat, therefore, that we have now adduced ample botanical as well as zoological and stratigraphical evidence to vindicate the

* The species of plants, ten or twelve in number, which have been found in the Kupfer-schiefer or the sandy beds associated with the Zechstein in Germany, are chiefly marine fucoids, and have been termed *Caulerpites.* According to M. Adolphe Brogniart, the only terrestrial plants of the German strata are the *Teniopteris Echardi* (Germar), and a Neuropteris mentioned by Naumann, which not being determined must be considered doubtful.

† See a very recent memoir by M. Yasikoff, "Bull. de Moskou," 1843, part ii. p. 237, in which he refers an interesting portion of the Permian rocks described by us upon the Kama, and between that river and the Sok, either to the *New Red Sandstone or the Carboniferous Limestone.*

application of the collective word *Permian* to a succession of strata which had not been previously united through their geological relations and organic contents.

These proofs will, we trust, be considered as still more strongly borne out by the grandeur of the phenomena to which we have appealed; for the Permian deposits of Russia repose upon carboniferous strata throughout more than two-thirds of a basin which has a circumference of not less than 4000 English miles.

A detailed tabular list of the animal remains of the Permian system in Europe was also given, mentioning the names of the authors who have described each species, the localities at which it has been found, and its vertical range in the Palæozoic series. This table will appear " in extenso" in the forthcoming work upon Russia, and in the meantime the following recapitulation is subjoined: but the authors express their regret that their table was drawn up without the benefit of the long-promised assistance of Professor Agassiz. His observations on a few of the Permian ichthyolites which were submitted to him will increase the number of that class of fossils.

Recapitulation of the Fauna of the Permian System in Europe.

Classes.	Genera.	Total Number of Species in Europe.	Species exclusively peculiar to the Permian system in Europe.	Species found in other formations.	Species found in Russia.			
					a. Peculiar to the country.	*b.* Previously found elsewhere. In the Permian and older formations.	In the Permian beds exclusively.	In older formations exclusively.
Polyparia	7	15	13	2	3	1?	2	
Echinodermata..	2	2	1	1				
Conchifera, Ord. Brachiopoda	7	30	20	10	8	3	4	5
——— Ord. Dimyaria ..	10	26	26		8		3	
——— Ord. Monomyaria	5	16	15	1	4		3	
Mollusca, Ord. Gasteropoda	11	22	19	3	3			
———Ord. Cephalopoda	1	3	3		1			
Annelida	1	2	2					
Crustacea	2	2	2		2			
Pisces..	16	43	42	1	2			
Reptilia..	4	5	5		1			
Total	66	166	148	18	32	3 or 4	12	5

Fourteenth Meeting of the British Association for the Advancement of Science. York, September 16.

[From the Athenæum,—Continued from page 147.]

The President's Address.

The noble Lord, to whose office I succeed, and who has introduced me to your notice, has spoken of me in terms, which, however flattering to my pride, I can only accept as the expression of his friendship and good-will; and I hope he will permit me to add, that whilst there are few persons for whose character and attainments I feel a more sincere respect, there is none whose favourable opinion I should be more anxious to merit. The members of the Association who were present at the meeting at Cork can bear witness to the courteous, dignified, and able manner in which he discharged the duties of his office, whilst others, who, like myself, had the opportunity of seeing them, could not fail to be deeply impressed with the magnificent works which are accomplished or in progress at his noble residence at Birr Castle. Whatever met the eye was upon a gigantic scale; telescopic tubes through which the tallest man could walk upright; telescopic mirrors, whose weights are estimated not by pounds but by tons, polished by steam power with almost inconceivable ease and rapidity, and with a certainty, and accuracy, and delicacy, exceeding the most perfect productions of the most perfect manipulation; structures, for the support of the telescope and its machinery, more lofty and massive than those of a Norman keep; whilst the same arrangements which secure the stability of masses which no ordinary crane could move, provide likewise for their obeying the most delicate impulse of the most delicate finger, or for following the stars in their course, through the agency of clock-work, with a movement so steady and free from tremors, as to become scarcely perceptible when increased a thousand fold by the magnifying powers of the eye-glass. The instruments, which were mounted and in operation at the time of my visit, exceeded in optical power, and in the clearness and precision of their definition of celestial objects, the most perfect productions of the greatest modern artists; and though much had been then accomplished, and great difficulties had been overcome, by a rare combination of mechanical, chemical, and mathematical skill and knowledge, in the preparation for mounting the great telescope of six feet diameter and fifty-four feet focal length, yet much remained to be done : but I am quite sure that the members of the Association will learn with unmixed satisfaction, that the noble Lord has entirely succeeded in his great undertaking—that the great telescope has already made its essay, and that its performance is in every way satisfactory, and that he proposes to communicate to the Mathematical and Physical Section in the course of the present meeting, an account of the process which he has followed in the preparation and polishing of his mirrors, and of the expedients which he has adopted for bringing under the most perfect control the movement of the vast masses with which he has had to deal.

It is now more than sixty years since the elder Herschel, by the superior optical and space-penetrating powers of his telescope, began a brilliant career of astronomical discovery ; and the interest which the construction of his great forty-foot reflector, a memorable monument of his perseverance, genius and skill, excited amongst men of science of that period, was not, if possible, less intense than what now attaches to the similar enterprise of the noble Lord : nor were the expectations which were thus raised disappointed by the result ; for though this noble instrument was generally reserved for the great and state occasions of astronomy only, requiring too great an expenditure of time and labour to be producible for the daily business of observation, yet the very first time it was directed to the heavens it discovered the 7th satellite of Saturn, and contributed in no inconsiderable degree to the more complete development of those views of the construction of the heavens (I use his own expression) which his cotemporaries never sufficiently appreciated, but which present and future ages will probably regard as the most durable monument of his fame. It is no derogation to the claims of this great discoverer that art and knowledge are progrèssive, or that a successor should have arisen, who, following in the track which he has pointed out, should bring a considerable zeal and more ample means to prepare the way for another great epoch in the history of astronomical discovery ; and I know that I do not misstate the sentiments of the accomplished philosopher who has succeeded to his name and honours, and who throughout his life has laboured with such exemplary filial piety, and such distinguished success, in the development and extension of his father's views, that no one takes a deeper or a more lively interest in the success of this noble enterprise, and no one rejoices more sincerely in the vast prospects of discovery which it opens.

Gentlemen, it is now thirteen years since the British Association held its first meeting in this ancient and venerable city, under the presidency of the noble Earl, who is always the first to offer his services in the promotion of the interests of science, and of every good and useful undertaking ; it was in this city that its constitution and laws were first organized, and it is by these laws, for which we are chiefly indebted to the excellent sense and judgment of Mr. William Vernon Harcourt, with very unimportant changes, the Association has continued to be governed. It is in conformity with the spirit of these laws, that we should seek to co-operate, and not to interfere with other Societies which have pursuits and objects in common with our own ; that we should claim no right to the publication of memoirs which are read at our Sections, and which are not prepared at our request ; that we should endeavour to concentrate and direct the influence of the public opinion of men engaged or interested in the pursuits of science, in favour of such objects, and such objects only, as they agree in considering important for its interests ; and above all, that we should avail ourselves of the advantages which we possess in the extensive range of our operations, and in our independence of particular societies and particular localities, of organizing and carrying into effect well-digested systems of co-operative labour.

Again, our meetings were also designed to bring men who are engaged in common pursuits, and interested in common objects, into closer union and more frequent intercourse with each other ; to encourage the more humble and less generally known cultivators of science, by bringing their labours under the notice of those men who are best able to appreciate and to give currency to their value ; to enable our members to see, in the places which they visited, where all establishments are, with rare exceptions, most liberally thrown open to their inspection, whatever is most remarkable in the production of their manufactures, in the principles and construction of their machinery, in their collections connected with art or the natural sciences, in their public establishments for charity or education, in the moral or physical condition of their inhabitants, or whatever other objects their neighbourhood presents, which may interest the antiquary, the geologist, or the lover of picturesque scenery;—we may venture to add, likewise, that they were designed for purposes of social as well as of philosophical recreation, a consideration of no small importance with men whose occupations are frequently monotonous and laborious, and such as require the occasional stimulus of change and variety.

In accordance with these views, we have visited in their turn the most remarkable localities of the three kingdoms, including the universities of England, Scotland, and Ireland, the great seats of our manufacturing industry, the great marts of our commerce. It is not necessary for me to speak of the success which has marked our progress. The numbers who have attended our meetings have been always large, and sometimes so great as to embarrass our proceedings, from the difficulty of finding adequate rooms to receive them. The communications which have come under the notice of our several Sections, have continued to increase in importance and interest, more particularly since the great co-operative inquiries of our body have come into full operation. We have been enabled, by the application of our funds, to complete some, and to forward many, scientific enterprises, of the highest importance and value; and I see no reason to apprehend that the future meetings of the British Association will not continue to advance in scientific interest, or will cease to exercise a most powerful influence in originating and promoting scientific labours which will equally tend to promote the interests of knowledge and the honour of the empire.

The founders of the British Association justly conceived, that men of different shades of political opinion or religious belief would rejoice in the opportunities which such meetings would afford them of coming together, as it were, upon neutral ground, where their natural warfare would, for a season at least, be suspended, and no sounds be heard but those of peace. They felt persuaded that the softening influence of mutual intercourse would tend to soothe the bitterness of party strife, and would expose to view points of contact and union, even between those whom circumstances had most violently estranged from each other, and show them that the features of the monsters of their apprehension were not so repulsive as their imaginations or intolerance had drawn them. I know that there are some zealots who are ready to denounce the interchange of the commonest charities of life with those whose opinions, however honestly and conscientiously formed, they believe to be unfounded or dangerous; but there is a wide and fundamental distinction between the condemnation of opinions and of the persons who hold them; and though I should be far from advocating that spurious and false liberality which should assume, that in the selection of friends, or even in the ordinary intercourse of society, there should be a total suppression of all that is distinctive, both of profession and of opinion, yet there are numberless occasions on which we can neither notice them or know of their existence, without the violation of all those rules of courtesy and good-breeding, which the most scrupulous regard for the integrity of our Christian profession and for the best interests of mankind would equally teach us to practise and to respect.

It was with a view of securing this neutral ground as the exclusive basis of their operations, that the founders of the Association cautiously guarded against any extension of its boundaries which might tend to admit new claimants to its occupation. They did not attempt to define the precise limits at which accurate science terminates and speculation begins, but they endeavoured to keep sufficiently within them to prevent the intrusion of discussions which might disturb the peace of our body or even endanger its existence; experience has fully established the wisdom of this law, and the absolute necessity of a rigid adherence to its provisions.

In returning to the scene of our first labours, the place of our nativity, but not of our childhood, it becomes us, as grateful children, to acknowledge our filial obligations to our founders. A reference to the list of these presents, as might be expected after a lapse of thirteen years, some very distinguished names, who have been lost to science. In their number we find the name of Mr. W. Smith, who first received at our meetings the ample recognition of the value of those original and unaided researches, which entitle him to be considered as the father of English Geology; of Dr. Lloyd, Provost of Trinity College, Dublin, the father of our excellent colleague Prof. Lloyd, and the founder of that truly illustrious school of accurate science in that university, which has given to the world a Robinson, a Hamilton, and a M'Culloch; of Sir J. Robison, who inherited from his father, the well-known Prof. Robison, his taste for science and its application to the arts ; of Dr. Henry, one of our most distinguished chemists, and only second in reputation to his fellow townsman, Dr. Dalton, whose very recent loss we have occasion to deplore, and whose name, under such circumstances, it would be unbecoming to mention in merely a passing notice.

Dr. Dalton was one of that vigorous race of Cumberland yeomen amongst whom are sometimes found the most simple and primitive habits and manners combined with no inconsiderable literary or scientific attainments. From teaching a school as a boy in his native village of Eaglesfield, near Cockermouth, we find him at a subsequent period similarly engaged at Kendal, where he had the society and assistance of Gough, the blind philosopher, and a man of very remarkable powers, and of other persons of congenial tastes with his own. In 1793, when in his 23rd year, he became Professor of Mathematics and Natural Philosophy in the New College in Mosley Street, Manchester, a situation which he continued to hold for a period of six years, and until the establishment was removed to this city, when he became a private teacher of the same subjects, occupying for the purposes of study and instruction the lower rooms of the Literary and Philosophical Society in George Street, rarely quitting the scene of his tranquil and unambitious labours, beyond an annual visit to his native mountains, with a joint view to health and meteorological observations. He made his first appearance as an author in a volume of 'Meteorological Observations and Essays,' which he published in 1793, and which contains the germ of many of his subsequent speculations and discoveries; and his first views of the Atomic Theory, which must for ever render his name memorable as one of the great founders of chemical philosophy, were suggested to him during his examination of olefiant gas and carburetted hydrogen gas. His theory was noticed in lectures which he delivered at Manchester in 1803 and 1804, and much more explicitly in lectures delivered at Edinburgh and Glasgow ; it was, however, first made generally known to the world in Dr. Thomson's Chemistry in 1807, and was briefly noticed in his own system of chemistry which appeared in the following year; and though his claims to this great generalization were subject to some disputes both at home and abroad, yet in a very short time both the doctrine and its author were acknowledged and recognized by Wollaston, Davy, Berzelius, and all the great chemists in Europe. But the atomic theory is not the only great contribution to chemical science which we owe to Dalton; he discovered cotemporaneously with Gay-Lussac, with whom many of his researches run parallel, the important general law of the expansion of gases—that for equal increments of temperature, all gases expand by the same portion of their bulk, being about three-eighths in proceeding from the temperatures of freezing and boiling water. His contributions to meteorology were also of the most important kind. Dr. Dalton was not a man of what are commonly called brilliant talents, but of a singularly clear understanding and plain practical good sense; his approaches to the formation of his theories were slow and deliberate, where every step of his induction was made the object of long-continued and persevering thought; but his convictions were based upon the true principles of inductive philosophy, and when once formed, were boldly advanced and steadily maintained. It is always unsafe, and perhaps unwise to speculate upon the amount of good fortune which is connected with the time and circumstances of any great discovery, with some view to detract from the credit of its author; and it has been contended that Wollaston, Berzelius and others, were already in the track which would naturally lead to this great generalization; but it has been frequently and justly remarked, that if philosophy be a lottery, those only who play well are ever observed to draw its prizes.

"Though Dalton's great discovery," says the historian of the Inductive Sciences, "was soon generally employed, and universally spoken of with admiration, it did not bring to him anything but barren praise, and he continued in his humble employment when his fame had filled Europe, and his name become a household word in the laboratory. After some years he was appointed a corresponding member of the Institute of France, which may be considered as a European recognition of the importance of what he had done; and in 1826, two medals for the encouragement of science having been placed at the disposal of the Royal Society by the King, one of them was assigned to Dalton, 'for his development of the atomic theory.' In 1833, at the meeting of the British Association for the advancement of Science, which was held at Cambridge, it was announced that the King had bestowed upon him a pension of 150*l.*; at the preceding meeting at Oxford, that University had conferred the degree of Doctor of Laws, a step the more remarkable since he belonged to the sect of Quakers. At all the meetings of the British Association he has been present, and has always been surrounded with the reverence and admiration of all who feel any sympathy with the progress of science. May he long remain among us, thus to remind us of the vast advance which chemistry owes to him." This was written in 1837, the year in which a severe attack of paralysis seriously impaired his powers; he last appeared among us at Manchester, when he received the respectful homage of the distinguished foreigners and others who were there assembled; he died on the 27th of July last, in the 78th year of his age. His funeral, which was public, was attended by all classes of the inhabitants, who felt justly proud of being the fellow-citizens of so distinguished a man.

I now proceed to notice some other topics which are connected with the distribution of the funds, and the general conduct of the affairs of the Association. Like other bodies, we have had our periods of financial prosperity and decline; and like other bodies, we have sometimes drawn more freely upon our resources, than their permanent prospects would justify. The statement which will be read to you by our excellent treasurer, (see *ante*, p. 882) will show, that during the last year our capital has been reduced: the great number of life subscribers, which at one time rapidly augmented our resources, has a natural and necessary tendency to reduce our annual subscriptions, at every succeeding meeting; and some alterations in the conditions of admission for those inhabitants of the places where we are received, who are not likely to follow the farther movements of the Association, have not tended to swell our receipts, though rendered, at the time, necessary by the great numbers who crowded inconveniently some of our sectional meetings.

I regret to find that some currency has been given to the notion,—which I believe to be altogether erroneous and unfounded,—that a large excess of income above our necessary expenditure, which may be devoted to the promotion of scientific researches and scientific objects, is essential to the successful working of the business of the Association, and that our movements should therefore be always directed to those places, where our coffers are most likely to be filled. It may be quite true, that the objects of the Association are most certainly and effectually promoted by going to those places which are likely to attract the largest concourse of scientific visitors, and that our finances thus become immediately dependent upon our general prosperity: but if, under any circumstances, these two principles of selection should ever come into collision with each other, there can be no doubt to which of them our preference should be given; and though I think we should very imperfectly accomplish the design of our institution, if our tour of visits did not comprehend, in their turn, every important district in the three kingdoms, yet it would be not only unadvisable, but dangerous even to our very existence, if we fixed our standard in any locality which did not present a reasonable prospect of procuring the requisite scientific supplies, and of not sustaining the union, as well as vigorous action of the body to which we belong.

There are some great principles which have generally governed the Committee of Recommendations, in recommending, and the General Committee in confirming grants of money for scientific objects, which I hope we shall never lose sight of: that no part of our funds should ever be applied to defray the personal expenses, or to compensate the loss of time or labour of any of our members, in making researches or experiments, even when they are undertaken or made at the request of the Association: that they should not be granted for the general promotion of this or that branch of science, but for specific and well-defined objects: that in no case should they be applied to make a bookselling or other speculation remunerative, which would otherwise not be so: that the results of inquiries which are carried on, partly or wholly at our charge, should so far belong to the Association, as to secure its just claim to the scientific credit, which they are calculated to confer. I know that some of these principles have been, in some instances, partially departed from, under very pressing and peculiar circumstances; but the remembrance of the discussions to which some claims of this nature have given rise, which it was improper to grant, but difficult and painful to refuse, has tended to confirm my own impression, not merely of the wisdom of these important rules, but likewise the almost imperative necessity of adhering to them.

It was at the memorable meeting of the Association at Newcastle, a period of great financial prosperity, that it was resolved to recommend and to undertake a very extensive system of astronomical reductions and catalogues: the first was the republication, under a greatly extended and much more complete form, of the Astronomical Society's catalogue, exhibiting the latest and most accurate results of astronomical observation, reduced to a common epoch, with the permanent co-efficients for their reduction, which the Nautical Almanac does not supply. The second was the reduction of all the stars in the Histoire Céleste of Lalande, nearly 47,000 in number, containing the most complete record which existed 60 years ago of the results of observation, and affording, therefore, an interval of time so considerable, as to enable astronomers, by comparing them with their positions as assigned by modern observations, to determine their proper motions and other minute changes, almost independently of the errors of observation : a third, was a similar reduction of stars in the Cœlum Stelli-ferum Australe, of Lacaille, 8700 in number, which had assumed an unusual degree of importance from the recently completed survey of the southern hemisphere by Sir John Herschel, and the establishment of observatories at Paramatta and the Cape.

Another work of still greater expense and labour, was the reduction and publication of the Planetary and Lunar Observations at Greenwich, from the time of Bradley downwards, which was undertaken by the Government at the earnest application of a committee of the Association appointed for that purpose, and acting in conjunction with the Royal Society. This great undertaking has been nearly brought to a conclusion under the systematic and vigilant superintendence of the Astronomer-Royal.

The publication of these works must form a great epoch in astronomy; and though the expense to which it has exposed the Association has been very considerable, and will amount, when completed, to nearly 3000*l.*, yet it cannot fail to prove a durable monument of the salutary influence which it has exercised upon the progress of science.

The catalogues of Lacaille and Lalande are to be printed and published, as is already known to you, at the expense of Her Majesty's Government; and the first, which has been prepared under the superintendence of Prof. Henderson, is nearly complete. The catalogue of Lalande and the British Association catalogue, were placed under the superintendence of Mr. Francis Baily; and in referring to the irreparable loss, which astronomical science has so recently sustained by his death, I should neither do justice to my own feelings nor to yours, if I did not detain you for a few moments.

Mr. Baily was, undoubtedly, one of the most remarkable men of his time. It was only in 1825, that he retired from the Stock Exchange, with an ample fortune, and with a high character for integrity and liberality; but his subsequent career almost entirely belongs to astronomy, and is one of almost unexampled activity and usefulness. The Astronomical Society was organized by him, and throughout life he was the most considerable contributor to its Memoirs. The catalogue of the Astronomical Society, the funds for which were contributed by several of its members, was entirely formed under his superintendence, and we are chiefly indebted to his exertions for the more ample development which the Nautical Almanac has latterly received, and which has added so much to its usefulness. There was no experimental research connected with the more accurate determinations of astronomy or physical science, which was not generally intrusted to his care: the publication of the Pendulum Observations of Capt. Foster, which were confided to him by the Admiralty, gave occasion to the most complete series of pendulum experiments which had ever been made, in which many most important defects of those instruments were first brought to light: he undertook the repetition of the celebrated experiment of Mr. Cavendish, and his discussion of the whole question, which forms a recent volume of 'The Memoirs of the Astronomical Society,' is a monument not less honourable to his patience, perseverance, and skill, than to the sagacity and accuracy of the great philosopher who first devised it. He had also undertaken, for the Commission of Weights and Measures, the conduct of the process for forming the new standard yard from the scale of the Astronomical Society, which he had himself compared with the imperial standard yard, destroyed in the burning of the Houses of Parliament. He published, at the request of the Admiralty, the correspondence and catalogue of Flamsteed; he presented to the Astronomical Society, a volume containing the catalogues of Ptolemy, Ulugh, Beigh, Tycho Brahe, Hevelius and Halley, with learned prefaces and critical notes, showing their relations to each other and to later catalogues. His preface and introduction to the British Association Catalogue, and more than one-third of the catalogue itself are printed ; and from the critical examination of the authorities, upon which his assumed positions rest, and from the careful distribution of the stars which are selected (more than 8000 in number) in those parts of the heavens where they are likely to be most useful to observers as points of comparison, it promises to be the most important contribution to the cause of practical astronomy, which has been made in later times. The whole of the stars of the Histoire Céleste are reduced, and a considerable portion (more than one-fifth) printed, but it is not known whether the introductory matter which, from him, would have been so important, was prepared at the time of his death. Mr. Baily was the author of the best Treatise on Life Annuities and Insurances which has yet appeared, as well as of several other publications on the same subject. His knowledge of the mathematicians of the English school was very sound and complete, though he had never mastered the more refined resources of modern analysis. In the discussion of the Cavendish and other experiments, he freely availed himself of the assistance of the Astronomer-Royal, and Mr. De Morgan, in the investigation of formulæ which were above his reach ; but he always applied them in a manner which showed that he thoroughly understood their principle, and was fully able to incorporate them with his own researches. In the midst of these various labours, (and the list, which I have given of them, ample as it is, comprehends but a small part of their number), Mr. Baily never seemed to be particularly busy or occupied : he entered freely into Society, entertaining his scientific as well as mercantile friends at his own house with great hospitality. He was rarely absent from the numerous scientific meetings of committees and councils—he was a member of all of them,—which absorb so large a portion of the disposable leisure of men of science in London : but if a work or inquiry was referred to him, it was generally completed in a time which would seem hardly sufficient for other men to make the preliminary investigation. Most of this was undoubtedly owing to his admirable habits of system and order: to his always doing one thing at one time: to his clear and precise estimate of the extent of his own powers. Though he always wrote clearly and well, he never wrote ambitiously: and though he almost always accomplished what he undertook, he never affected to execute or to appear to execute, what was beyond his powers. This was the true secret of his great success, and of his wonderful fertility; and it would be difficult to refer to a more instructive example of what may be effected by practical good sense, systematic order, and steady perseverance.

It was the same meeting at Newcastle which gave rise to the design for the greatest combined scientific operation in which the Association has ever been engaged for the extension of our knowledge of the laws of magnetism and meteorology.

It was the publication of Colonel Sabine's Report on the variations of the magnetic intensity at different points of the earth's surface, and the map which accompanied it, which appeared in our volume for 1837, which first enabled the celebrated Gauss to assign provisionally the co-efficients of his series for expressing the magnetic elements; the proper data of theory are the values of the magnetic elements, at given points uniformly and systematically distributed over the surface of the earth: and it was for the purpose of supplying the acknowledged deficiency of these data, and of determining the laws which regulated the movements of this most subtle and mysterious element, the Association was induced to appoint a committee to apply, in conjunction with the Royal Society, to her Majesty's Government, to make a magnetical survey of the highest accessible altitudes of the Antarctic seas, and to institute fixed magnetical and meteorological observatories at St. Helena, the Cape, Hobarton, and Toronto, in conjunction with a normal establishment at Greenwich, and in connexion with a great number of others on the continent of Europe; where systematic and simultaneous observations could be made which would embrace not only the phenomena of magnetism, but those of meteorology also: it is not necessary to add that the application was promptly acceded to. The views and labours of the framers of this magnificent scientific operation ; the brilliant prospects of discovery which it opened ; the noble spirit of co-operation which it evoked in every part of the civilized world, were alluded to in terms so eloquent and so just, in the opening address of Mr. W. Vernon Harcourt, when occupying this chair at Birmingham [see *Athen.* No. 618], that I should do little justice to them if I employed any terms but his own, and I must content myself with simply referring to them. Much of what was then anticipated, has been accomplished, much is in progress, and much remains to be done ; but the results which have already been obtained have more than justified our most sanguine expectations.

Sir James Ross has returned without the loss of a man, without a seaman on the sick list, after passing three summers in the Antarctic seas, and after making a series of geographical discoveries of the most interesting and important nature, and proving, in the language of the address to which I have just referred, that for a man, whose mind embraces the high views of the philosopher with the intrepidity of the sailor, no danger, no difficulty, no inconvenience could damp his ardour or arrest his progress, even in those regions where

> Stern famine guards the solitary coast,
> And winter barricades the realms of frost.

The scientific results of the first two years of this remarkable voyage have been discussed and published by Col. Sabine in his contributions to Terrestrial Magnetism in the Transactions of the Royal Society ; and they are neither few nor unimportant. They have shown that observations of declination, dip, and intensity, the three magnetic elements, may be made at sea with as much accuracy as on land, and that they present fewer anomalies from local and disturbing causes : that the effects of the ship's iron are entirely due to induced magnetism, including two species of it,—one instantaneous, coincident with and superadded to the earth's magnetism, and the other a polarity retained for a shorter or longer period, and transferable therefore during its operation by the ship's motion from one point of space to another : that in both cases they may be completely eliminated by the observations and formulæ which mathematicians have proposed for that purpose : no intensity greater than 2.1 was observed ; and the magnetic lines of equal declination, dip, and intensity, were found to differ greatly from those laid down in Gauss's Theoretical Map, the northern and southern hemispheres possessing much greater resemblance to each other than was indicated by that primary and necessarily imperfect essay of the theory.

The range of Sir James Ross's observations extends over more than three-fourths of the navigable parts of the southern seas; and you will learn with pleasure that one of his most efficient officers, Lieut. Moore, has been despatched from the Cape, with a vessel under his command, to complete the remainder.

Nothing could exhibit in a more striking light the completeness of the organization and discipline of the system of magnetic observations, than the observations of the great magnetic storm on the 25th of September 1841; it was an event for which no preparation could be made, and which no existing theory could predict; yet so vigilant and unremitting was the watch which was kept, that we find it observed through nearly its whole extent, and its leading circumstances recorded, at Greenwich, and in many of the observatories on the continent of Europe, at Toronto, St. Helena, the Cape, Hobarton, and at Trevandrum in Travancore; for even the mediatized princes of the East have established observatories, as not an unbecoming appendage to the splendour of their courts. Some of the observations of this remarkable phenomenon, and of many others (twenty-seven in number) of a similar nature, have been discussed, with great care and detail, by Colonel Sabine, and lead to very remarkable conclusions. They are not absolutely simultaneous at distant stations, nor do they present even the same succession of phases, as at first anticipated; and it is the disturbances of the higher order only which can be considered as universal. They are modified by season as well as by place, the influence of winter, in one hemisphere, and of summer in the other, on the same storm, being clearly distinguishable from each other. The simultaneous movements in Europe and America have been observed to take place sometimes in opposite, and sometimes in the same directions, as if the disturbing cause was in one case situated between these continents, and in the other not; and we may reasonably expect, when our observatories are furnished with magnetometers of sufficient sensibility to indicate instantaneously the effects of disturbing causes, that the localities in which they originate may be determined : these are very remarkable conclusions, and well calculated to show the advantages of combined observations ; for such inquiries, observations in a single and independent locality, however carefully they may be made, are absolutely valueless.

The meteorological observations are made, in all these observatories, on the same system, and with equal care with those of magnetism ; they embrace the mean quantities, diurnal and annual variations of the temperature, pressure of the atmosphere, tension of the aqueous vapour, the direction and force of the wind, with every extraordinary departure from the normal condition of these elements, as well as auroral and other phenomena. It would be premature to speak of the conclusions which are likely to be deduced from these observations, inasmuch as the reduction and comparison of them have hitherto made little progress, but they cannot fail to be highly important ; for it is by the comparison of observations such as these, made with reference to a definite system, with instruments constructed upon a common principle, and carefully compared with each other, and by such means alone, that the science of meteorology can be not only advanced but founded. Our philosophical records have for the last century been deluged with meteorological observations ; but they have been made with instruments adapted to no common principle, compared with no common standard, having reference to no station but their own, and even, with respect to it, possessing no sufficient continuity and system ; they have been for the most part desultory, independent, and consequently worthless. It would be unjust to the merits of one of the most assiduous and useful of our members, Mr. Snow Harris, if I did not call your attention, in connexion with this subject, to his Reports, included in the reports of our twelfth meeting, [*Athen.* No. 769, see also No. 827,] on the meteorological observations at Plymouth, made by him or under his superintendence, with the aid of a very moderate expenditure of the funds of the Association. They comprehend observations of the thermometer, at every hour of the day and night, during ten years, and of the barometer and anemometer, during five years, carefully reduced and tabulated, and their mean results *cynographed* or projected in curves. Nothing can exceed the clearness with which the march of the diurnal changes is exhibited in these results; and I sincerely hope that means may be found for printing them in such a form as may secure to them their permanent authority and value.

Another discussion of the meteorological observations made at sixty-nine stations at the equinoxes and solstices in the years 1835, 1836, 1837, and 1838, which have been reduced, and cynographed with great care and delicacy by Mr. Birt, at the expense of the Association, forms the subject of a Report by Sir J. Herschel, [*Athen.* No. 828,] in the volume of our Reports for the present year, and may be considered as a prelude, on a small scale, of the species of analysis which the results of the great system of observations now in progress should hereafter undergo. The inferences which are drawn from the examination of the changes of atmospheric pressure, with more especial reference to the European group of stations only, are in the highest degree instructive and valuable.

The system of magnetic observatories was at first designed to continue for three years only, but was subsequently extended to the lst of January 1846: for it was found that the first triennial period had almost elapsed before the instruments were prepared, or the observers instructed in their duties, or conveyed to their stations. The extent also of co-operation increased beyond all previous expectation: six observatories were established, under the zealous direction of M. Kupffer, in different parts of the vast empire of Russia,—the only country, let me add, which has established a permanent physical observatory. The American government instituted three others at Boston, Philadelphia, and Washington; two were established by the East India Company at Simla and Sincapore; from every part of Europe, and even from Algiers, offers of co-operation were made. But will the work, which has thus been undertaken with such vast prospects, be accomplished before the termination of the second triennial period? or is it not probable that the very discussion of the observations will suggest new topics of inquiry, or more delicate methods of observation? If the march of the diurnal, monthly, and annual movements of the needle be sufficiently determined, will its secular movements be equally well known? In other words, shall we have laid the foundations of the theory, which may even imperfectly approximate to the theory of gravitation, in the accuracy and universality of its predictions? It is with reference to these important questions, and the expediency of continuing the observations for another triennial term, that M. Kupffer, too, addressed a letter to Col. Sabine, suggesting the propriety of summoning a Magnetic Congress, to be held at the next meeting of the British Association, and at which himself, Gauss, Humboldt, Plana, Hansteen, Arogo, Lamont, Kairll, Bache, Quetelet, and all other persons who had taken a leading part in conducting, organizing or forwarding these observations, should be invited to attend. This proposal has been for some time under the anxious consideration of your Committee of Magnetism, consisting of Sir J. Herschel, Col. Sabine, the Astronomer Royal, Dr. Lloyd, the Master of Trinity College, and myself; and it will be for the General Committee, before we separate, to decide upon the answer which must be given. I think I may venture to say, that there would be but one feeling of pride and satisfaction, at seeing amongst us the whole or any considerable number of these celebrated men; and there can be little doubt but that, whatever be the place at which you may agree to hold your next meeting, they will experience a reception befitting the dignity of these great representatives of the scientific world.

It is quite true, that the preparations for such a meeting would impose upon your Committee of Magnetism, and more especially upon Col. Sabine, no small degree of labour. Reports must be received from all the stations, up to the latest period, of the state of the observations; their most prominent results must be analyzed and compared, and communicated as extensively as possible amongst the different members of the congress, so as to put them in possession of the facts upon which their decision should be founded. Great as is our reliance upon the activity and zeal of Col. Sabine, and of his admirable co-adjutor Lieut. Riddell, perfect as is his acquaintance with every step of an inquiry, with the organization and conduct of which he and Prof. Lloyd have had the principal share, I fear that he would require greater means than his present establishment could furnish, to meet the pressure of such overwhelming duties.

If it should be the opinion of such a congress that it was expedient to continue the observations for another triennial period, and if such an opinion were accompanied by an exposition of the grounds upon which it was founded, there can be little doubt that there is not a government in the civilized world which would not readily acquiesce in a recommendation which was supported by such authority.

The last volume of our Transactions is rich in Reports on Natural Science, and more especially in those departments of it which have an important bearing on Geology: such is Prof. Forbes's Report 'On the distribution of the Mollusca and Radiata of the Ægean Sea,' [*Athen.* No. 830] with particular reference to the successive zones of depth which are characterized by distinctive forms of animal life and the relation between existing and extinct species. You will, I am sure, be rejoiced to hear that Her Majesty's Government has not only secured the services of its author, in connexion with the geological survey, but has most liberally undertaken, upon the application of the Council, to defray the expense of printing the very interesting work upon which this Report is founded. The report of Mr. Thompson, of Belfast, on an analogous branch of the Fauna of Ireland, is remarkable for the minuteness and fulness of the information which it conveys. Prof. Owen has continued his report on the British Fossil Mammalia, which was begun in the preceding volume, and towards procuring materials for which a contribution was made from the funds of the Association. I regret to find that a class of Reports on the recent progress and existing state of different branches of science, which occupied so large a portion of our earlier volumes, and which conferred upon them so great a value, have been almost entirely discontinued: if the authors of these Reports could find leisure to add to them an appendix, containing the history of the advances made in those branches of science during the last decad of years, they would confer an important benefit on all persons engaged in scientific inquiries.

The history of the sciences must ever require these periodical revisions of their state and progress, if men continue to press forward in the true spirit of philosophy to advance the boundaries of knowledge; for though there may be impassable boundaries of human knowledge, there is only one great and all-wise Being, with whom all knowledge is perfect, who can say, "Thus far shalt thou go, and no further." The indolent speculator on the history of the sciences may indulge in an expression of regret that the true system of the universe is known, that the law of gravitation is discovered, that the problem of the three bodies is solved, and that the rich mine of discovery is exhausted, and that there remain no rich masses of ore in its veins to make the fortune and fame of those who find them : but it is in the midst of this dream of hopelessness and despondency that he is startled from time to time by the report of some great discovery—a Davy has decomposed the alkalies ; a Dalton has discovered, and a Berzelius has completely developed the law of definite proportions ; a Herschel has extended the law of gravitation to the remotest discoverable bodies of the universe ; and a Gauss has brought the complicated and embarrassing phenomena of terrestrial magnetism under the dominion of analysis : and so it will ever continue to be whilst knowledge advances, the highest generalizations of one age becoming the elementary truths of the next. But whilst we are taking part in this great march of science and civilization, whilst we are endeavouring to augment the great mass of intellectual wealth which is accumulating around us, splendid as may be the triumphs of science or art which we are achieving, let us never presume to think that we are either exhausting the riches or approaching the terms of those treasures which are behind. Still less let us imagine that the feeble efforts of our philosophy will ever tend to modify the most trivial and insignificant—if aught can be termed trivial and insignificant, which He has sanctioned—of those arrangements which the great Author of Nature has appointed for the moral or material government of the universe. Far different are the lessons which He taught us, by the revelation of His will, whether expressed in His word or impressed on His works. It is in a humble and reverent spirit that we should approach the fountain of all knowledge ; and it is in a humble and reverent spirit that we should seek to drink of the living waters which ever flow from it.

Mr. John Taylor read the Treasurer's account, already printed in the Report of the General Committee [*ante*, p. 882]. Prof. Phillips read the programme of proceedings.

The Marquis of Northampton moved, and Earl Fitzwilliam seconded, thanks to the President, which being carried by acclamation, the meeting adjourned to Wednesday, Oct 2.

(To be continued.)

The late Mr. William Griffith.

In a letter from Dr. Horsfield, we learn that on the intelligence of Mr. Griffith's death reaching Lord Auckland, his Lordship in a most kind and benevolent manner prepared without delay from his own recollection, a Memoir of this distinguished man, which was incorporated with the address read at the Anniversary Meeting of the Royal Asiatic Society on the 17th May, and excited much interest.

We mention the circumstance as highly creditable to, and characteristic of, the generous character and disposition of Lord Auckland who, we may remark, was one of Mr. Griffith's kindest friends while in India, and the first to appreciate rightly his eminent merits, both as a scientific man, and public servant.

The memoir adverted to has been in the most kind and condescending manner presented to us since the above notice was written. It is as follows.

Extract from the Anniversary Address to the Royal Asiatic Society of Great Britain and Ireland, May 17, 1845.

Mr. Griffith was one of the most accomplished botanists of our day; with the most accurate and extensive acquisition of learning in his department, he combined a spirit of activity and enterprise, such as has been rarely equalled, great talents, and a very remarkable power of labor, arrangement, and application. He was born in the year 1810, and was educated at the London University. He went out to India, as an assistant-surgeon on the Madras Establishment, where he arrived on the 24th September, 1832, and was shortly afterwards selected by the Bengal Government for the examination of the botany of the Tenasserim Provinces. He was, in 1835, deputed to Assam, with Dr. M'Clelland, for the purpose of assisting Dr. Wallich in his inspection of the growth of the Tea plant in Assam, and from thence he proceeded, in company with Dr. Bayfield, to the then unexplored tracts which lie between Suddiya and Ava, upon the extreme frontier of our Eastern territory. In 1837 he accompanied Captain Pemberton on his mission to the wild countries of Boutan. In 1839 he was sent, with the army of the Indus, to prosecute inquiries into the botany of Affghanistan. In 1841 he was appointed to the medical duties of Malacca. In 1842, upon Dr. Wallich's absence, from illness, at the Cape, he was intrusted with the superintendence of the Botanical Garden at Calcutta, and with the duties of the Botanical Professor in the Medical College; and, upon the return of Dr. Wallich from the Cape, he resumed his place at Malacca, where he was seized with disease of the liver, and died at the early age of thirty-four, having already acquired a distinguished reputation,—having in every capacity in which he served the Government received its approbation and its thanks; and having given a promise of such further services to botanical science as few have had either the opportunity or the talent of affording. In all his varied and extensive journeys, his courage and his energy never failed him; whether in the jungles of Assam, or the hills of Affghanistan, he still pursued his researches, undeterred by danger, either of disease or of violence; and if disabled, as he was more than once by fever and debility, his first convalescence found him ever ready for fresh exertions. He had thus, by the application of extraordinary powers of observation, and in perquisitions extending through the vast regions which have been enumerated, formed large and valuable collections, and brought together materials for a great botanical work; and he looked with impatience to a period of repose for compiling a Scientific Flora of India, when he sunk under his last fatal illness. Perhaps no more impressive picture of the energy of this extraordinary man, and of his devotion to his favorite science, can be given than that which may be drawn from the following extracts from a letter which was dictated by him on his death-bed, and addressed to Dr. M'Clelland:—

"I write this by deputy, being seriously ill of hepatitis; the attack has been very severe, and the treatment necessarily active, so that I am reduced to an extreme state of weakness. Although my adviser does not despair, still the issue is doubtful, and under this impression I commence a few lines to you on business.

"Mrs. Griffith (supposing the result of this illness to be fatal to me) will bring up with her all the collections at Malacca, and they being added to those at the export warehouse, and all having been previously cleaned and packed, I leave to you to present to Government, for the Honorable Court of Directors, to be sent home without any delay. As you know the trouble I have taken with these collections, and the hopes I had of making them subservient to a general scientific Flora of India, I need not impress on you how much I am interested in their proper disposal, and their being brought properly before the scientific public; and I would say the same regarding my drawings and manuscripts, which will accompany my wife to Calcutta, should it so happen that I leave her.

" In all the plans which I have consigned to your execution, both regarding my wife and collections, I am confident your own feelings will prompt you to every exertion on my account. Asking God's blessing on you and your wife, I bid you good bye.

" Thus far," continues Dr. Moorhead, his medical attendant, " was written at Mr. Griffith's dictation, but I grieve to say the fatal result came to pass yesterday evening, Sunday, 9th February, at half-past seven o'clock."

Memoranda on the above by Dr. M'Clelland.—" To the above details, furnished by Dr. Moorhead, I may remark that Mr. Griffith's constitution for the last two or three years seemed greatly shattered, his energies alone remaining unchanged. Exposure during his former journeys and travels laid the seeds of his fatal malady in his constitution, while his anxiety about his pursuits and his zeal increased; he became care-worn and haggard in his looks, often complaining of anomalous symptoms marked by an extreme rapidity of pulse, in consequence of which he had left off wine for some years past, and was obliged to observe great care and attention in his diet. In Affghanistan he was very nearly carried off by fever, to which he had been subject on his former travels in Assam. No government ever had a more devoted or zealous servant, and I impute much of the evil consequences to his health, to his attempting more than the means at his disposal enabled him to accomplish with justice to himself."

Although Mr. Griffith's researches were directed primarily to Botany, he neglected no opportunity, during his visits to various parts of India, of attending also to other departments of Natural History. Of his zeal and success in Zoology, the collections which he made afford abundant proof; they consist chiefly of mammalia, birds, fishes, and insects. While attached to the army of the Indus, he made, on account of Government, large collections of mammalia and birds, which have been transmitted to the Honourable Court of Directors, and which constitute a valuable addition to the museum at the India House. In mammalogy he collected a considerable number of the smaller animals of Affghanistan, among which are several new to science; but his ornithological collections are more extensive, having brought together about six hundred specimens, not only from the route of the army, but from several separate excursions to the ranges of mountains north of Cabul. Besides the discovery of a considerable number of new species, the interest of these collections consists in their affording, perhaps, the most extensive and instructive illustration of the geographical distribution of the several species of birds found in India, which has as yet been attempted.

Mr. Griffith has also been zealous and successful as a collector of the fresh water fishes of India, during his various travels: the importance and extent of these is detailed in a paper on the subject, printed in the second volume of the Calcutta Journal of Natural History; and some of his discoveries in Entomology have been communicated to the public by the Rev. F. W. Hope, in the eighteenth volume of the Transactions of the Linnæan Society of London.

He was most especially remarkable for the philosophical spirit in which he invariably prosecuted his researches, and for the patience with which he watched the most minute phenomena which appeared to him connected with the subjects of his investigation. Some of his published papers, especially those on Vegetable Impregnation, and the Progressive Development of Organs, have never been excelled and rarely equalled.

The merits of this accomplished naturalist and devoted labourer in the field of scientific discovery, were appreciated and fostered by the noble President of this Society while at the head of the Government of India, and it is to his Lordship's kindness that the Society are indebted for some of the most interesting parts of the foregoing communication. His loss has also been recently noticed in terms of deep regret by the present Governor-General, Sir Henry Hardinge, in his Excellency's Address at the annual distribution of honors and prizes at the Bengal Medical College. *

As it is understood that the whole of the valuable materials prepared and collected by Mr. Griffith are consigned to the Directors of the East India Company, the most confident hopes may be cherished that the expectations of the scientific world will not be disappointed of the full benefit which they are calculated and were intended by him to confer on botanical and zoological knowledge, and that the irreparable loss entailed on his widow by his early death, and the sudden extinction of all those hopes of fortune, honour, and reward, which his extensive knowledge and indomitable energy were so well calculated to raise, will meet with such alleviation as, to the enlightened liberality of the Honourable Court, the great value of his labours, and the forlorn and ill-provided state of his widow and family, may be considered to merit.

In connection with the above we may remark, that the late Mr. Griffith's private collections, MSS. and drawings are now exposed at the Export Warehouse in Tank Square, preparatory to making them over to the Government. The MSS. consist of eight or ten bound volumes of botanical researches, affording also full details of the natural productions and objects of cultivation, scenery, people, &c. throughout the lines of his extensive travels, together with the heights and position of Passes and principal places, fixed by direct barometrical and astronomical observations made by himself.

His botanical researches as exhibited in these Manuscripts, are of the most extensive and important nature, so much so that their publication will constitute a new era in botanical science, and confer immortal honor on the public body or the individuals by whom it may be brought about. .

Besides the vols. of MSS. above adverted to, there are at least as many volumes more of scientific Botanical drawings and descriptions of plants contained in the Herbarium, or met with in his travels.

In addition to his Will, dated 31st Oct. 1844, and his letter on his death-bed, quoted in the foregoing memoir, he has also left the following instructions written on the same melancholy occasion, regarding the disposal of his collections and papers.

All specimens of whatsoever sort or kind to be presented and given to the Honorable E. I. Company. Vide documents enumerated below.

1st. A list of Collections left at the Export Warehouse, Calcutta.

2nd. Collections now in my possession at Malacca, no list made out.

All Drawings and Manuscripts relating to Natural History also to become the property of the Hon. E. I. C.

The collections are arranged chiefly from the countries in which they were made, and each bundle is, or was, marked outside with the natural family and the name of the country. To almost each of the collections there is a rough volume of MSS. containing numbers tallying with the No. marked on the specimens: many other tickets also give besides additional localities, (thus all the localities of the Affghan collections, many of the duplicates of which have lately been sent to Mr. Lemann,) are to be found in the Affghan MSS. and an additional vol. of MSS. gives barometrical heights and astronomical observations; so are Cossiah, Assam, Bootan, Mergui, Mishmay, &c. but there are some general collections which were commenced to be arranged generally, and some of the Natural Families in which I was most interested, as "Ternstromiaceæ," "Ericiniæ," "Menispermaceæ," "Vaccinieæ," are also arranged generally; in such cases the locality of each species of specimen is marked in pencil on the cover of the sheet. The collections of *Mosses and Ferns* duplicated (the last of which are now with Sir Wm. Hooker and Mr. Lemann) are among the most complete, and I trust that the Honorable Court will allow them to be placed for elucidation with Sir Wm. Hooker and Mr. Wm. Harvey, of Trinity College, Dublin.

The collections in spirits of wine in five boxes, contain flowers and often fruit of almost all the interesting kinds; this was done to afford good opportunities of studying them afterwards, as the constant travelling during which most of the collections were made, did not admit of their minute examination in the fresh state; they will require fresh spirits, and in most cases fresh arrangement.

Although the MSS. and drawings are a good deal confused, often rubbed and torn, yet, as they relate to India plants examined in their fresh state, a little trouble will, I hope, enable them to prove of use, for which intent I beg to recommend them to be arranged by Mr. Lemann, Sir Wm. Hooker, Mr. Bentham.

I recommend myself to Mr. Brown, Dr. Lindley, Mr. R. H. Solly, Dr. Wight, Mr. Bentham, Dr. Martius, Dr. Nees Von Esenbeck, Mons. Decaisne, trusting that they have considered my exertions creditable, and that they will assist in favour of my reputation as a scientific Botanist, which I had hoped a longer life would have enabled me to establish. * * * * * * * * * *

To the Honourable Court, I humbly recommend my three unmarried sisters, Apollonia, Matilda and Letitia, left in very indifferent circumstances, trusting that the Honourable Court will be pleased to grant them some degree of favour in continuance of their unvaried patronage of Indian Botanical pursuits, and their constant condescension to me.

Signed, by the Medical officer who attended him,

William Morehead,

Madras Medical Service.

With the following views of Dr. Wight on the subject, we conclude our remarks for the present.

Extract of letter from R. Wight, *Madras Medical Service, to* J. McClelland, *Assistant Surgeon, Bengal Service, dated Coimbatore,* 31*st March,* 1845.

" You ask me what I think whether to continue or drop the journal, my idea is that the surest plan by far for ensuring the publication of Griffith's papers is to continue the publication of the journal, each number of which may be made to absorb a portion of them, and when they are all published, it may then become a matter of consideration as to its further continuance. But in the mean time it is an object to preserve the fruits of one of the ablest and most untiring labourers that ever embarked in the culture of the fields of science. To obtain that certainty, and without the risk of loss to his friends and family, the journal affords a medium. True it may not give them so wide a circulation as they merit, but still they are secured in the first instance, and if it is found that there is a demand for them after, his whole works could be collected and printed in a distinct form.

"My advice then is, decidedly to continue the journal for the present, even in the event of its being found that the whole of his papers are not intrusted to our joint care. If they are, there can be no doubt, in my mind, of the propriety of carrying on the journal; if they are not, then between Mr. Gardner and myself we will easily keep up its character as a Botanical periodical for at least another year. If the papers are intrusted to our care, immediate steps must be taken for their publication, as things of that kind don't keep; other labourers are at work in the same field, and unless we at once commence the business, much will be lost. Acting on this principle, you ought, if we are to have the publication of them, to advertise in the forthcoming number, that the publication of the late Mr. Griffith's papers is to be immediately commenced in the journal, and will be continued through successive numbers until the whole are printed. As regards my co-operation, use my name in the way you may think most advantageous with reference to both the journal and MSS.

"Should further funds be wanted, I shall gladly help to the extent of 500 rupees in successive portions, or in getting his drawings printed."

From the same, dated Ootacamond, 4th May 1845. "I shall endeavour in this letter to keep as close to the subject as possible in offering suggestions for carrying out what was evidently to the last uppermost in his mind; namely, the proper preservation and disposal of his collections, manuscripts, and drawings, so as to insure their being rendered as much as possible available to the advancement of the science of which he was such an enlightened and untiring cultivator. Towards accomplishing the wish expressed in the following words of his last letter, preservation is the first and grand object, publicity the next. 'As you know the trouble I have taken with these collections, and the hopes I had of making them subservient to a general scientific flora of India, I need not press on you, how much I am interested in their proper disposal, and their being properly brought before the scientific public; and I would say the same regarding my drawings and manuscripts.' The two can easily be combined by printing and publishing the whole in this country before sending a single line or drawing out of it. Once published, they are at once and for ever safe, and doubtless they will be as carefully edited here as they could be in Europe, where those of his friends who are really qualified to do them justice, and would be willing for his sake to take the trouble, have for the most part occupation enough of their own.

"But even supposing we had an Editor in Europe ready to engage in the duty, which is far from being the case now that Mr. Solly is no more, still as nearly all his labours have reference to Indian Botany, his papers to my mind, ought beyond all question to be first published in India, especially under the existence of a proper medium for doing so in your journal, which is very fairly supported by the public.

"On these grounds I am strongly of opinion that an immediate application should be made to Government for them, for the purpose of publication in the journal previous to their being sent to Europe, of course giving the assurance that the utmost care will be taken of the originals, and that no pains will be spared towards having them as correctly edited as circumstances will permit. It could at the same time be urged, as you observe, that publication here does not interfere with ultimate publication in Europe in a more perfect form, accompanied with all his already published papers; nor do I think that previous publication in the Journal would at all interfere with the sale of a complete edition of all his works, should such be afterwards published. I confess I feel most anxious for the publication of his Botanical papers in this country, under the impression that, should they ever find their way to the India House before publication, the labours of the greatest Botanist that ever set foot in India will be lost, perhaps for ever swamped, amidst the accumulated records of hundreds of men, that are daily being added to their stores.

" So much for Papers, now to Collections. For the same reasons that it would be wrong to send home his papers uncopied, I think it would be equally wrong to send his collections in mass.

" A complete set of his specimens ought, I think, to be retained for India. This might be easily accomplished, as requiring, on the part of the person making the division, no Botanical knowledge; all that is wanted on his part being to lay aside one or two specimens from each paper, with copies of whatever remarks or labels might be attached to the original specimens, so as to make the set kept back for India, as nearly a facsimile of the other as possible. Thi ssuggestion I think it would be judicious to bring to the notice of Government, both with a view to guard against accidents, and to preserve to India a lasting and proud memorial of the most Herculean labours of one of the most philosophical and industrious men that ever traversed its soil for the purpose of investigating its natural products."

Dr. Wight next alludes to the probability of the collection being for a time useless. "But still these should not stand in the way of doing justice to the memory of Griffith, were it for no other purpose than to act as a stimulus to those who come after. And to ensure this work being done in the best manner, I will willingly give my services to seeing it executed, first by securing the specimens against the attacks of insects through the application of a spirituous solution of corrosive sublimate, and then having them properly glued down on suitable paper for reference, at the same time arranging them as correctly as my limited time and imperfect knowledge of many of them will permit, into their proper natural orders and genera.

" So prepared, they might then be deposited among the Garden collections for the benefit of all future Indian Botanists who might wish to consult them. The cost of thus securing them against all contingencies, would not I dare say, exclusive of the paper which would come from the stores, exceed one hundred rupees, while the cases to contain them might be provided for probably at 100 or 150 rupees more, and to Indian Botanists such a collection must be well worth ten times the amount. I would urge the adoption of this plan, for the sake of all future Indian Botanists."

" From the same, dated Coimbatore, 20th June 1845. " As you remark, I do not see that poor Griffith's final instructions regarding the disposal of his collections in any way affects the suggestions I offered in my last, which I trust the Government will sanction; should such prove the case, then the first thing to be done is, to subject the whole collection to the preserving effects of a solution of corrosive sublimate in spirits, which effectually destroys any insects, whether hatched or in ova, for should the eggs afterwards hatch, the insect is immediately poisoned. For this purpose a solution of the strength of about one and half or two drachms to the pint is required, to which two or three drachms of camphor is added. It is applied with any sort of brush, the flowers being carefully soaked, as being most liable to attack, and the most important part of the specimen. A watery solution might answer equally well, except that it does not dry so soon, and by wetting the paper is apt to cause mouldiness. A considerable collection of Malacca plants he sent me just before leaving Calcutta, is now undergoing that operation preparatory to their being glued down for incorporation with my general Herbarium.

" Having been thus guarded from the depredations of insects, the next operation is, to have them glued down on suitable paper, and disposed in cases. The paper that I would recommend for the purpose, both as being cheap and generally quite large enough, is that known under the name of Laid Demy. The size is, as near as I can guess, about sixteen by ten inches; it is rather small for some plants, but large enough for 99 out of the 100, and the larger ones can be folded a little or cut to fit the paper.

" The collections," he says, " are all grouped into natural orders following Lindley's arrangement. These groups should be most carefully preserved, enclosed in wrapper sheets (the specimens are put on half sheets) each marked on the left hand corner with the name and number of the order as given in Lindley, and finally arranged in boxes according to the numerical series, which greatly facilitates consultation, and the number at once points out the proper place of each packet in the series.

" I have been thus particular on the supposition that you, not being a Botanist, might never have had an opportunity of studying the economy of a Herbarium. My own Herbarium occupies twenty boxes, each three feet high within, and wide enough to contain two series, somewhat in that form with double doors for facility of access. It would be more economical to make the box six feet high at once; mine are adapted for travelling; that would be a standing one never to be moved. The location of such a collection is of some moment; I would suggest that it form an appendage of the Medical College.

"If sent to the Garden, it might chance some few years hence to suffer the fate of Roxburgh's, which would be bad indeed. Supposing these suggestions adopted, it then follows, as a matter of course, that the MSS. referring to each family should be printed, and two or three copies deposited in the Herbarium for the information of Botanists, who might at any time have to consult the plants. The easy way of course to provide these would be, by printing the whole in a continuous series in the Journal, and striking off twenty or thirty spare copies to serve for both this country and Europe. The originals could then without risk be sent for deposit in the Museum of the India House. The expense of these arrangements would not exceed a few hundred rupees, and, to say the least, is a mark of respect which the Government owes to one of its most zealous servants,—a more zealous one, I am convinced, it never had. But leaving that out of the question, I apprehend that, as being, of all existing Governments, that which has, throughout, been the most steady and consistent promoter of science and scientific men, it owes it to itself for its own credit; as there does not at this moment exist a single doubt, in the mind of any competent living Botanist, that Griffith at the time of his death stood second only on the list of truly philosophical Botanists, exclusive of his high attainments in other branches of natural science; and to fail in giving every facility to the posthumous diffusion of his unpublished labours, would be a blot on its hitherto untarnished character as the most liberal supporter of Indian science, the more indefensible too, as all that is required could be accomplished at so small a cost, that I would myself, at my own charge, undertake all I have suggested should be done, had the donation been made to me in place of to the Government. These suggestions though hurriedly written, are not the off-hand reflections of the moment, but the result of much consideration of the subject to which they refer; such being the case, you are quite at liberty to make use of my sentiments, should you think them in any way calculated to advance the object in which we both feel so deeply interested, namely, that we at least, in common I believe with the whole Botanical world, 'consider his exertions creditable,' and are most anxious to assist in establishing on the broadest basis his reputation 'as a scientific Botanist,' which, unhappily for natural science, he has not lived to do for himself."

Extract of the Will of the late Dr. Griffith, *dated* 30*th Oct.* 1844.

"I give and bequeath all my Books to John McClelland, Assistant Surgeon in the East India Company's Service on their Bengal Establishment, and Robert Wight, Surgeon in the said East India Company's Service on their Madras Establishment, equally between them, and to the survivor of them; and I direct my Executors to put them or him in possession of every such Books as soon as conveniently may be after my decease: I leave, give, and bequeath all my collections of Natural History and all my Manuscripts and Drawings unto the Honourable the East India Company, and all my Microscopes to Richard Horsman Solly, Esq. number Forty-eight, Great Ormond Street, Bloomsbury, London; and direct my Executors to put the said East India Company and the said Richard Horsman Solly in possession of the same, respectively, as soon as conveniently may be after my decease.

"(Signed) William Griffith."

THE

CALCUTTA JOURNAL

OF

NATURAL HISTORY.

The Natural History, the Diseases, the Medical Practice, and the Materia Medica of the Aborigines of Brazil, by Dr. Von Martius. *Translated by* John Macpherson, M. D., *Assistant Surgeon.*

[Concluded from page 176.]

III.—*Practice of Medicine, and Materia Medica.*

Medical Practice.

This is entirely in the hands of a few men and in some instances old women, who push themselves forward by their powers of observation, and by their cunning. The doctor, called in the Tupi language Pajé, is always a man of influence in the tribe, and perhaps treated with more respect than the physician meets with at the present day in Europe. He belongs to no corporation, to no particular class ; he is not doctor, is not even master of arts : he does not acquire by any diploma his right to cure, yet his influence is very great, in fact unlimited. The stolidity and ignorance of the multitude, and his own activity, make him pass with it for a more elevated nature. He is often at once the oracle and the lawgiver of the whole tribe. He is employed to help and counsel in its most various concerns, and the more his appearance is improved by age, experience, or dignity of person, the greater confidence does he inspire among his patients. He is commonly priest, prophet, and soothsayer, and in addition worker of miracles, and magician.* If we compare him with the Schaman of the Asiatic nomadic races, we are struck with the great resemblance between them, and they may both be considered measures of the intellectual and moral condition of the people among whom they work. There can be no doubt that in Schamanism the last fragments of a gone-by civilization, the scattered traces of a higher knowledge of nature, are concealed. This is also the case with the medicine of the Brazilian savage. In the agency of the Pajé, superstition and credulity, cleverness and deep knowledge are combined. He believes in the remedies and the curative processes which he prescribes, and is so far as scientific as the European physician : but like many of our profession, he does not despise various formalities, which calculated for the superstition of the blind multitude, are supposed to aid the uncertainty of the remedy, by the increased confidence which they inspire in the patient.

The traces of ruin and of decay which are so striking in all the social and political relations, in all the mental endowments of the red men, the wonderful confusion which meets us in their languages, which have separated from each other to an endless extent,—are all to be found in their medical knowledge. We can therefore regard the individual facts which refer to the practice or theory of these men, only as isolated and confused traditions, as the last remains of a knowledge of nature, the foundations of which lie deeper than that violent and uncertain catastrophe, of whose historical date and cause we do not in the present state of our

* See Catlin's account of the N. American medicine-men.—*Tr.*

ethnographical and historical knowledge have the least indication. But this very circumstance is calculated to increase the interest of the European scientific world in that past condition of medical knowledge.

I must before going further remark, that the Indian doctor applies in every case remedies, which to him as well as to his patient are secrets. Of the nature of these remedies, of the way in which they operate and cure, he has certainly no clear or distinct idea. On this account his practice is always undecided, his prognosis is uncertain, and the result doubtful. He is not led to the choice of a particular remedy by any regular induction from well-known analogies, by the result of experience, or even by any truth, which he may have learnt by tradition. He possesses but a confused idea of the efficacy of remedies, or perhaps only a superstitious dread of their power. We therefore consider the medical practice of the Indian to be a kind of magic.

Magic or Sorcery.

We may assume that the essence of magic is an attempt to call in the aid of unknown powers (spirits), to enclose them within certain bounds (the Magic circle), to keep them there, and to apply them. This must happen by severing the unknown power from its usual connections, and by fixing and isolating it within a certain circle. The sorcerer therefore, who tries to overturn the order of nature, appears as a being inimical and hostile to the established state of things, and as having a certain power to disturb it; accordingly he is an object of fear to many, and is often banished from the social union. It was in this point of view that I always regarded the processes of the Indian Pajé, and if we are to appreciate truly the savage as physician and worker of miracles, we must descend to the depths of those black processes, in which man works with diabolical powers, whose source is unknown to him. Of all the Indians with whom I have spoken on this subject, old Tubixaba, of the race of Coërunas, was far the most intelligent. When I asked him one evening how he cured his patients, he made an indecent gesture and grinned. Not satisfied with this symbol, I desired further information from him; he then drew, to my no small astonishment, a circle in the sand, and in it a *lingam*, and said solemnly, "All Magic comes from lust or from hate, and by means of them also do we cure."

This speech gave me much to think of. If I do not err, it points in reality at the source of all magic, as well as of the medicine of the Indians.* Their practice is a blind use of unknown hidden powers of nature, at present devoid of every particle of scientific knowledge, and in many Pajés united without doubt with a confused idea that they have procured this crude simple knowledge by unlawful means. For I must not conceal, that the knowledge of the Pajés, whether male or female, is often imparted to their pupils only as the price of prostitution.

Thus, secret arts, lust, and unnatural crimes are connected together: by such means is magic propagated, and by such will it continue to be so among uncivilized tribes, until they become chaste.

The pupil usually retires into the desert with the Pajé for some time; and when an adept, receives some substance, such as a root, a piece of animal or vegetable charcoal, the claw of an animal, &c. as a sign of being initiated. This he always carries about with him as an amulet, and he expects from it direct aid in cases of sickness. But the pupil does not always receive it directly from his master. He is sometimes informed of it by a dream or a vision. The Indians attach great weight to many dreams, and to visions. They not only boast of having seen the evil spirit, but of having had converse with him. I need scarcely remark that a belief in the existence of such a spirit is at the bottom of all these

* We can scarcely agree with our author.—*Tr.*

ideas. This unfriendly being is represented under various traditional forms in different tribes. Honour is not paid, but superstitious dread attaches to him: and the Pajés avail themselves of this. Many tribes have a whole series of evil spirits, others only one. I need not enter further into these mythological ideas of the Indians; but cannot help remarking that in the Old Testament, magic is represented as conversation with false gods.

The idea of impurity also enters largely into the magic of the savage: every thing excreted from the body is considered by the Indian to be impure, and therefore applicable to the foul arts. Certain excretions, such as the spittle and the urine of the magician, play an important part in many cases. The first is considered to be healing and soothing, and as such is applied externally; the last is used internally, as an excitant, and also as an emetic. The air deeply expired from the chest of the Pajé, has an enlivening power and virtue against disease, attributed to it.* Connected with these ideas is the belief of the Indians in the injurious influence of women, at the catamenial period, and in the purity and expiatory power of young children and of virgins.

But, as Gregorio remarked, hatred also plays an important part in the magical and curative processes of the Indians. The multitude commonly fears the Pajé as a dealer in the black arts, and there is a degree of hostility in their mutual relations. Among the Abipones the doctor is called plainly Keebit, *i. e.* devil, as they identify the two. The doctor is as it were a necessary evil to the tribe.† When a patient is once taken under treatment, he falls exclusively into his power. By means of certain magical words or symbols, the doctor gets complete possession of the mind of the patient, withdraws him from all sympathy with his ordinary relations, and places him completely under the influence of his dark

* This reminds us of certain mesmerist *Pajés* among white men.—*Tr.*

† He is occasionally so to the village in more civilized lands.—*Tr.*

practices. The Indian sick accordingly, when once given over to the Pajé, are no longer nursed by their own families; indeed are often not even allowed to be visited by them.

This strange idea of the power of the doctor over his patient is confirmed by the belief that every disease is caused by some dark, hostile power or by sorcery. However obvious the causes of an ailment may be, the patient and his friends never ascribe it to them, but to some personally unfriendly power. The patient is looked on as bewitched; and if he has any known enemies, they are immediately considered to be to blame for the illness. If no enemy is known, then suspicion falls on some individual who may have happened to incur the dislike of the patient or of his friends. This individual is not unfrequently made away with secretly, or openly killed, for the purpose of counteracting the malignant influence.

The deaths of the doctors themselves, and after them of old women having the reputation of witchcraft, are oftenest sought for the purpose of curing the patient. Among the Paiaquas on the Paraguay, the Pajé in whose hands a patient dies, pays the forfeit of his life.* The Chiquitos sometimes put to death the wife of a man who has been long ill, thinking that she has been the cause of his illness. Among the Abipones too the belief is universal, that every disease is the consequence of the black art of another party. If the patient dies, the Pajé tears out his heart and tongue, boils them, and gives them to the house-dog to eat, being satisfied that this will occasion the death of the person who caused the malady. In doing so, he acts on the belief that the enemy of the dead man had made his dog eat some game killed by himself. Missionaries have told me of innumerable instances, in which the long-continued illness especially of a man of importance, has caused a whole round of most revolting murders. Thus does the mind of the Indian sink into these dark abysses of hate and superstition.

* Surely we are not to credit this.—*Tr.*

In truth, nothing is more calculated to place in a favorable point of view our enlightened investigations of nature, than this deficiency of judgment, this darkening of the understanding. We too practise magic, we also in handling the numberless natural powers which surround us, are magicians and sorcerers. The philosopher who from a solution of sulphate of copper deposits a new copper plate on the silvered model, or makes a daguerrotype picture in a second, is a magician in the sense which I have just described. He isolates and confines within the narrow magical circle of his acquired knowledge, physical powers, whose nature is unknown to him.

But if we compare this condition of modern science with that intricate combination of cunning and superstition, which the medical procedures of the Indian Pajé present, we are struck by the strange fact, that in the history of the intellectual progress of the civilized world, each step in advance has been the consequence of a preceding one, and that we know exactly how we have attained our present eminence—while it is quite inexplicable, and is likely to remain so, why the American population which is as old as we are, has not been able to reach any degree of certainty or of clearness.

To develop from psychological, historical and natural-historical grounds, how the present state of intellectual darkness has been produced, and has spread over so large a portion of the world, would be a most interesting, at the same time a most difficult attempt. But the only lantern to guide us in the inquiry, must be the conviction that the present state of American gloom is a darkening of what was brighter, a secondary condition. As a contribution towards the solving of this interesting problem, I shall now give an account of some of the more general ideas and of the imperfectly observed facts which we find prevailing in the natural, historical and medical knowledge of the Indian.

Physics.

The pervading idea of all the Indians' knowledge of physical phænomena, is that of the *unity of nature.* All terrestrial things hang together, every individual thing is connected with another. In accordance with this belief is the conviction that there is something mysterious in the mutual action of bodies, and one step more brings us to the belief that every thing terrestrial is in intimate connexion with something supernatural. However savage or sensual the Indian may be, this belief is always found in him; but it assumes the character of a blind superstition, because the individual facts want connecting links. Nor has the Pajé applied it to any generalisation of facts; besides his relation to the multitude is in reality esoteric.

According to the views of the Indian all the works of nature, and the actions of the elements are supposed to aid or to injure each other. Hence he deduces the idea of a good and beneficent, and of an injurious principle. He sees these principles everywhere, he embodies them, and peoples woods and deserts with evil unfriendly natures. Thus he becomes a spirit-seer, and all inimical powers, especially poisonous and rapacious animals, are to him only manifestations of the evil principle. These again he tries to counteract by other friendly powers, and thus he is led to the use of specifics. Indeed he knows of no remedies, but special ones. He has not got the length of any large or general views of the nature of their action; as he recognises a dualism between what is friendly, and what is inimical, so also does he believe the sexes to be antagonistic in their effects. Thus he considers woman to be injurious and poisonous to man. Under certain circumstances a woman is positive poison: for instance, he avoids the vicinity of a woman during the catamenial period, especially if he has been wounded or bitten by a poisonous animal, or if he has been attacked by fever.* The common practice among the Indians of staying at home during the lying-in season in place of the woman, and apart from her, has its foundation in a similar idea. The child at the breast is according to them so intimately connected with the mother, that even a pinch of snuff taken by the father, is supposed to be injurious to it.

From the same idea they will not in some diseases, eat the female of an animal, for instance, of the ape or tapir. In cold fevers again, they consider the penis and the clitoris of the ape, powerful remedies. Their belief in the antagonistic powers of different animals, has led them to various other remedies, of the positive efficacy of which I cannot talk from personal experience, but of which I have very often heard favorable accounts. Thus they observe that poisonous snakes will never remain in the neighbourhood of the Dasy-procta, (like a hare). Whenever they are bitten, they try to procure a living Dasy-procta. They scarify the wound with its teeth, and drink their warm blood. The like is the case with the Falco Degener, the Palamedea Cornuta (a large water bird, bigger than a goose,) and the Parra Jacana (a marsh bird). They pound the beaks, the talons and the spurs of these birds, and drink them in an infusion of certain herbs.

They also believe in similar antagonisms and friendships between certain plants, between plants and animals, and between different parts of the same plant. The Anana bush is supposed to have a friendship for the rattle-snake; the Mandiocca plant an enmity against the Mais. The prejudicial effects of the poisonous Mandiocca root are supposed to be removed by the expressed juice of the Mais.

The belief in the injurious influence of certain stars on man, especially when he is sick, is universally prevalent. The most injurious effects are ascribed to the moon, especially at new and full moon. Moon-light, striking directly on wounds,

* She is also in certain cases a counter-poison.

is believed to make them worse. Clear star-light is also unfavourable to diseases, while a clouded sky is beneficial. Sun-light too impedes the cure, especially of wounds and fevers, and therefore patients suffering from them must await their recovery in the darkest corner of their huts. They almost always augur bad results from winds, especially when during the dry season they blow from the south, or during the rainy from the west.

The Indians divide the year by the seasons, when certain trees ripen their fruits, or the turtles lay their eggs in the sand-islands. From these fixed epochs they reckon the changes of their simple existence, the pregnancies of their wives, and the maturity of their women. These terrestrial changes concern them more than the celestial ones. A few only of the most observant take any interest in the latter, and in relation to the periodicity of diseases, the phases of the moon, the time of high-water, and of spring and ebb tides, are the only points to which they attend.

Perhaps the most interesting chapter in the crude and limited physics of these neglected men, is that of their cosmogonies and geogonies. Here we find the most traces of a former knowledge of nature, although much debased and very confused. I must however only allude to them, as they have nothing to do with the immediate object of these remarks, and are rather connected with their religious myths.

Anatomy.

Their anatomy is in its merest infancy. They never examine a body systematically. They only dismember and disembowel the bodies of their enemies. They know the large organs in the interior of the cavities, and have for them distinct, and often very descriptive names. Thus, in the Tupi language, the lungs are called, 'pya bubui,' *i. e.* floating liver; the stomach is called, 'cigiê-assu,' *i. e.* larger; the intestines, 'cigiê-merîm,' *i. e.* smaller stomach. They have not of course studied the convolutions of the brain, but they show that they have a good general idea of its structure, by the imitations of the brain with coloured cotton, which some races, such as the Mauhés and Mandrucûs, make to adorn the dried skulls of the enemies slain by them. I may add, that they cut up game with much precision and quickness.

Pathology and Nosology.

We should be surprised if the Indians had made any progress in these sciences, in which results are only obtained by enlightened, rational, and unprejudiced observation. The Indian distinguishes but few conditions of disease, and has only a dark notion of its essential symptoms. He knows a certain condition, which he names fever. He describes a few kinds of cutaneous eruptions, which he knows by certain sensible characters. He has for certain affections separate names, commonly derived from the part of the body in which they are observed. But his special nosology is confined within these narrow limits.

In like manner he has only the crudest notions about the nature of disease, and its exciting and predisposing causes. Besides having a confused idea of the periodicity of certain diseases being connected with the phases of the moon, he seeks for the causes of his ailments in the circumstances which appear nearest to him, in the wind, the sun, the rain, certain foods, infection by white men or negroes, the former of whom he dreads especially as conveying certain diseases. He next looks to witchcraft as a cause: in fact, the Indian in his idea of nature thinks exclusively of a selfish strife of opposing beings and powers. He says in the sense of Aristotle, Ἡ φύσις δαιμονία, ἀλλ' οὐ θεία: "Nature is dæmoniacal, not divine."

This belief in the dæmoniacal nature of disease develops another one, which has at times some influence on the treatment and management of the sick. If the cause of his ailments be not quite plain, the patient is regarded as a changed being, who does not continue in his former relation to his family, but is possessed, and fallen under the influence of unfriendly powers. He is subject to a necessity from which he can be released only by his own powers, assisted perhaps by friendly natural ones. His vicinity has something ill-omened,* and dangerous in it. He is therefore left as much as possible to himself. This idea has laid the foundation of the panic which seizes an Indian population on the appearance of an epidemic, and which leads to the great mortality attending it.

IV.—*Materia Medica.*

It is in the Materia Medica and Pharmakognosy of the Indian that we find the strongest traces of a former knowledge. In every age man follows analogy, and thence the system of *signatures* in medicine, of which traces are so common among the Brazilians. But it requires a higher degree of knowledge to escape from these loose analogies, and to study the powers of remedies according to the principles of induction. The remedies of the Indians require to be fully examined by scientific physicians, and it is wonderful to how small an extent this has been done, although the small number of educated doctors who have gone to Brazil may be some excuse for it. As it is, the traditions of the Indians have remained almost exclusively in the hands of barbers, self-taught men, and old women, and have never had their truth thoroughly investigated.

Throughout the whole of America the belief in the cold or hot action of certain substances on the body is universally prevalent. Thus, bananas and rice are hot, Mandiocca flour and the Carás (Caladium) are cold kinds of food. In like manner their remedies are divided into hot and cold. This is however probably an idea of Arabic medicine imported from the Spanish peninsula, where to this day it is very generally entertained.

* *Uncanny* is the best translation we know for *Unheimlich.—Tr.*

Articles from the Animal kingdom.

The Materia Medica of the Indians is remarkable for the number of substances belonging to the animal kingdom which it includes. All the excretions of the system are to him either impure and injurious, or pure, and under certain circumstances beneficial. He carefully buries human excrement the moment it is passed. He attributes unclean properties to the mucus of the nose, to the blood, and to the wax of the ear, and employs them in preparing magical charms. The spittle and the urine are also remedies in use. The secretion of Tyson's glands is used as a cure for the bites of serpents and of large ants. He has a great idea of the healing virtues of certain bones, beaks, talons, and spurs, of particular birds, (such as Parra, Palamedea). He wears the teeth of the ounce, the claws of the great ant-eater, the hinge of the large river oysters, &c., not only as ornaments, but as amulets on his neck and his extremities. Thus, he considers wearing the teeth of the crocodile a prophylactic against the bite of poisonous serpents, and their powdered teeth are drunk in water as cures for snake bites. From the musky smelling fat, which is found in two bags under the neck of the crocodile, he prepares a powerful remedy against the bite of the rattlesnake. He cuts portions of the horns of the Cervus Paludosus into four cornered pieces of the length of an inch, heats them till they are almost burnt, and then drops in the crocodile fat. The pieces of bone thus prepared are bound over snake bites, from which they are supposed to extract all the poison. Many people of European origin have faith in this remedy, and wear it on their persons. The Indians employ the Bezoar of the deer as a most excellent medicine in complaints of the digestive organs, and the green fat of the crocodile is used as a liniment in rheumatism, and as a salve for wounds. The pounded flesh of the black toad (Spix Ranæ) split and roasted at the fire, is a protective against witchcraft, and is used by women in labour to render childbirth easier. The pounded fangs of the rattle-snake are ordered for unhealthy ulcers; a live rattle-snake has its head and tail cut off, and is then boiled down with a young fowl, long enough to make the whole of the consistence of a jelly. This mess drunk off at once is supposed to heal chronic eruptions and syphilis. Large ants, we have already said, are eaten preserved in Mandiocca flour; they are also considered to be good stimulants in weakness of digestion. The dried and powdered stomach of the crocodile is used for gravel; the small stones sometimes found in the intestines of that animal are used for several diseases, and the powder of dried fish-bone, for strangury. They stuff into carious teeth calcined tiger claws to cure the pain. The pounded rattle of the rattle-snake when introduced into hollow teeth, is said to make them drop out. Bezoars are often brought down from the mountains of Peru to the plains of the Amazon, and are in high repute in stomach complaints. They ascribe great efficacy in discussing swellings and improving the unhealthy granulations of wounds, to various animal fats. This is not only the case with the fat of the crocodile, but also with that of ounces, deer, cattle and fowls. They apply it directly over the part, either unmixed, or rubbed up with various kinds of charcoal or with herbs. The fat of the ounce is applied for the especial purpose of destroying worms in unclean wounds. In sciatica they apply the freshly stripped skin of dogs over the part.

Articles from the Mineral kingdom.

Few minerals are used by the Indian in medicine. The Amazon-stone, or Lapis Nephriticus, (whose country is still a riddle, like the history of various pieces of stone, which shaped and polished with more or less skill are common over the whole of South America) is worn as an amulet: but the Indians, whom I questioned, knew nothing of its use in diseases of the kidneys, sciatica, gout, and rheumatism, in all which Jesuits have in former centuries ascribed to it great efficacy. Pumice, which sometimes floats down the rivers from the Peruvian frontier, is on account of this strange property, prized and used as an amulet. Of other minerals employed as medicines, the Indian is acquainted only with salt and lithomarge; both are used in complaints of the abdomen. He has no idea however of preparing them by any chemical process. He does not even know how to separate potash from the ashes of the wood which he burns. Thus the low state of Indian medicine is abundantly proved by the absence of any one chemical substance in his materia medica.

Articles from the Vegetable kingdom.

The remedies used by the Pajés are chiefly gathered fresh from the tree or shrub, and applied in the form of infusions or of decoction internally, and of cataplasms and washes externally. He does not think of more recondite preparations. Their plants thus applied have often the most powerful effects, and are frequently substituted with advantage for the chemical preparations of Europe. These superficial applications amply deserve the attention of rational medicine. The effects of fomentations with fresh leaves on bad ulcers, which I sometimes witnessed, were so rapid and powerful as to border on the wonderful. Thus the sores on the feet of a negro of my party, which I had for months been trying in vain to cure, were healed by a mess of fresh squeezed leaves of Julocroton phagedænicus, one of the Euphorbiaceæ. I saw equally favorable results follow the application of poultices of Euphorbia cotinifolia to large warts, and of the fomentation made of the squeezed flowers of the water-plant Pistia occidentalis to the old ulcers of a boy. Poultices of the American cotton plant also often heal old unhealthy ulcers with wonderful quickness. In fractures of the extremities the Indians on the Rio Doce use the squeezed plant of the Tillandsia recurvata, which is made into a poultice with the half-hatched eggs of the Crax alector. Bernard Gomes recommends a similar application after the reduction of fractures. The fresh juices of many Aroideæ, whose powers would be lost by any other mode of exhibition, are especially powerful; the roots and mucus of various plants, such as Canna glauca, and Alpinia pacoseroca, are, when fresh gathered, applied usefully to heal and clean wounds. The root of Piper nodulosum, in taste resembling a pepper-corn, is also chewed to relieve tooth-ache. The fresh expressed juice of the leaf-buds of the Cecropia, which is rich in mucus and in salts, is used as a cooling application in inflammations of the eye, and in erysipelas. I have in like manner seen a West Indian cure syphilitic ulcers of the penis by bathing them in the fluid of an unripe cocoa-nut. Possibly this method may have been introduced by the Portuguese. I find that it was in use in the East Indies one hundred and fifty years ago.* (Meister; Orientalisch-Indianischer Kunst und Lustgärtner. Dresden, 1642, p. 53.)

But for internal use the Indians employ only fresh plants. Their store-house is the wood. They are never in the habit of gathering any plant and of drying it for future use. The only vegetable substance that I have seen preserved by them, is the rind of the Strychnos gujanensis and toxifera, whose extract is the chief ingredient in the poison of their arrows.

Experience has taught even the ignorant Indian, that his remedial plants are not equally efficacious at every season of the year. Thus an Indian declared to me, that the cold infusion of the wood of Echites cuarnosi, is only efficacious against gastric fever, when the shrub has passed from the flowering to the seeding period. In lands, in which the plants afford substances of such very different qualities, it becomes a matter of importance to mark the stage of development at which they yield them, and there is a wide field for observation

* The common sources of information make no mention of this use of it at the present day.—*Tr.*

still open. The number of plants used by the Pajé is very considerable. I have myself seen many of them in their hands: of others I have heard accounts given, and I am convinced that several hundreds are in use. Many of them are no doubt of little value, and the knowledge of others may not have been communicated to Europeans, from the feeling of distrust with which those new-comers are regarded by them. In my "Systema Materiæ Medicæ Brasiliensis," 470 plants belonging to 226 families are described; but many of these have been introduced by Europeans. If we now enquire into the sources from which the Indians have derived the knowledge of so many plants, it becomes plain that many must have been introduced at a period antecedent to historical records. They are the cultivated or mythical plants.

Mythical Plants.

Almost every tribe has a more or less complete myth or story, about the way in which useful plants have been applied to household or to medicinal purposes. In short, their plants are like the most important ones of the Old World, various kinds of grain, the olive, the vine, the bean and other kinds of vegetables: as we do not know their original country, so are we ignorant of that of the analogous ones of the New World. No sure tradition tells how the Indians first discovered them, or when or how they first used them. They are never found wild, except where here and there they have run so, and are every where cultivated with much care. We must therefore assume regarding these plants, that like the European cultivated ones, they are derived from paradise, or (if this expression will be objected to by some) that the Aborigines of America have derived them, and gradually extended their cultivation, from districts of America where the inhabitants were once in possession of a higher degree of knowledge and of cultivation, of which they have left traces behind them in their colossal buildings. As regards the mythical plants of Brazil, it is very remarkable, that almost all of them without exception, occur in the islands of the Caribbean sea, just as in Brazil, and also in widely separated districts of the New World, and that several were known and used in North America, Mexico, and Chili, when Columbus landed there for the first time. Another still more remarkable circumstance is this, that these plants are designated by different names in several American languages, but that these same words have also quite a different meaning in each of these languages. This peculiarity, if thoroughly investigated, might throw much light on the aboriginal history of the American man. But I cannot here enter into the subject, and mean only to point out the most important of the plants termed by me mythical, which occur in Brazil.

1. *Manihot utilissima,* Pohl, the poisonous Manioc-plant, from which the common flour and bread of the American are prepared. In the Tupi language it is called *Manüba,* and in its Guarani dialect *Mandiba.* Among the Caribs of the continent it has often this name : in the Haiti language it is called *Juca,* and the flour, *Kiere.* Among the Chaymas and the Cumanagotos, the plant is called *Quicharapo,* the root *Quichere.*

2. *Manihot Aypi,* Pohl; in Tupi *Aypim,* the mild Mandiocca. In Haiti, it is said by Oviedo not to be indigenous. There it is called *Boniata;* by the Chaymas, *Cazé* or *Cachite;* in Mexico, *Huacamote.*

3. Indian corn, *Zea Mais,* L. I have found no species in use in Brazil, except that known among us. In Paraguay and the most southern provinces of Brazil, the *Zea Cryptosperma,* Bonafous, is found. This circumstance deserves more attention, from the fact that at present several others of the species *Zea* are distinguished as being cultivated in different parts of the New World. Thus there are the *Zea Curagua,* Molina, of Chili, the *Zea Hirta,* Bonafous, of California, the *Zea Erythrolepis,* Bonafous, of the Missouri districts; and finally, several species different from all these, in Mexico.

In the Haiti language, the Indian corn (which is said to have been introduced about the year 1204 from Anatolia) is *Mahiz*. Among the island Caribs it is *Auachi, Goaxi* or *Marixi;* among the continental ones *Aouassi* or *Yurar;* among the Azteks *Tlaolli,* and in Tupi *Auaty* or *Uva-tim,* which means beaked corn.

4. Different kinds of Batatas, *Convolvulus Batata,* L.: in Tupi, *Jetica;* in Haiti, *Batata;* in Carib, *Napi;* in Aztek, *Camotti.*

5. The creeping and tuber-bearing kinds of *Dioscorea* (yams) are named *Cara* in Tupi, *Igname* on the coasts of Paria, and *Ajé* in Haiti. I may mention here that another tuber-bearing plant, which is called *Tupinambú,* the *Helianthus Tuberosus,* L., was not known to the aborigines of Brazil. Its country must be sought in Buenos Ayres, if not perhaps in Mexico.

6. *Taiá, Tayóba Mangaraz* are the Tupi names of the mild mucilaginous and mealy *Araceæ,* which are eaten as vegetables when boiled. These plants go in Brazil also by the name of *Inhame.*

7. The Earth-nut, *Mandubí* in Tupi, *Maní* in Haiti, or *Arachis Hypogæa,* is eaten both raw and roasted, and also yields a favourite fatty oil.

8. The Melon tree, *Caria Papaia,* and other species, as *C. digitata, C. Dodecaphylla.* The species of this remarkable family do not seem even yet to have been sufficiently distinguished. One species, that grows in the Carib islands, with simple three-lobed leaves, called *Ababai,* is essentially different from those of the main-land. The species called by the Portuguese *Mamáo,* introduced by them into Africa and the East Indies, differs from the Peruvian one which is called *Papaie,* and which distinguishes itself from all others by the superior size and flavour of the fruit. The Indians use the milky juice of these trees for worms,* and think that meat

* It is in great repute in the Mauritius as a vermifuge.—*Tr.*

becomes more tender and better tasted by being kept for some time exposed to its exhalations.

9. Plaintain, *Musa Sapientum,* in Tupi *Pacoba,* and *Musa Paradisaica,* in Tupi *Pacobuçu,* the *Banana* of the Caribs. This tree was found spread in numerous varieties over tropical America, when the New World was discovered; and, as far as I know, it has never been met with in a wild state.

10. The Guava tree, *Psidium Guajava,* Raddi, or *Ps. Pomiferum* and *Pyriferum,* L. This tree also, in Haiti *Guajabas,* among the island Caribs *Cojábu,* among the Chaymas *Guarapa,* must also be reckoned among the mythical plants of Brazil, where it is hardly to be found wild, though extensively cultivated by the Indians. The *Psidium Araçá,* Raddi, is again found growing originally wild, though producing an equally good fruit.

11. The Cashew-tree, *Anacardium Occidentale,* L. This tree called in Tupi *Oacajú* and *Cajú,* by the Caribs of the islands *Caschiú,* of the mainland *Moué,* occurs chiefly in many spots near the sea and the mouths of great rivers, in places where probably Indian settlements stood formerly. Here also it possesses that large pear-shaped swelling of the fruit stalk, which recommends it as a fruit tree. A remarkable species, the *Anacardium mediterraneum,* is perhaps to be regarded as the wild stock, and is specifically different from the small one, *A. humile.*

12. The Spanish pepper, *Capsicum.* Of this family many species are used. Their fruit is the most important condiment of the Indians. There is no doubt that these plants have been in use among the Indians time out of mind. They are called in Aztek *Chilli,* in Zapotek *Quijuna,* and, what is very remarkable, have the same name in Tupi (written by the Portuguese *Quiinha*) in the language of Chili *Thapi,* in Haiti *Axi,* among the continental Caribs *Pomi,* among the Chaymas *Pomucy,* and in Cusco *Uchú.*

13. Calabash-tree, *Crescentia Cujeté*, L. This tree also occurs within the tropics in almost all portions of the new world, and always in the neighbourhood of the aborigines, who prepare from its gourd-like fruit, very neatly carved drinking vessels, in Carib called *Cui*, in Tupi *Cuja*. The tree is called by the Tupi tribes *Choité* or *Cuité*, by several other ones *Tutuma*.

14. Cotton shrub, *Gossypium vitifolium*, Lam. was found every where in cultivation on the discovery of America. Cotton was one of the chief articles which the Indians brought as tribute to their Caziks and to their European plunderers. The Indian indicates the limits of his field by a small cotton thread drawn round his plantation. The cotton shrub is called by the Tupis *Amyniú*, by the Guaranis *Mandiyú*, by the island Caribs *Amoulou*, by the continental ones *Maourou*, by the Azteks, who weave beautiful cloths from it and colour them, *Ychaxihuitl*, by the Zapoteks *Xilla*.

15. The Arnotto-bush, *Bixa Orellana*, L., in Tupi *Urucú*, in Carib *Rocu*, and on the continent *Biche*, is known as a colouring matter, and as a medicinal plant among all the aborigines of tropical America. I have never seen this species wild, but a very similar one, the *Bixa Urucarana*, Willd. as a curious example of the resemblance of names used among different tribes, I may mention that the Abipones in Paraguay call the yellow-yielding bark of the *Trichilia Catigoa*, S. Hil. *Achite*, while the Azteks call the *Urucú Achiotl*.

16. The bottle-gourd, *Lagenaria Vulgaris*, DC., is also one of the most widely extended plants connected with the remote history of the Americans. It is called by some of the Brazilian Indians *Caramemú*, by the insular Caribs *Batia*, by the continental ones *Maiatá*, which means a vessel, by the people of Chili *Penca*.

17. The Physic nut-tree, *Jatropha Curcas*, L., is often found in the vicinity of Indian huts, but I have never found

it actually wild. Its use appears to have been long extended over great portion of America. It is called in Aztek *Quauhayohuatlis,* and by the Tupis *Manduy-guaçú,* large earth-nut. The Spaniards of Buenos Ayres call the seeds *Pinnones del Paraguay.*

18. The Castor-oil plant, *Ricinus Communis,* L. This tree is found growing to the height of our elder-bushes in great abundance near Indian dwellings, but not in a wild state. The Brazilians call it *Mamona,* the insular Caribs *Lamaheu, Chouloumanum* and *Alamaramarou.* The practice of beating oil out of the seeds is known universally among the Indians; but they entirely neglect the culture of the plant, as they but seldom make use of its product.

The history of the foregoing cultivated plants is not yet sufficiently developed, even in a purely systematic point of view. Thus it remains for future observation to determine, whether many of them on closer examination may not be found to consist of specifically different kinds, whether the original stock of some one or other of them may not yet be discovered, and whether we may not be able to assign more distinctly defined limits for the diffusion of each species, by historical reference to the people that used it first.

Wild plants used in Medicine.

From the group of mythical or pre-historical and cultivated plants, we must next distinguish another set, which the present Indian inhabitants of Brazil have not received down from a period of knowledge now gone by, but which they have only in later times become acquainted with and applied to useful purposes; they have become gradually known to them in the course of their long (perhaps thousands of years long) wanderings, which are not however enlightened by any rays of history. These plants are to this day in a wild state: *i. e.,* they are not cultivated by the Indians for domestic or for medical use. Here we must observe the very remarkable fact, that among these plants we find those which have the most powerful medicinal properties; for instance, the *Cephaelis ipecacuanha,* in Tupi *Ipe-caa-goene, i. e.* creeping emetic plant, different species of Copaiva balsam, gum elemi, gum anime, those plants which are used in the same way in Brazil, as the common *Nicotiana Tabacum* and *Rustia* in Florida, Mexico and the Carib islands, where it is called *Jubi:* the tree which produces elastic gum, *Hevea Gujanensis:* a great number of powerful cathartics, various *Convolvuli* and *Ipomeæ,* the *Cucurbitaceæ, Trianosperma ficifolia,* and *Tayuyá,* Mart. &c., and the purging nut, *Anda Brasiliensis,* Raddi: the most powerful alteratives, as different species of *Guarea,* of *Andira,* and of the *Umari, Geoffræa spinosa,* L. whose seeds are powerful vermifuges, &c. The list might be much increased, but I content myself with here referring to my "Specimen Mater. Med. Vegetab. Brasil. Leipzig, 1843."

Some of these plants are common to Brazil along with many other tropical regions, like the *Ananas* (pine apple,) the *Icaco-plum, Chrysobolanus Icaco,* L. some widely-spread kinds of *Mureci, Brysonima V. and Chr.* of Kunth. &c. Others are less widely extended, but have been confounded with allied American species. Among them for instance is that *Rubiacea,* whose fruit, when unripe is employed to prepare a dark colour and in tattooing, and is when ripe, eaten: the *Genipa Brasil.* Mart., a tree, different from the *G. Americana,* L. as well as from the *G. Caruto,* Humb. In like manner the *Mombin-plum, Spondias venulosa,* Mart. is different from the *Mombin* and *Hobo, Sp. purpurea* and *S. lutea,* L. I must also in this hasty enumeration not forget to mention, that certain useful plants grow wild in Brazil, the use of which was as good as unknown to the aborigines before the arrival of Europeans, although other American tribes were at the same time familiar with their uses. The most striking example of this is the *Cacao-tree, Theobroma Cacao,* L. While, as is well known, most tribes of New Spain knew how to prepare from it a paste like our chocolate, and used their beans in place of coins, the Indians of the Amazon stream, along which the tree is very abundant, used only to make a fermented drink from the sweetish-sourish juice which the shell of the seed contains. This would seem to shew that at the period of our arrival there was no intercourse between them. In like manner, (if I may believe the reports I received) the *Avogato Pear, Persea Gratissima,* Gärtner, which grows wild throughout a great portion of the lower Amazon basin, was there scarcely known to the inhabitants, while it has been long known to the Indians, and eaten by them and the colonists throughout a great part of America, as a great delicacy. It is called in the Haiti tongue *Ahacaca,* in Peru *Palta,* and among the Azteks *Quauhitl.* On the whole many things seem to show, that for many centuries there has been exceedingly little intercourse between the hordes of Brazil and the more civilized races of the New World. Perhaps the only visible signs that we can see of a former connection are those artificially cut specimens of the Amazon stone, which are found among the most different tribes of Brazil. If their intercourse had not been interrupted, we should certainly have found among the Brazilians many useful plants, which they do not possess, or at least do not know the properties of. Such is the *Agave Americana,* L. It is found indeed in many places along the sea coast, but no where in the interior. The Brazilian savage does not know the art of preparing the fermented drink *Pulque* from it, and I do not know that it is designated by any name except its Carib one. In New Spain the *A. Americana* is commonly called *Mayuey,* a Haiti word, which probably formerly designated the *Fourcroya Cubenis.* The latter is a native of warmer districts than the former, whose original habitat is to be sought in New Spain or in some of the elevated plains of Central America. Another indication of the little intercourse between these tribes, is the fact that the varieties of Indian corn common in Mexico and the neighbouring countries, are unknown in Brazil, and that the love-apple, *Solanum Lycopersicum,* L., in Aztek *Tomalt,* in Zapotek *Pethoxé,* and the Mexican kinds of *Pine-apple,* and of *Sapota, Achras* and *Lucuma* are none of them cultivated; an etymological examination of the cultivated plants growing wild in Brazil, must among other things satisfy us that the names of many of them are simple roots, which are sometimes applied to a single species, and sometimes to several allied ones, but that most of them are compound words. The words *Caa* leaf, *üva* in the Guarani dialect, plant, *Ibira* tree, *Spé* twining plant, are some of the commonest, as *Caa-apeba* broad leaf, *Piper Peltatum, Caa-pim* the name of grasses, *Tajoba,* the hot *Araceæ,* from *tai* to burn in the mouth: *Icicar-üva* resin tree, from *Icica* resin, &c. &c. Many compound words have a generic and specific meaning, as *Jetai-Cicar-üva,* tree of the resin *Jetai, Hymenæa.* Many of their simple roots occur also in languages very different from the Tupi, but bear quite other meanings. Thus *Mari* or *Mali,* means in Tupi *Geoffræa spinosa,* in Carib *Cassia Brasiliana. Copà* means in Tupi balsamic resin, and *Copa üva* Copaiba: *Copallia,* in Aztek is incense, *Copal* in Chili sulphur.

I close these etymological remarks with a few more examples of their compounds. *Nandy-yroba* bitter oil, *Carapa Gujanensis,* because such oil is expressed from its seeds. *Guavyroba,* several species of *Mrytus* and *Eugenea,* which have an acrid oil in their leaves or fruit. *Pinda-üva,* several kinds of *Tylopia,* so named because they make fish-line, *Pinda,* from its inner bark, *Japicanga,* thorny bushes with round heads, several kinds of *Smilaceæ. Curuba-y,* itch tree, *Bowdichea Major,* Mart., because the bark of the tree is used against eruptions.

The peculiarities of this botanical nomenclature of the Indian seem to indicate, that the useful properties of these plants were gradually recognised while they were in their present low state of civilization: and the mixing together of more simple with more complex designations is another ground for assuming, that they are by no means in their primitive condition, but in that state of moral and of social advancement, which meets us as an inexplicable riddle among nations in a similar stage of progress.

The sources of the Indian's knowledge of remedies.

We now come to enquire, how it happens that the rude Indian has discovered certain medical properties in plants except by tradition, which however in many cases does not seem to have helped him. The most important aid has been derived from that perception of analogy, which lies so deep in the nature of man at every stage of his progress. He compares the physical characters of certain natural objects with similar ones of his own body, and is led to the doctrine of *signatures,* on which the whole materia medica of antiquity, of the Arabs, and of the middle ages, and indeed partially that of the present day, is found to rest. In this manner the Indian thinks plants and parts of plants of a red colour are related to the blood, and yellow ones to the gall and liver.

Thus he applies the blood-red fungus *Boletus Sanguineus, Urupé-tauá* in vomiting of blood; dark, brown or red astringent barks of several trees for erysipelas and chronic eruptions and swellings; the yellow juice of a species of *Vismia,* the yellow wood of species of *Abuta* and *Cocculus* in diseases of the liver and of the gall-bladder: he considers the snake-like root of the *Pareira brava,* an efficacious remedy for snake-bites, as likewise the tubers and the juice of the stalks of the *Dracontium polyphyllum,* the foot-stalks of whose leaves resemble in their dark marbled surface the skin of the rattle-snake. He finds some resemblance between the form of the testicles, in Tupi *Capyá,* and the roots of various kinds of *Caapiá* (*i. e.,* herba testiculi) *Dorstenia,* and therefore considers them powerful stimulants in general debility and in nervous fever. He observes that the milky juice of many *Euphorbiaceæ, Figs,* and *Apocyneæ,* when it issues from the bark and dries in the air in whitish threads, resembles round-worms, in Tupi *Sebuii,* and he therefore employs it to clear himself from worms, and calls several of these plants *Sebuii-iiva.* The *Selaginella convuluta* rolls itself up in the dry season like the rose of Jericho, and expands again as a sensitive hygrometer when the air becomes damp, and acquires a fresher colouring: the Indian sees in this, to him very surprising phænomenon, an indication that the plant has the virtue of awakening the dormant powers of life, and he therefore employs it as a restorative. In this respect he follows the same instinct as the Hindu, who ascribes kindred powers to the similarly organised *Lycopodiaceæ.* He has observed that wounds of the bark of the *Araucaria Brasiliana,* and of several *Terebinthaceæ* and *Leguminosæ* fill with Balsamic resin, which gradually thickens, and forms a coating to the injured part, and therefore he uses these balsams to heal his own wounds. He sees a slimy juice issue from many of the *Aristolochia* family, on being wounded, and he therefore considers them to be sudorific. These examples may be enough to shew that the old apothegm "similia similibus" is known even to the wild Brazilian.

We recognise also another source of the knowledge of the properties of plants in his nice observation of the instinct of the lower animals. Many medicinal plants have beyond all doubt been discovered in this way. The Indians in Minas, and the eastern coast-provinces, know by the name of *Tiú iiva,* a *Euphorbiacea,* (*Adenoropium opiferum,*) whose root, a capital cathartic, is sought and eaten by the *Lacerta monitor,* L., when it is ill: in like manner the *Drymis granatensis* is called in Tupi *Tapyra-motutí, i. e.* Tapir-bark, because the Tapirs make use of the bark of that tree to cure themselves from colic and diarrhœas. It now only remains for me to make a few remarks on the method of procedure of the Indian Pajé.

Medical Treatment.

The treatment of their sick is very simple and uniform. That imperturbable equanimity, or rather that stolid indifference, which has become a second nature to the Indian, is displayed here also. A sort of fatalist delay makes him often miss the favourable moment, and the fatal termination of the disease is much oftener caused by deficient and tardy, than by energetic and precipitate treatment. The Pajé is never the master, he is at most the minister of nature. While the medical faculty in Europe very often render a complaint serious, the Indian doctor remains merely an observer, often without any distinct diagnosis, and is an undecided spectator of the progress of disease. But when he has once got a distinct idea of it, and of the treatment to be directed against it, then he assumes as it were the position of a *priest of nature* towards his patient. This is like the position in which we find the physician in antiquity, when he directed himself individually with his whole might against the demoniacal power of the disease, and when his knowledge of the nature of the opposing circumstances, and the directness of his dealing with them, inspired the respect and veneration of the patient for his procedure, as being *the inspiration of a higher being.*

A consequence of this peculiar sacerdotal relation is this, that the Pajé's operations are directed almost exclusively to the patient, that the members of the family draw back from him, that every external influence is excluded as much as possible, and all things are kept in an unusual degree of quiet. If the hut has several compartments, as is especially common along the Amazon and its tributaries, the patient is placed in the most retired corner, and there secluded from light, air, noise and company. In some districts, when the musquitoes prevail for many months, during which the Indians withdraw into those dark closets with mud walls, (called Furnos by the Brazilian colonist, and Hornitos on the Orinoco) this place is usually the sick room.

The Examination of the Sick.

Before however the patient is withdrawn from the light, he undergoes a very narrow ocular scrutiny on the part of the careful Pajé, which extends to every portion of his body, and includes touching and feeling. When the pulse is examined, it is felt at the temporal artery. The oral examination is, as might be expected from the natural silence of the Indian, very monosyllabic. In conducting it, the Pajé repeats very often certain words, which, if I have not mistaken their meaning, refer chiefly to the exciting causes. I have never observed the examination extend to the excretions of the patient. On these occasions the Indian always complains of pain in the heart; even if there be only something the matter with his extremities, he repeats this complaint with a most pitiful expression of face. The doctor however is not led astray by it, although he certainly speaks but few words of comfort. He constantly asks whether the patient has an appetite for food, and if the reply be affirmative he counts it a bad sign. But the examination extends to the whole family: with a tedious indifference, which among us would drive the relations half-mad, he asks a number of the most common questions, such as where the members of the family had been on a certain day, what they had said or done, whom they had met, &c. All the while he maintains an earnest countenance of concern, and shakes his rattle from time to time. It is made of a hollowed-out gourd or calabash with a stalk, adorned with various birds' feathers, claws of animals, &c., and half filled with small pebbles. This instrument is of as much importance to the Pajé, as the large gold-headed cane used to be among us in the hands of a consequential member of the faculty. Besides being a symbol of his excellence, it is also the vehicle of his magic powers. The Pajé sets it on the ground, after he has whirled it round with an expression of profound admiration, and listens to the noise of the stones rattling against each other, as to an oracle. He and the female doctors, who resemble him, are thence called *Maraca-Imbara* (Rattle Whirlers,) a name by which the missionaries designate a sorcerer or magician. Sometimes the Pajé brings with him a tame snake, which he makes to dance while he is busied about the patient.

Application of Remedies.

The relations witness all this as dumb and timid spectators, till at last they break forth in the cry "Poçánga," "Medicine," "Medicine." The Pajé's remedies are now sent for, if he has not brought them along with him. No one can assist him in compounding them, unless perhaps some old female of the family happens to be present. I have already said that he seldom thinks of preparing his remedies before hand. If they be vegetable ones, he must first go to the woods and fetch them. The stalks, roots, wood, &c. if intended for internal use, are prepared in a hot, rarely a cold infusion, or in a decoction. The Indian ascribes high medicinal powers to the feculent matters which are deposited from plants well rubbed and stirred about in water. The practice therefore of bruising roots, barks, stalks or leaves between stones, or in wooden mortars, is very common. Besides these modes of applying remedies, the Pajé also makes poultices with boiled herbs, and salves or balsams, in which the natural balsamic gums play a conspicuous part. He is acquainted with many emetic plants : but when he has not got them, he excites vomiting by irritation of the throat, which he causes by thrusting into it some leaves rolled together.

As to his remedies from the animal kingdom, the Pajé commonly has them all ready in his hut, where they are rolled up in a palm leaf, or kept in the hollow of a bamboo.

In cases of wounding, the first procedure of the Pajé is to bend himself with great gravity over the patient, apply his mouth to the wound, and then suck freely. If the wound is caused by a poisonous animal or by a poisoned weapon, the doctor often takes a piece of the tobacco plant or of a sialagogue root, as of one of the peppers, &c. into his mouth, to chew, and to protect him from the chance of harm. He spits out what he has sucked with great gravity on the floor, and then rubs it with his foot. But he often also makes use of this application over painful spots, even if there be no wound. He frequently spits out cockchafers, worms, and thorns, shews them to his patient, and assures him that he must get well, now that the cause of his complaint is removed.

General Management and Care.

In this respect their practice resembles much the homœopathic. The most rigid fasting is ordered. Seclusion from light and air, and complete silence are enjoined. The patient usually lies motionless, and does not by any sound betray his sufferings, however acute they may be. The doctor, who in severe cases, seldom quits the patient's side, often goes through a great many operations, which to the eye of the European appear only as deception and juggling, but to which both the patient and the family ascribe a deeper meaning, than meets the eye. The most common operation, to which a patient is subjected for an internal complaint, is that of shampooing, not only the part affected, but the whole body. This process is performed by the Pajé with great perseverance, and in the most complete silence. The doctor is often covered with perspiration, and takes food from time to time, to recruit his strength. But this forcible mode of cure often causes the patient intense pain, which he bears in silence. The Pajé usually commences with the affected part, and goes on to press the extremities up and down, and generally produces profuse perspiration, at times vomiting and purging also. When the process is finished, the patient is allowed some drink, and left to sleep for several hours. I have seen this treatment employed in several cases of snake-bites, and may take occasion to remark, that I have never seen a fatal case of this dangerous accident among the Indians ; while two other cases, one of a white man, the other of a mulatto, in which the help of an Indian doctor could not be procured, terminated fatally. If the treatment just recorded may shew some slight traces of animal magnetism, their other processes bear much rather the character of exorcisms.* Their priest-doctor falls upon the patient's bed with fearful contortions of face, or if the patient be in a hammock, upon the ground, and spurts out all kinds of exorcisms to drive out the evil principle. In this stage the following processes are particularly applicable. Spitting on the patient; fumigating him with the large cigars,† which the Indians use at most of their feasts and carousals; covering the patient with strong smelling herbs, and smearing him with blood. The substances, which the Pajé uses for such purposes, vary much in different tribes. I have already mentioned that supernatural powers are ascribed to certain animals ; but hairs also, and the ashes of bones, &c. are among the strange preparations which the Pajé employs.

If we consider the dreamy life which the Indian almost always lives, and from which nothing but the effects of the violent passions arouse him,—if we think of his superstitious dread of the unknown powers of nature, his fear of spirits, and his deep-rooted inclination to feign what man does not possess, namely, mastery over some unknown higher power in nature,—we may be able to understand the light in which the doctor is regarded by his patient. But the doctor is a self-deceived

* Analogous processes are common in this country : and barbers often prevent the returns of intermittent fever by such manipulations ; (though, it was reserved for the judicial wisdom of a Bengal civilian recently to pronounce, that they can kidnap children by mesmerism.) Some customs of the Burmese in sickness are exorcismal.—*Tr.*

† The Brazilian Indians use very large cigars, often a foot and a half long, and two inches thick. Cigars are called *Tamot* by the Chaymas. This word is the probable root of *Tabacus*.

conjuror, much more than a crafty deceiver: and the patient is rather a timid, thoughtless, passive agent than a steadily confiding friend. To describe their mutual relation still more completely, I must add that it is commonly the Pajé who understands how to prepare poison for their arrows. He is also generally the depository of the knowledge of the kindred arts. Thus, he directs the preparation of the fine red colouring stuffs, *Carajurú* and *Guaranápaste,* and guides the tribes to gather the plants which stupify fish.* Many races are acquainted with certain poisons which, when introduced into the system, are supposed in a longer or shorter time to cause death. The Pajé is the possessor of the secret of these sinister arts, and is thus in some places dreaded as an actual poisoner. These poisonous plants are partly *Lianæ,* especially of the family of *Sapindaceæ,* partly species of *Amaryllis.* From the first, they are supposed to prepare their most virulent poisons from extracts of the stalks, from the latter, by drying and preparing the bulbs in a peculiar way. In the work of preparation they also make use of superstitious practices, and labour by night, unseen by Europeans whom they always distrust. It is universally believed along the Amazon stream, that there are poisons which, when introduced into the mouth, in small quantities during sleep, produce gradual sinking, and certain death. But the Indians are very reserved on the subject. I could only learn that it was a powder prepared from the roots of a bulb (an *Amaryllis ?)* which had a golden-yellow flower.

The Pajé as Surgeon.

The surgical attainments of the Pajé, as might be expected, are not very great; they scarcely extend beyond scarification, venesection, and the application of splints in fractures.

* V. Martius has given a list of plants employed for this purpose in "Spix et Agassiz Pisces Brasil;" we have seen fish stupified in this way in great numbers in the sea at Khyouk Phyoo.—*Tr.*

The first of these is practised on the chest in diseases of the whole system, or on the inflamed part in local affections. The Pajé performs it with the beak of a hawk or of a toucan, or with the spine of a ray-fish *(Raja.)* Venesection is also performed with this spine, or with the sharp tooth of a Coati *(Nasua,)* and among several races in the east of Brazil, as the Coroados, Puris, and Botocudos, by shooting into the vein from a small bow a little arrow armed with a piece of rock crystal. A vein in the calf of the leg is most frequently selected, more rarely one at the elbow or on the temples. Blood-letting is very often used as a precautionary measure. Young married women are in the habit of losing, almost regularly at the end of the rainy season, a large quantity of blood to prevent conception. Baron V. Eschwege states, that he once found a number of women bathing in a river, and saw an old man open a vein in each of them. Missionaries have told me, that they have frequently seen this operation performed simultaneously on several women. This custom is connected with the general wish which they feel to cause abortion, and save themselves the troubles of pregnancy. I have seen cases, in which the unnatural mothers struck their bodies violently with this design. The women also are often bled about the time of child-birth. In obstinate tooth-aches, the Pajé punctures the gums. Broken limbs are put up in the splint-like leaf-stalks of the *Assai* palm, (*Euterpe oleracea,* and *edulis,*) the proper setting of the bones being of course frequently neglected. For dressings he uses various fresh or boiled plants, or a dog's skin, fresh taken off. In large open wounds, the Pajé frequently uses fire to hasten recovery. The wounded member is thickly enveloped in the inner bark of trees, and is often half-roasted on a prop, beneath which burning coals are placed. The patient bears this painful procedure with his usual indifference, and strange to say, it generally causes rapid cure by the first intention. I can, as an eye-witness, affirm the recovery of an Indian, whose skin had been pierced with lances in several places; on the sixth day he left his couch with his wounds healed. *Quos ferrum non sanat, ignis sanat.*

If the Pajé has exhausted his stock of remedies, and recovery does not follow, and he sees the death of his patient approaching, he withdraws from him, using a variety of deprecatory phrases. The relations approach, and cover the sick man with the inner bark of trees, or with cloth, that they may not see the death-struggle or hear the last cries of pain. They cover him up to such a degree, that the sick man's death is often hastened by suffocation. I have been told that in some cases, where recovery is considered quite hopeless, it is customary to shorten his painful existence by a blow on the head. During his last moments, the family and the neighbours raise a wild cry of lamentation, to deaden the sounds of the dying man, and their own grief. The corpse is, a few hours after death, enveloped in the inner bark of trees or in cloth, sunk in a round grave, in a squatting position, with the head between the knees, turned towards the east, and covered in with earth, which the relations trample down with their feet, uttering the while wailings and lamentations. Among some tribes, bodies of distinguished warriors are gradually *mummified* over the fire, or the skeleton is kept anointed with oil and Rocou, and adorned with feathers.

The Pajé's Fee.

If we now come to enquire, according to the ideas of European civilization, what the doctor receives for his trouble? we must answer, *everything or nothing.* In a society so poor, there is no wealth. "Dat Galenus opes" is here an inapplicable phrase. The Pajé who has effected a cure, may carry away with him from the cabin of his patient any of the products of Indian industry; but nothing, with the exception of the weapons, is of any value. A few of the products of European civilization, such as an axe, a knife, a fish-hook, or a bottle of brandy, are sometimes to be found; but are considered much too expensive a *honorarium*. I am not sure, however, whether the patient if asked to give them, would venture to refuse. He might give them through fear, if not from gratitude : for the Pajé is dreaded as the handler of mighty natural powers, and it is dangerous to refuse him any thing. He also takes care to make his rank and the rights of his position respected. As a proof of his importance, I may mention that among many tribes, the *jus primæ noctis* is conceded to him.

To conclude : this point of view again presents to us that deep degree of demoralization and of barbarism, which the life of the red man presents, in all its phases and developments. We must confess that the attempt to discover traces of a higher kind of knowledge in the isolated and confused facts and traditions which constitute Indian medicine, has been a failure. Here, as in the history, the language, the mythology and the ethnography of the red man, we find only one dark picture ; and while we cannot let so dark and sunken a state of things pass by us in review, without feelings of grief and concern, yet we immediately begin to wonder, and to ask this question—what singular catastrophe has the red man experienced, in what fearful paths of error has he wandered for thousands of years, to occupy now so degraded and so lamentable a position ?

This paper appeared originally in *Buchner's Repertorium für die Pharmacie*, in 1844, and was afterwards printed separately. We have been obliged to abridge the third portion slightly.

V. Martius's account of Brazilian medicine resembles in its general features the history of that art among all barbarous nations; we may add, that the same strange mixture of credulity, self-deception, and imposture, ever varying in degree, and preponderating at times on the part of the patient, at times on that of the doctor, is the foundation among civilized as well as among savage men of the belief in the efficacy of various absurd processes. Thus the alleged cures by homœopathy, the water cure, galvanic rings, mesmerism, or whatever happens to be the fashionable delusion of the day, never fail to find a large circle of credulous believers, just as the virtue of the Pajé's mysterious processes is implicity believed in by his patients; though this is, we fear, the true view of the case, it is mortifying enough to our vanity.—*Tr.*

Contributions towards a Flora of Ceylon. By George Gardner, F.L.S., *Superintendent of the Royal Botanic Gardens, Kandy.*

Under the above title it is my intention to give, from time to time, a series of articles preparatory to the publication of a Flora of the whole island, the materials for which I am now elaborating. They will chiefly consist of descriptions of such obscure or new genera and species as may turn up during my investigation, and which may be considered worthy of more immediate publication. It is not a little astonishing that the Botany of this island should be less known than that of almost any part of the continent of India, especially when it is known that a Botanic Garden has been kept up in it by Government for upwards of thirty years, under the superintendence of individuals who, we must suppose, were considered by those with whom the appointment lay, to be in every respect competent to fulfil the duties connected with such an institution. In place of this, I find that, with the exception of my immediate predecessor, who, however, never did any thing for Botany, the whole of the others were common gardeners. It is not then to be wondered at that hitherto the science of Botany, as connected with the Gardens at least, should have aimed at little higher than the cultivation of cabbages. There is, however, one name among those four which stands out in bold relief from the others, that of Mr. Moon, the founder of the present Garden, who, in the year 1824, published a " Catalogue of Ceylon Plants," the only work entirely devoted to the Botany of the island which has been published since the " Flora Zeylanica" of Linnæus appeared in 1747. Considering the difficulties under which Mr. Moon laboured, principally from the want of a library, that belonging to the Garden being then, as it still is, very limited indeed, he deserves much credit. It must be confessed, however, that mere catalogues of plants such as this never have, and never can further science, since it is so easy to set down a name, whether it be correct or not, and, that such is the case too often in Mr. Moon's, I have determined from the examination of such of his specimens as exist in the Garden Herbarium with his names attached to them. When there are no distinctive characters published along with the name, so that others may be able to ascertain what plant was meant, the utility of the work is completely nullified; and hence it is that now when the natural sciences are cultivated with an accuracy hitherto unknown, it is seldom that a catalogue makes its appearance, unless, indeed, those which refer simply to the contents of a museum or a garden, for facility of reference. In Mr. Moon's Catalogue there are the names of a good many Ceylon plants which he correctly determined to be new, but as there were no characters attached to them whereby other Botanists could ascertain what they were, the consequence has been, that most of them have since been published under other names, by other Botanists, such, for example, as by Wight and Arnott in their works on the Botany of the Peninsula of India. Mr. Moon has also done much more than any of the others towards the formation of a Ceylon Herbarium, that portion of it formed by him which still remains at the Gardens, containing specimens from nearly all parts of the island. It shall be my endeavour to do justice to his labours in the work on which I am now engaged.

ANSTRUTHERIA. *Genus Novum.*

(Ord. Nat. Elæocarpeæ.)

Char. Gen.—*Flores* hermaphroditi. *Calyx* bibracteolatus, 4-partitus, foliolis ovatis subæqualibus, œstivatione valvatis, persistentibus. *Corollæ* petala 4, hypogyna, œstivatione imbricata, cuneata, subregulariter laciniata; *stamina* circita 30, hypogyna; *filamenta* filiformia, glabra; *antherae* erectæ, cordato-oblongæ, obtusæ, biloculares, longitudinalita-dehiscentes. *Ovarium* sessile, triloculare. *Ovula* in loculis 2, pendula. *Stylus* simplex, persistens; stigma capitato-subtrilobatum. *Bacca* sicca, membranacea, ovata, glabra, 3-locularis, indehiscens, loculis monospermis. *Semina* pendula, compressa, glabra: *Embryo* in axi albuminis, carnosi, orthotropus: *cotyledonibus* planis, ellipticis, venosis *radicula* tereti, elongata, crassa, supera.—arbor *parva, ramosa, Ceylanica*; foliis *oppositis, petiolatis, ovato-ellipticis, acuminatis,* integerrimis, stipulis *deciduis* pedunculis *axilliaribus, unifloris, solitarius vel binis,* petalis *glabris, albis.*

1. Anstrutheria *Ceylanica.*—Plate IV.

Habit.—Common about Point de Galle, in the southern province, on low wooded hills near the sea. Flowers in September.

Descr.—A very much branched *shrub* or small *tree. Branches* round, glabrous. *Leaves* opposite, petiolate, glabrous, entire, ovate-elliptical, acuminate, rounded at the base, from 3—3½ inches long, and about 1½ broad, green and shining above, pale beneath, reticulated, veins prominent on both sides; *petiole* about 4 lines long, convex beneath, channeled above. *Stipules* oblong, deciduous. *Peduncules* solitary or binary in the axils of the leaves, shorter than the petiole, 1-flowered. Calyx with two rounded, concave bracts immediately below it, and enclosing the flower bud in its young state, free, 4-parted, segments ovate, acute, about equal, persistent, densely covered externally with adpressed hairs, œstivation valvate. *Petals* 4, hypogynous, cuveate, deeply and somewhat regularly lacintated, with an imbricated œstivation. *Stamens* about 30, hypogynous; *filaments* filiform, glabrous. *Anthers* erect, cordate-oblong, obtuse, 2-celled, dehiscing longitudinally. *Ovary* sessile, superior, 3-celled. *Ovules* in each cell 2, collateral, pendulous. *Style* simple, persistent. *Stigma* capitate, somewhat 3-lobed. *Fruit* a dry berry with a thick spongy membranous coat, ovate, glabrous, indehiscent, 3-celled, cells 1-seeded. *Seeds* pendulous, somewhat triangularly compressed, glabrous. *Embryo* in the axis of a fleshy albumen orthotropous; *cotyledons* plane, elliptical, veined: *radical* cylindrical, thick, elongated, and directed upwards.

I have named this very distinct genus in honour of Philip Anstruther, Esq., late Colonial Secretary of Ceylon, a gentleman who during a long residence in the Island was the warm patron of all that relates to Agriculture, Horticulture, and Botany. It is, therefore, with pleasure that I connect his name with one of the many undescribed vegetable productions indigenous to the country.

Obs. I.—It is evidently to this plant that Dr. Arnott refers at page 23 of the third volume of ' the Annals of Natural History,' in the following words :—" Allied to *Elæocarpus*, I possess a new genus, also from Ceylon, of which the petals are exactly as in *Elæocarpus*, the filaments long as in *Grewia* or rather *Tilia*, the anthers short and considerably different from those of either ; the leaves, with nearly the structure of some species of *Capparis*, are opposite and quite entire ; the calyx has a valvular œstivation, and when in bud is glabrose and enclosed within two rounded concave bracteolæ ; it may be *Elæocarpus integrifolius* of Moon's ' Catalogue of Ceylon plants.' I have seen neither fruit nor seed."

Ample opportunity has occurred to me, since my arrival in Ceylon, for the investigation of the structure of this plant in all its stages. It grows in great plenty about Point de Galle, where I have collected fine fructified specimens, my flowering ones being from a tree which flowered in the Royal Botanic Gardens at Peradenia in October 1844. It is a remarkable circumstance, that the flower buds are produced, and attain nearly their full size, about six months before they actually open.

At first I was inclined to refer this genus to *Chlænaceæ*, principally from the little involucrum which is formed of two approximated bracts immediately under each flower, and from the structure of the fruit; but from a more attentive consideration of its entire structure, I now agree with Dr. Arnott, in considering it more nearly related to *Elæocarpus*. Yet it does not associate well with the genuine genera of that order, or although it possesses in common with them a valvate calyx, and fimbriated corolla, it has anthers which dehisce longitudinally, and a dry baccate indehiscent fruit. There is a genus, however, which has been placed dubiously in *Elæocarpeæ,* to which it bears a very great resemblance in the structure of its fruit. It is *Friesia* of DC., which consists of trees, natives of Van Dieman's Land and New Zealand. The principal differences which exist between that genus and *Anstrutheria* is the mode by which the anthers dehisce, and the position of the ovules ; those of *Friesia* being superposed, while in the other they are collateral. They both agree in having opposite leaves.

Obs. II.—The order *Elæocarpeæ* is divided by Endlicher into two tribes, the first of which contains those genera which possess drupaceous fruit, while those which have it capsular belong to the second. If a third be established for *Friesia* and *Anstrutheria,* in which the fruit is baccate, there will be a regularly graduated scale of carpological structure in the family. The three tribes may stand thus :

Ord. Nat. Elæocarpeæ, *Juss.*

Tribus I.—Elæocarpeæ Veræ. *Endl.* Fructus drupaceous.

Tribus II.—*Friesieæ, Gardn.* Fructus baccatus.

Tribus III.—*Tricuspidareæ. Endl.* Fructus Capsularis.

EXPLANATION OF PLATE IV.

Fig. 1, Portion of a branch of *Anstrutheria Ceylanica,* nat. size. 2, Bracteoles. 3, do. and flower bud. 4, an expanded flower, magnified. 5. A flower with the petals removed. 6, back and front view of an anther. 7, ovary and style. 8, cross section of ovary. 9, vertical do. 10, ripe fruit, nat. size. 11, a seed. 12, section of do. 13, embryo, all magnified.

SARCANDRA. *Genus Novum.*

(Ord. Nat. Chloranthaceæ.)

Char. Gen.—Flores hermaphroditi, laxe spicati, singuli intra bracteum navicularem sessiles, Stamen 1, ovario supra basim antice insertum; *filamenta* incrassata, cylindrica; *Anthera* biloculari, loculis introrsis, apice approximatis, basi distantibus, longitudinaliter dehiscentibus. *Ovarium* ovatum, uniloculare. *Ovulum* pendulum, orthotropum. *Stigma* sessile, subcapitato-depressum. *Drupa* monosperma, staminis cicatrice gibbosa; putamine tenui, fragile. *Semen* pendulum, testa membranacea. Embryo antitropus, in apice albuminis carnosi inclusus; *radicula* infra. —— Suffrutex *Ceylanica*, chloranthi facie; ramis *nodoso-articularibus*, foliis *oppositis*, *petrolatis*, *penniveniis grossi glanduloso-serratis*, petrolis *basi in vaginam* brevem amplexicaulem combinatis, spicis *terminalibus*, *simplicibus*.

1 Sarcandra *Chloranthoides.*

Hab.—In dense virgin forests in the Central Province. Fl. in May and June.

Descr.—Suffruticose, glabrous, about 3 feet high. *Stem* and *branches* round, with tumid joints. Leaves opposite, from 4-6 inches long, and about 2 broad, elliptic-lanceolate, much accuminated, caveate at the base, coarsely glandular—serrated from below the middle, green and shining above, paler and opaque beneath. *Petioles* short, combined at the base along with the interfolious stipules into a membranous sheath, which has two setaceous teeth on each side. *Spikes* terminal, simple, shorter than the leaves, smooth; *rachis* striated. *Flowers* alternate, sessile in the axils of ovate acute bracts which are about equal in length to the ovary. *Floral envelopes* none. Stamen 1, inserted on the middle of the anterior face of the ovary, of a brownish colour. *Filament* very much thickened, cylindrical: anther two-celled, cells bursting inwardly, approaching at the apex, but separated below by the fleshy connective, slightly incurved. *Pollen* globose, yellow. *Style* none. *Stigma* sessile, capitate, depressed. *Ovary* ovate 1-celled with a solitary pendulous orthotropous ovule.

Drupe obovate, black, about the size of a small pea, bearing on its anterior face the scar of the deciduous stamen, 1-sided: *putamen* thin fragile, ash-coloured. *Seed* pendulous, nearly round; *testa* membranaceous. *Embryo* antitropous, small, included in the apex of a copious fleshy albumen: *radical* inferior.

Obser. I.—In every thing but the number and the structure of the stamens, this plant is a Chloranthus. There are, however, such marked peculiarities in these organs, that I have determined to keep it separate from that genus. I have now before me recent specimens of what I believe to be *Chloranthus officinalis* of Blume, and in them I find that there are three stamens, which, according to all authors, seem to be the normal number in the genus. These are united at the base, and inserted on the anterior face of the ovary, as in my plant. In place, however, of each stamen consisting of a solid cylindrical oblong mass, with a cell on each side of its inner face at the apex, which unite above, but are separated below both behind and before by a fleshy connective, I find those of *Chloranthus officinalis* to be each an ovate hollow organ, with a longitudinal slit in front, on the upper edge of each side of which there is the single cell of an anther situated. This, remarkable difference in the organization of the anther, is too important not to be considered as forming a distinct generic type.

Obser. II.—Lindley and others describe the anthers of *Chloranthaceæ* to be 1-celled. This, however, I do not find to be the case. In the plant which I have just described, there can be no doubt that the two cells borne by each filament belong to the same anther, as is evident from their being united at the apex. A horizontal section, moreover, of the filament only shows a single bundle of vascular tissue. In *Chloranthus officinalis* it appears more probable, at first sight, that each stamen is made up of two, each having a single cell; but here also the filament only shows one bundle of vessels. The posterior wall of the hollow organ, which forms the anther, is evidently only a widely dilated connective.

Obser. III.—Most authors agree in referring *Chloranthaceæ* to the neighbourhood of *Pipnaceæ* and *Sausuraceæ*, which is unquestionably their true position, the point of attachment of their ovule being the only important distinction between them.

Strombosia.—*Blume Bijdr.* 1154. *G. Don Dict.* 2. *p.* 21. *Meisner Gen.* 71. (51.) *Endl. n.* 5752.

(Ord. Nat. Olacineæ.)

Char. Gen.—*Calyx* adnatus, 5-fidus. *Corollæ* petala 5, intus villosa, œstivatione valvata, apicibus sub antheri revoluta. *Stamina* 5, cum petalis inserta, iis opposita et basi adnata. *Antheræ* oblongæ, introrsæ, inclusæ, 2-loculares longitudinaliter dehiscentes. *Ovarium* disco immersum, basi 5-loculare. *Ovula* tot quot loculi spurii ex apice placentæ, pendula, anatropa. *Stylus* brevis, filiformis. *Stigma* 5-lobum, lobis obtusis. *Drupa* oblonga, exsucca, calyce toto adnata, monosperma. *Semen* inversum, testa membranacea. *Embryo* in axi albuminis, (copiosi carnosi,) orthotropus, apici fructus proximus, brevissimus terebinsculus; *Cotyledonibus* complanatis, orbiculatis; *radicula* magna, supera.—Arbores *Javanicæ, et Ceylanica inermes*; foliis *alternis, exstipulatis, integerrimis, lucidis, penniveniis,* floribus *in fasciculis axillaribus dispositis.*

1. Strombasia *Ceylanica.*

Hab.—In dense virgin forests on the mountains near Kandy. Flowers in October.

Descr.—A *tree* 50-60-feet high. *Branches* round, the young ones subflexuose, and of a green colour. *Leaves* alternate, exstipulate, petiolate, oblong, or ovate-oblong, acuminate, obtuse at the base; entire, glabrous, shining, penninenous, veins about six on each side, midrib, prominent both above and below, from 4-7-inches long, and from 2-2½-broad: *Petioles* about 2 lines long, thickened from the middle upwards, convex on the under surface, and channeled above. *Flowers* small, of a greenish white colour, in nearly sessile clusters of from 6-15 in the axils of the leaves, and also occasionally on the internodes. *Pedicels* about a line long, bearing a few small reddish coloured bracts. *Calyx* adherent, limb 5-lobed, lobes rounded, persistent. *Corolla* campanulate, 5-free valvate oblong-lanceolate petals which are hairy inside. *Stamens* 5, opposite the petals, and to which the flattened filaments adhere for half their length. *Anthers* oblong, introrse, 2-celled. *Ovary* completely immersed in a conical, fleshy, entire, yellow disk, 5-celled at the base, but only 1-celled at the top, with five ovules pendulous from the apex of a central placenta. *Style* short, filiform: *Stigmá* obtuse, obsoletely 5-lobed. *Fruit* an oblong, somewhat fleshy drupe, of from 8-10 lines long, and to which the calyx firmly adheres, leaving only that small portion at the apex exposed which is covered by the disk, the withered margin of which is seen surrounding the persistent base of the style, 1-celled, and by abortion 1-seeded. *Seed* pendulous, inverse, of the same shape as the drupe, the cavity of which it nearly fills. *Testa* thin, membranaceous, adhering firmly to the very copious albumen. *Embryo* very small compared with the mass of albumen, in a small cavity at the upper end of which it is found. *Cotyledon* of a whitish colour, flat, and orbicular. *Radical* pointing towards the upper end of the seed—with reference to its attachment—of a greenish colour, round, thick, and about twice as long as the cotyledons.

Obser. I.—I have but little hesitation in referring this plant to Blume's genus *Strombosia*, notwithstanding the very short character he gives of it in his "*Bijdrayen*," which, however, is partly correct so far as it goes, for he seems to have been unacquainted with the structure of the fruit and seed. Since he first described it about twenty years ago, no one seems to have met with it again, for the character given by Don, Meisner, and Endlicher, are merely transcripts of Blume's one. By Blume himself, as well as by the above mentioned authors, it is placed at the end of the natural order *Rhamnaceæ*, from being considered more nearly related to it than to any other. This was also the conclusion I arrived at when I first met with the tree, which was then only in flower: now, however, that I have found it in fruit, and have examined the ovary with more care, I find that it must be referred to *Olacineæ*, with which it agrees in every point except one, which I do not find taken notice of in any of the published genera belonging to this order. This anomaly is the fleshy disk in which the ovary is completely immersed up to the base of the style. But as in some of the genera, *Schœpfia* for example, the torus is pretty fully developed, and as it is from that organ the disk arises, it is easy to suppose that in this instance a superior degree of development has taken place.

Obser. II.—*Strombasia* will range in Bentham's first tribe *Olaceæ* along with *Olax* and *Schœpfia.* Its nearest affinity is with the latter genus, from the perfect adherence of the calyx to the ovary, and the stamens being opposite the petals. This latter peculiarity in these two genera is easily accounted for by supposing that the external series, which exists in the other genera of the tribe, entirely suppressed. According to Bentham (Linn. Trans. 18, p. 618,) Brown considers *Schœpfia* to be a true Santalacious genus, but I believe Bentham to be more correct in referring it to *Olacineæ*, the economy of the ovary being the same, and perfect adherence of the calyx is now known to exist in other two genera of the order, viz. in *Hypocarpus*, Alph. DC. (Prod. 8. p. 245,) and in a new Indian genus which will shortly be published by Dr. Wight, under the name of *Bursinopetalum.*

Obser. III.—From the very imperfect natural character which Blume has given of the Java species, it is not easy to say how far it is distinct from the Ceylon one. There is only one point in which I can detect a well marked difference, viz. the shape of the fruit, which in Blume's plant is said to be turbinate, while in mine it is oblong.

Kandy, Ceylon, 15*th June,* 1845.

Prodromus Systematis Naturalis Regni Vegetabilis, &c. Editore et pro parte Auctore. ALPHONSO DE CANDOLLE. *Pars* 8 *et* 9, *Paris* 1844-45.

It is now one-and-twenty years since the first volume of this work was given to the world by the illustrious father of the present editor. Seven years previous to that period, viz. in 1817, he laid before the public the first volume of a similar work, but on a much more extensive scale, under the title of Regni Vegetabilis Systema Naturalle, &c.," in which it was his intention to give—what was then a desideratum in Botanical science—detailed descriptions, and an extended synonymy, of the whole vegetable kingdom arranged according to the natural system of classification. Finding however, that there was but little probability of his living long enough to finish such a task, from the great research and labour attending such an undertaking, it ceased on the publication of the second volume in 1821. These two volumes contain an elaboration of the natural orders *Ranunculaceæ, Dilleniaceæ, Magnoliaceæ, Anonaceæ, Menispermaceæ, Berberaceæ, Podophylleæ, Nymphæaceæ, Papaveraceae, Fumariaceæ,* and *Cruciferæ;* besides an enumeration of all Botanical authors and their works up to that period.

It was then that he determined on producing the present work, which was intended to contain only the essential characters of the genera and species of all known plants, with a few select synonomes. From the time of the publication of the first volume in 1824, up to the period of the author's death in 1841, seven volumes appeared at irregular intervals. Nearly the whole of his time was devoted to it, and unlike most systematic Botanical works which have appeared during the present century, it is not a compilation merely of what was already known, but each natural order was worked up with great care, and all new species which the author had access to were accurately described. In a few only of the 118 orders which are contained in the seven volumes, did he receive any assistance, and that principally from one or two of his favourite pupils. To the elaboration of one natural order alone—the *Compositæ*—six entire years were devoted, and with it two volumes and a half of the work are occupied. Such numbers of new species belonging to this interesting tribe have of late years accumulated in the Herbaria of European Botanists, that in these two volumes and a half, M. De Candolle has described about eight thousand, being a greater number than Linnæus knew of plants altogether from all parts of the world.

To those who have made botany a study, it is useless to say how well M. De Candolle was qualified for the task he imposed upon himself, from his intimate knowledge of vegetable anatomy and physiology, the true basis of systematic botany,—the clearness of his perception, and the possession of an enlightened and philosophic mind, the workings of which are obvious in every page of his numerous writings, whether scientific or otherwise. To those who are beginning their practical botanical studies, and who wish to gain a knowledge of the many beautiful and strangely organized vegetable beings which people the earth's surface from the poles to the equator, and even the sea itself, this work, even though incomplete, is quite indispensable, as in no other is there a like number of plants described.

To many of the orders, particularly those in the earlier volumes, very large additions of species have since been added in various periodical and other publications. These have lately been accumulated in a work entitled "Repertorium Botanices Systematicæ," by G. G. Walpers, the first volume of which was published at Liepsic in 1842; and together with another which appeared in the following year, may be considered as a supplement to the seven volumes of the "Prodromus" published by the elder De Candolle. The publication of this compilation was, indeed, a great boon to the working Botanist, as it brought together materials which lay scattered through many volumes, although it must be confessed that the compiler has, in many instances, been guilty of great carelessness, several books and monographs having been overlooked, and even in some of those which he has consulted, there exist descriptions of species which have been quite neglected. Four numbers of a third volume have just been received by us, and sorry we are that we have nothing to say in their favour. While the work brought up De Candolle's leeway, it was, indeed, most useful; but the success attending that portion has led the author to run ahead of the "Prodromus," and the consequence is, that he has gone beyond his depth. The principal orders which the third volume contains, are *Solanaceae*, *Scrophulariniae*, and *Labiatae*, the whole of which are very nearly transcripts of the monographs of Dunal and Bentham on these tribes.

The two volumes, the 8th and the 9th of the "Prodromus," which it is our intention more particularly to notice, have only lately appeared. The work is now carried on by M. Alphonse De Candolle, who seems to inherit all his father's Botanical zeal and ability. The whole labour does not, however, devolve upon himself, he being only, to use his own words, "Editore et pro parte auctore." The volumes are now to appear at much shorter intervals than heretofore, and the editor has secured the assistance of some of the most learned Botanists in Europe to aid him in bringing the work to a close. The seventh volume brought to a termination the orders belonging to the sub-class *Calyciflorae*. The present two are occupied with 22 orders belonging to the *Corolliflorae*, among which may be mentioned *Oleaceae*, *Jasmineae*, *Loganiaceae*, *Bignoliaceae*, *Cyrtrandaceae*, and *Boragineae*, from the MSS. of M. De Candolle, with notes and additions by his son;—*Lentibulareae*, *Myrsineaceae*, *Sapotaceae*, *Rhenaceae*, *Styraceae*, *Apocyneae*, and *Hydrophylleae*, by M. Alph. De Candolle;—

Primulaceae, by Duby ;—*Asclepiadeae*, by Decaisne ;—*Gentianeae*, by Grisebach ;—*Polemoniaceae*, by Bentham ;—and, *Convolvulaceae*, by Choisy.

In the earlier volumes of the " Prodromus" both the generic and the specific characters are very short, so much so, that in such orders as contain many genera, and such genera as contain a great number of species, the difficulty of distinguishing between them often becomes very great. In the late volumes, however, a great change was made for the better in this respect. A still further improvement will be found in the two last volumes, especially in those orders which have been worked up by M. Alph. De Candolle himself, a short general character being added to the essential specific one. To those who are daily occupied in determining species from descriptions, this renders the labour comparatively easy. With how much greater facility, for example, are the *Apocyneae* made out from M. Alph. De Candolle's characters, than the *Asclepiadeae* from those of Decaisne, where only essential characters are given. Only one thing is now wanting to render the " Prodromus" the most perfect systematic work which has ever been given to the Botanical world,—a synopsis of the genera at the head of each order. This would cost but little trouble to prepare, would occupy but little space, and to working Botanists would be a very great saving of time.

The tenth volume may be expected about the end of the present year, as we learn from Mr. Bentham, who is occupied with the Scrophularineæ for it, that the printing was to commence in January last.

Notes on Indian Botany. By Robt. Wight, M.D., F.L.S.

Under this title I propose occasionally, as opportunities offer, in the course of my botanical pursuits, to communicate observations on such matters as may appear of sufficient scientific interest to merit a place in the pages of the "Calcutta Journal of Natural History."

The matters embraced in these "Notes" will, it is probable, prove as miscellaneous as the title is indefinite, comprising remarks on any subject relating to Botanical Science that for the time happens to engage my attention; discussions on natural affinities; on the composition and characters of natural orders; revisions of old, or descriptions of new genera; descriptions of new or imperfectly known species, &c. Such being the mixed nature of the matters they are intended to embrace, I have chosen for these contributions the above indefinite title.

The subject I have chosen to head the series, as being calculated to give an idea of what is to follow, is one which lately engaged my attention, and led in the course of the enquiry, to very unexpected results,—an examination of the structure of the ovarum of the genus *Viburnum.* I think I shall be able to show in the course of the following remarks, either that the structure of the ovary of this very old and almost universally known genus, is unknown, or that two distinct genera are combined under that name.

On the structure of the Ovarium and generic character of Viburnum.

This, judging from the circumstance of Sprengel quoting Virgil as his authority for the name, seems to be a very old appellation. Linnæus quotes Tournefort as his authority for it, but was himself the first to fix its limits by a precise definition, which was in these words, "*Pentandria trigynia. Calyx* 5 *partitus superus. Corolla* 5-*fida. Bacca* 1-*sperma.*" No notice is taken either here or in the extended natural characters of his Genera Plantarum of the ovary. This character passed current among Botanical writers until the publication of the 4th volume of De Candolle's Prodromus in 1830, when he altered it by the addition of the word "*abortu*" "*Bacca abortu* 1-*sperma*," thereby implying that there were in the ovary a plurality of ovules, all except one of which aborted in progress towards maturity. This addition has, since then, been admitted by all writers, so far as I am aware, except Professors Endlicher and Lindley. The former describing the ovary "*Ovarium inferum triloculare. Ovula in loculis solitaria ex apice anguli centralis pendula,*" but adds "*Bacca abortu unilocularis monosperma,*" evidently implying that he had himself examined the ovary of at least one species, if not more, and found it as here described, plurilocular. Lindley, in his School Botany, takes no notice of the ovary, but allows a 3-seeded fruit; "Fruit succulent, 3-seeded," though in two of the three species he defines, I find the ovary 1-celled with a single ovule.

While examining the four Neilgherry species with reference to the articles on *Caprifoliaceæ* for my "Illustrations of Indian Botany" and "Neilgherry Plants," I found in all a 1-celled ovary with a single pendulous ovule, and naturally inferred, on comparing them with Endlicher's character, that they must form a distinct genus. But before finally separating them, and adding I knew not how many synonyms to our already overgrown list, I determined to examine the structure of the ovary in every species to which I had access, among which fortunately was *V. Lantana* and *V. Opulus*, two British species, in both of which the same structure exists. Three American species were next examined with the same result; then five Nepaul ones, still the same; and lastly, three from other parts of India, in all seventeen species, in all of which the ovary is 1-celled with 1 ovule.

It results from these observations that the inference already drawn in regard to this genus becomes almost inevitable: namely, that if either Endlicher or Lindley's characters are the result of actual observation, all these species must be removed from the genus they define, or that they, in common with all other recent writers, must have assumed, without examination, the presence of a plurality of ovules, which does not exist, when stating the berry to be either "1-seeded by *abortion*," or "3-seeded."

I am unable to advance beyond this point, but trust enough has been said to direct the attention of systematic Botanists to the subject now touched upon, which, when carefully investigated, may lead to interesting results, examples of solitary one-seeded carpels with several stigmas being of comparatively rare occurrence in Dichlamedyous orders: *Compositæ, Valerianeæ,* and *Dipsaceæ,* being almost the only orders in which this combination occurs. Among Monchlamydeous plants it is more frequent, one-celled ovaries being the predominant, though not invariable, structure in Endlicher's class *Thymaleæ.*

Owing to its possessing this peculiar structure, the genus *Viburnum* appears more nearly related to these orders and to *Loranthaceæ* than might at first sight be suspected. *Loranthaceæ* and *Caprifoliaceæ* have long been associated as nearly related orders, though apparently with little propriety, as the former is assuredly more justly referrible to the *Thymalæous* group than to either *Araliaceæ* or *Caprifoliaceæ,* with which it is now associated. The intervention, however, of *Viburnum* with the flowers and habit of the one, and the ovary and fruit of the other, tends materially to strengthen the previously existing, but remote relationship.

Description of some new species of LORANTHUS.

The genus Loranthus is one of great extent, including upwards of 300 published species. This of itself is enough to render the labour of investigating its species a most irksome task, even under the most favourable circumstances. But great as the difficulties are, arising from the mere number of species, these, previous to the publication of the 4th volume of De Candolle's Prodromus, were augmented beyond calculation by want of arrangement and loosely constructed specific characters. The labours of that great Botanist in recasting the whole genus and grouping the species into easily understood subgenera and sections, combined with a more uniform system in the construction of his specific characters, have done much towards abridging the labour of future Botanists, who may have to engage in their investigation. Much however as he has done, I believe, I may still assert, that there are few, if indeed a single genus in the system of plants, that yet stands so much in need of the skill of an able and philosophical Mongraphist as Loranthus.

The succinct characters and judicious arrangement of De Candolle, aided by the copious descriptions of many, or rather most, of the species, brought together by the younger Schultes (Syst. Vegetab. Vol. VII.) have rendered the determination of known species a comparatively certain operation, but still much is wanted towards a really philosophical exposition of this great genus as a whole.

Martius, Blume and G. Don, seem all to be impressed with the idea that it might be advantageously divided, and among them it is broken into about 20 genera.

In the correctness of this view I cannot coincide, for taken as a whole it seems, so far as our acquaintance with its structure goes, a singularly natural genus. As regards the Indian portion, I can speak with considerable confidence, from the examination of a number of species, and it is my belief the American division is quite in keeping. That it is readily susceptible of division there can scarcely be a question, but that the parts ought to have a generic value assigned, I am far from thinking, under the conviction that being, as a whole, so extremely natural and uniform in its structure, its parts must prove most artificial: and to that extent become a blemish in a natural system.

In advancing this opinion, I wish however to be understood as laying particular stress on our present ignorance of the seminal structure, a most important point in the construc-

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tion of natural genera, but not once alluded to in the generic characters of any of the above-named authors, all of which are based on distinctions taken from the number and form of the bracteæ, the form and divisions of the corolla, and the inflorescence; points in themselves of barely sectional value, and to which much too high importance is assigned.

Having premised these general remarks on the genus generally, I shall now add characters of a few undescribed species, adopting De Candolle's subgenera.

1. Loranthus (Euloranthus) Arnottianus, (R. W.) Fruticose, very ramous, the ramuli and young leaves covered with minute ferruginous scales, (like Elæagni) leaves short petioled, opposite or subalternate, coriacious, form obovate, very obtuse to orbicular, spikes axillary, solitary, about the length of the leaves, many flowered; flowers sessile on the rachis: petals 4, linear, gibbous at the apex: ovary depressed, crowned with the slightly 4-toothed limb of the calyx: style filiform, persistent; stigma capitate; berry globose, small.

Hab.—*Courtallum—Parasitic on trees.*

This species belongs to the §. *Odorati,* DC., and is very nearly allied to both *L. odoratus* and *Hookerianus,* (W. & A.) from the latter, though in technical characters so like, it is certainly distinct, and equally so from the former. The leaves vary in size from half an inch to one and a half in length, and the larger ones are about an inch and a quarter broad near the apex; the ovary is little depressed, and is not immersed in the rachis. In both the flowers are about a quarter of an inch long and gibbous at the apex before expansion: in both the style is persistent as in the stylose section.

2. Loranthus (Euloranthus) intermedius, (R.W., *L. Wallichianus,* R. W. Icones, No. 143) glabrous branches terete: leaves obovate obtuse, often retuse at the apex, cuniate towards the base: racemes axillary fascicled, simple,

2-3 together, about the length, or occasionally longer than the leaves : flowers pedicelled, with a single lateral cuculate bractea at the base of the ovary, petals four, linear, thickened at the point : flower bud acutely 4-angled ; angles slightly winged towards the apex : ovary subglobose truncated : berry globular, about the size of a pea.

HAB.—*Travancore, Shevagherries, Neilgherries, on the road side below Coonoor—Flowering, July and August.*

This species is exactly intermediate between L. *obovatus* and L. *Wallichianus ;* it has the angularly four-sided flowers of the former with the diminutive size of the latter, though still twice as large, those of *Wallichianus* being about two lines long, while here they are fully four. In the length of the racemes, as compared with the leaves, it exceeds both. The leaves are from 1 to 2 inches long, and about 1 or $1\frac{1}{4}$ broad, coriacious. All the three species are found on the hills : L. *Wallichianus* at Burliar 2000 feet ; *intermedius* at Coonoor 6000 ; and *obovatus* abundant about Ootacamund 8000 feet of elevation. When I formerly published it as L. *Wallichianus,* I had not then seen that plant.

3. LORANTHUS (EULORANTHUS) BLUMEANUS, (R. W.) Glabrous branches terete, young shoots furfuracious : leaves short petioled, broad ovate or subcordate at the base, subacuminate : racemes simple, axillary, or 2 or 3 fascicled at the knots of the branches, much shorter than the leaves : flowers pedicelled, bractea anterior, gibbous below : flower bud cylindrical pointed furfuracious, calyx truncated entire : petals 4, linear acute : ovary globose.

HAB.—*Courtallum—August,* 1835.

Both this and the preceding belong to De Candolle's section "*Breviflora,*" though in this the flowers are fully an inch long. The flower buds being pointed not gibbous at the point very readily distinguishes this species from all the others of the section. Leaves about 4 inches long, by from 2½ to 3 broad, rounded or subcordate at the base, pointed, coriacious, racemes from an inch and a half to 2 inches long with from 8 to 12 short pedicelled flowers; bractea small, thick and fleshy, and being adpressed to the base of the ovary gives it a humpback appearance, which is common to other species of the section. It is a most distinct species.

4. LORANTHUS (SCURRULA) EUPHORBIÆ (R.W.) Glabrous, erect, very ramous branches, leaves short petioled, elliptic or orbicular, with a tendency to attenuation downwards when dry, obscurely 3-nerved, succulent, veinless, when green: flowers sessile, axillary or fascicled round the knots of the branches: bractea lateral, embracing the base of the ovary, very obtuse; calyx truncated entire: corolla tube terete, limb elongated, indurated, acute before expansion, laciniæ-subulate, becoming elastically involute on dehiscence: filaments red; anthers subulate: stigma clavate: berry red, about the size of a small bean.

HAB. *Parasitic on Euphorbia antiquorum and tortilis, flowering July. Frequent about Coimbatore.*

Very nearly allied to L. *elasticus*, but I think quite distinct; differing in the form of the leaves and in their being only 3, not 5-nerved. The flowers of this are slender, about an inch and a half long, above one-third of which only is truly petaloid, forming the proper tube; the limb is firm and coriacious; at first bursting with elasticity, and then becoming spirally involute like the main-spring of a watch. The whole plant is exceedingly fragile, and will scarcely bear the gentlest handling, tumbling all to pieces in drying. The juices of this plant do not show a trace of milkiness.

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Observations to accompany the Annual Return of Sick and Wounded of H. M. 15th, or King's Hussars, from 1st April 1844 to 31st March 1845. By F. Mouat, M.D. *Surgeon, H. M. 15th Hussars.*

[The most valuable contributions that have hitherto been made to the statistics of disease among European troops within the Indian presidencies, are undoubtedly the tables furnished by the late Dr. Murray to the second Volume of this Journal: unfortunately only two of them had appeared, when they were put a stop to, by the close of his active and energetic career.

The following elaborate report by Dr. Mouat, now acting Inspector General at Madras, gains additional weight, from the great experience which he has had of the diseases of soldiers, of the climate of India in general, and especially of Bangalore, at which station he has so long resided. It is especially interesting at the present time, when a plan for assimilating the returns of all the presidencies is believed to be under consideration, as being quite a model of an annual report, and as affording information on every head on which it can be required.

There has been for the last three years a general tendency towards the assimilation of the forms of the returns of the Queen's and Company's troops in Bengal, and the particular form, under which the matter of this report is arranged, has been in use among the Company's troops in Bengal since November, 1842.

At least six years ago, Major Tulloch and Dr. Marshall declared all the Indian returns which they had seen, to be quite useless for general statistical purposes, and accordingly they have not included any portion of India (Proper) in their statistical reports.

We do not know that measures of any consequence have been hitherto adopted to improve this state of things, as regards the Company's troops, and it does not redound to the credit of any one, that up to the present date, owing to the imperfection of our returns, we are not able to ascertain many points of the utmost importance, as regards the health and welfare of our vast and widely scattered

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armies. We even doubt, whether there are in existence, any adequate materials for giving a medical history of so recent an event as the late Gwalior campaign.

It is almost needless to remark, that it is only by general investigations, by throwing together a whole series of returns, and thus combining the experience of many years, that the accuracy of the results of more limited enquiries can be fairly tested, and that questions regarding the healthiness of particular stations, and the various effects of climate, can be satisfactorily decided.

To attain such important ends, it is necessary to improve our present system of returns, and to enforce uniformity throughout the three presidencies, as also highly desirable to have copies of all returns sent to Calcutta as a centre.

As to the new forms of returns to be employed, the simplest way would be to adopt those now in use in H. M.'s Service, perhaps with some slight modifications.

It is far from unlikely that each presidency may be unwilling to alter the forms now in use, and it is no doubt quite possible to point out many imperfections in H. M.'s returns, but they answer admirably for all practical purposes, and the annual returns compiled by H. M.'s Inspectors General since the year 1826, at a vast expense of labour, ought already to be yielding valuable results.

If a system of centralising all the returns were once adopted, it would increase very considerably the duties of the Members of the Medical Board in Bengal: but, if after an addition to their office establishment, they found the burden of arranging and compiling them to be too heavy, Government would no doubt relieve them of this additional duty, and would find it its interest to appoint a separate officer for the special purpose of superintending the returns of all India.

The monthly returns of H. M.'s Service give merely a bare list of diseases, and attempt no classification of them; it might be as well to adopt some practical classification, such as that now used in the annual returns. But the sooner any forms, based on theoretical views, such as the monthly ones now in use for Company's troops, which are founded on Good's classification, are got rid of, the better. They are ludicrous in many of their details.—J. M. P.]

H. M. 15th Hussars stationed at Bangalore.

Average Strength 722.

Remained last return, ...	46
Admitted,..	797
Discharged, ...	783
Died, ...	9
Remaining, ...	51
Proportion of deaths to diseases, ...	1 in 94
,, of sick to well, ...	1 in 13

Changes during the year.

Officers Joined, ...	6
,, Exchanged or removed, ...	1
,, Died at Head-Quarters, ...	3
,, ,, Elsewhere, ...	0
Men Invalided from Poonamallee, ...	10
,, Sent home effective to join Depôt, ...	2
,, Transported as criminals, ...	1
,, Discharged by purchase, ...	6
,, ,, Free, ...	1
,, Enlisted at Head-Quarters, ...	1
Recruits from England, ...	41
Transfer Joined, ...	0
,, Given, ...	1

Constitution of the Regiment.

	Serjeants.	Corporals.	Trumpeters.	Farriers.	Privates.	Total.
English, ...	35	26	4	7	501	573
Scotch, ...	2	1	..	..	29	32
Irish,....	11	5	3	1	81	101
Foreigners, ...	..	..	..	..	15	15
Total,....	48	32	7	8	626	721
Under 18 years of Age, ...	..	..	..	..	4	4
From 18 ,, to 20, ...	..	..	..	..	16	16
,, 20 ,, to 25, ...	..	6	1	4	137	148
,, 25 ,, to 30, ...	12	16	1	3	318	250
,, 30 ,, to 35, ...	18	5	5	1	69	95
,, 35 ,, to 40, ...	13	3	..	..	64	80
,, 40 ,, to 45, ...	4	2	..	..	18	24
,, 45 ,, to 50, ...	1	..	..	..	..	1
Upwards of 50, ...	0	0	0	0	0	0
Total,....	42	32	7	8	626	727

Return shewing the composition of the Regiment, according to the periods the Men have been stationed in the East Indies, for the annual period; commencing 1st April 1844, and ending 31st March 1845: as well as the relative admissions and deaths in the different classes specified for the purpose of determining whether the liability of the Men to sickness and mortality is lessened by length of residence.

Period of Residence.	Strength of each class.	Admission of each class.	Death of each class.
Under 1 Year, ...	43	28	..
From 1 to 2 Years, ...	17	23	..
,, 2 to 3 ,, ...	5	11	..
,, 3 to 4 ,, ...	22	84	..
,, 4 to 5 ,, ...	124	327	4
,, 5 to 6 ,, ...	422	193	4
,, 6 to 7 ,, ...	2	5	..
Above 7 Years, ...	86	126	1

Section I.

Topographical description of Station—its Vicinity—nature of the Climate—atmospheric Phenomena, &c.

Bangalore, the Head-Quarters of the Mysore Division of the Army, is situated 12° 57′ North latitude, and 77° 46′ East longitude, about 200 miles West of Madras, on a table-land or plateau; forming an area of about sixty miles by fifty, including Nundy Droog, Colar, and Ossoor.

The climate of this elevated region is comparatively cool.

The country in the vicinity of the station is undulating, and, though well cultivated of late years, yet at certain seasons possesses a peculiarly dreary and sterile appearance, intersected by ravines studded with granite rocks and masses of boulders, and each valley headed by a tank or series of tanks. But the cantonment itself is beautifully wooded, with a luxuriant vegetation, and ornamented with gardens, containing a profusion of flowers, shrubs and ornamental trees, and affording an ample variety of vegetables throughout the entire year. Hence to the European visitor it possesses peculiar attractions, and recalls many pleasing associations.

The soil is very fertile. It requires, however, both water and manure, (as the decayed vegetable matters, which form so fertile an alluvial deposit in many other places do not exist, except in the valleys, the jungles, and under the bunds of the tanks,) being generally a red ferruginous clay with nodules of iron and particles of sand, formed by the decomposition of the granite from the surface exposed to the action of the atmosphere.

The rocks are principally gneiss; and there is much granite, consisting of mica, felspar, and quartz. The former is often in a state of disintegration, well adapted for China crucibles, &c., and the felspar disintegrates into a clay used for pottery by the natives.*

Iron ore is found in great abundance; but the other mineral products are as yet little known, and doubtless will yield to future enquirers and explorers, a rich harvest.

The agriculture, the vegetable productions, and much that is interesting to the medical enquirer, must be omitted in a report like the present; as well as the physical appearance of the country, its mountains, valleys, rivers, &c.

The station itself is situated on an elevated crest running east and west, about two miles from the fort of Bangalore, and extending, when the new Barracks are built, to the Race-course. Of its eligibility for a Cantonment, we shall copy from last year's Report.

Bangalore as a station for European troops, possesses peculiar advantages, as being on the centre of a plateau 3000 feet above the level of the sea, enjoying the constant refreshing breezes of two monsoons, and an atmosphere exceedingly pure and elastic. To the human frame and feelings it is very agreeable and refreshing; and to vegetable life, exceedingly well adapted, as is evinced by the luxuriant crops and variety of fruits and vegetables, which it yields during the entire year.

If it possesses many advantages, it likewise has some drawbacks as a station for troops. The former it derives from its elevation, its central position, its freedom from swamps,

* Vide Benza, in the Madras Journal of Literature and Science.

jungles, and other sources of malaria, the frequent refreshing showers, constant strong breezes, and a bracing elastic air with cloudy or hazy mornings for several months, which mitigate the fiery rays of a sun that is vertical twice in the twelve months.

Hence, though the air is almost always cool and refreshing, yet in the day-time outside, when exposed to the sun's influence, it is hot and oppressive ; and the injurious effects are as great as in other less favoured situations. In fact, the transitions from heat to cold are great, and, when due precautions are not observed, trying to the delicate, and conducive to inflammatory attacks in those predisposed to them.

In the house the annual average of the thermometer is 74 degrees, with an annual variation of only 7 degrees. Exposed outside, however, it ranges from 50° to 129°, with an annual variation of no less than 44½°.

Here at once we have the explanation of its extreme salubrity, as well as of its very trying effects on the frame exposed unprotected to its influence ; together with the violence and frequency of inflammatory attacks, the rapidity of convalescence, the small proportion of deaths to treated, and the exemption which certain classes possess altogether to the assaults of those very affections : leading, as the subject does, to the very important consideration of the entire economy of the soldier, as it is influenced by these physical considerations, and reconciling the strange paradox of a place being very healthy, and at the same time exhibiting much violent and inflammatory disease, and, under certain circumstances, a very heavy list of casualties.

It tends, however, to the conclusion, that the benefits possessed by the station are its own; the disadvantages or drawbacks those of faulty economy, or capable of being mitigated or removed by better Barrack accommodation, by care to avoid exposure, by absence of extreme fatigue, dissipation, and of unnecesary restraints, as well as ill adapted dress.

These subjects have been especially noticed in previous reports. What is so intimately associated with health and disease, as the atmospheric phenomena, we should give in detail, as they form one of the great links of statistical and hygienic enquiries.

Atmospheric Phenomena.

April, 1844. Weather.—Mornings and nights cool; days hot, and at times close and oppressive: sun exceedingly powerful.

Wind.—Variable; westerly in the mornings, and easterly at night.

Rain.—Showers 15th, 17th, 20th, 22nd and 26th, and 1 inch 30 cents fell.

Dew.—None.

Clouds.—Occasionally on the days it rained, otherwise clear.

Haze.—Light, a few mornings.

Fogs.—None.

Health.—Corps very healthy. Catarrh among the children, and epidemic among the horses.

Prevailing diseases.—Numerous local affections, chiefly venereals and contusions.

Deaths.—None in hospital, but one man shot himself in Barracks.

Thermometer.	Extreme range during the month,	77° to 88°	Exposed in the house.
,,	Ditto difference in the 24 hours,	8°	
,,	Least ditto ditto,	4°	
,,	Average ditto ditto,	6°	
,,	Highest when exposed to the sun,	126°	Exposed outside.
,,	Lowest when exposed to the weather,	64°	
,,	Extreme variation when exposed outside,	62°	

May. On the whole, hot and oppressive; and the sun exceedingly powerful in the mornings.

Weather.—Still cool; the evenings and nights often cool, but as frequently close, hot, and oppressive.

Wind.—Westerly and S. W., and at times variable.

Rain.—Fell twelve days, indicated 4th, 6th, 13th, 16th, 21st, 22nd, 23rd, 24th, 25th and 27th, and 5 inches 32 cents fell.

Dew.—None.

Clouds.—Occasional clouds on these rainy days.

Haze.—Much hazy weather, which made the mornings cool and pleasant.

Fogs.—None.

Health.—Corps very healthy.

Prevailing diseases.—Fevers, dysentery, venereals, and contusions.

Deaths.—None.

Thermometer.	Extreme range during the month, from	74° to 88°	In the house.
,,	Ditto difference in the 24 hours,	7°	
,,	Least ditto ditto,	2°	
,,	Average ditto ditto,	5°	
,,	Highest when exposed to the sun,	124°	Exposed outside.
,,	Lowest when exposed to the weather,	63°	
,,	Extreme variation when exposed outside,	61°	

June. Weather.—Delightfully cold, and pleasant at times; high, disagreeable winds; mornings and nights very cold; evenings pleasant and cool: sun at times very hot.

Wind.—W. and S. W., generally very high during the day, and squally in gusts, dry and parching.

Rain.—Fell fourteen days, but only indicate by gage 2nd, 3rd, 6th, 15th, 16th, 17th, 25th, 26th and 29th, and about 1 inch 95 cents fell.

Dew.—Generally heavy in the mornings.

Clouds.—Generally cloudy.

Haze.—Mornings nearly all hazy till 8 or 9 o'clock.

Fogs.—None.

Health.—Corps very healthy.

Prevailing diseases.—Acute dysentery, cephalalgia, and ophthalmia amongst the children.

Deaths.—Four deaths; one cholera Ind., one hepatic, one dysentery acute, and one febris cont. com.

Thermometer.	Extreme range during the month, from	72° to 83°	In the house.
,,	Ditto ditto in the 24 hours,	7°	
,,	Least difference ditto,	3°	
,,	Average ditto ditto,	4° to 25°	
,,	Highest when exposed to the sun,	124°	Exposed outside.
,,	Lowest when exposed to the weather,	62°	
,,	Extreme variation when exposed outside,	62°	

July. Weather.—Cold, bracing, and delightful; hazy till 8th or 9th, and the days cloudy or cool; but with high, disagreeable, cold, gusty squalls.

Wind.—Westerly and S. W., occasionally W., and squally during the day.

Rain.—On 2nd, 5th, 10th, 11th, 12th, 13th, 16th, 18th, 19th, 20th, 21st, 26th, 27th, 28th, 30th and 31st, but only indicates sixteen days, and 3 inches 65 cents fell.

Dew.—Occasionally heavy in the morning.

Clouds.—Generally the days clouded the entire month.

Haze.—Mornings all hazy and cool.

Fogs.—None.

Health.—Corps very healthy.

Prevailing diseases.—Acute rheumatism, dysentery, venereal cases, contusions.

Deaths.—None.

Thermometer.	Extreme range during the month, from	72° to 78°	In the house.
,,	Ditto difference in the 24 hours,	6°	
,,	Least ditto ditto,	3°	
,,	Average ditto ditto,	4° to 10°	
,,	Highest when exposed to the sun,	112°	Exposed outside.
,,	Lowest when exposed to the weather,	59°	
,,	Extreme variation when exposed outside,	53°	

August. Weather.—Cold, bracing, and most agreeable; at times cold, occasionally rain, damp and frequent showers: cloudy with heavy squalls, and at times high winds.

Wind.—Westerly and W. S. W., and at times W. N. W.; occasionally squalls, and high winds.

Rain.—It rained twenty days, and indicated 1st, 2nd, 4th, 5th, 7th, 8th, 9th, 10th, 11th, 13th, 15th, 17th, 19th, 21st and 29th, and 4 inches fell.

Dew.—Heavy some mornings.

Clouds.—Clouded weather the whole month.

Haze.—Mornings all hazy, even to 9 and 10 o'clock, or later.

Fogs.—None.

Health.—Corps very healthy.

Prevailing diseases.—Hepat. rheumatism, and local diseases.

Deaths.—One, from hepatic abscess. Capt. Baird died also of hepatic abscess.

Thermometer.	Extreme range during the month, from	71° to 79°	In the house.
,,	Ditto difference in the 24 hours,	6°	
,,	Least ditto ditto,	3°	
,,	Average ditto ditto,	4° to 9°	
,,	Highest when exposed to the sun,	124°	When exposed outside.
,,	Lowest when exposed to the weather,	59°	
,,	Extreme variation when exposed outside,	65°	

September. Weather.—Cool and delightful end of month, at times close and oppressive; but mornings all cool and refreshing, and nights cool.

Wind.—Westerly till 23rd; then variable and easterly, ranging from west A. M. to easterly at noon and P. M.

Rain.—Five inches 90 cents fell in thirteen days, indicated only 1st, 3rd, 4th, 7th 22nd, 23rd, 24th, 25th and 30th.

Dew.—A few mornings.

Clouds.—Much cloudy weather.

Haze.—Mornings almost all hazy.

Fogs.—One morning.

Health.—Corps healthy.

Prevailing diseases.—Rheumatism and venereals.

Deaths.—One death, from phthisis pulmonalis.

Thermometer.	Extreme range during the month, from	70° to 81°	In the house.
	Ditto difference in the 24 hours,	6°	
,,	Least ditto ditto,	2°	
,,	Average ditto ditto,	4°	
,,	Highest when exposed to the sun,	126°	When exposed outside.
,,	Lowest when exposed to the weather,	60°	
,,	Extreme variation when exposed outside,	60°	

October. Weather.—Cool, pleasant, very delightful: mornings delicious, days cool, and nights cold.

Wind.—Easterly till 8th, then westerly and variable till 20th; after which E. N. E. or N. W., or variable.

Rain.—Rained twelve days, indicated on 7th, 8th, 9th, 12th, 14th, 16th and 18th, and 2 inches 30 cents fell.

Dew.—Generally heavy in the morning.

Clouds.—Several cloudy mornings and days.

Haze.—Generally heavy until about the 22nd, and then clear.

Fogs.—None.

Health.—Regiment healthy.

Prevailing diseases.—Fever, dysentery, hepatitis, and rheumatism.

Deaths.—None.

Thermometer.	Extreme range during the month, from	71° to 79°	In the house.
,,	Ditto difference in the 24 hours,	6°	
,,	Least ditto ditto,	1°	
,,	Average ditto ditto,	4° to 2°	
,,	Highest when exposed to the sun,	113°	When exposed outside.
,,	Lowest when exposed to the weather,	63°	
,,	Extreme variation when exposed outside,	50°	

November. Weather.—Most delightful the whole of the month ; mornings and nights cold, and the days and evenings cool, bracing and elastic, and very cold at times.

Wind.—N. E. ; at times N., and occasionally N. W.

Rain.—None the entire month.

Dew.—Heavy the first half of the month, and not much afterwards.

Clouds.—Scarcely any cloudy weather.

Haze.—Only a few hazy mornings.

Fogs.—Light, three or four mornings.

Health.—Corps healthy ; some sickness in Right Wing returned from Arnee.

Prevailing diseases.—Febris, dysenteria, hepatitis, rheumatism, and catarrhus.

Deaths.—One, from paralysis, and one shot himself in Barracks.

Thermometer.	Extreme range during the month, from	66° to 79°	In the house.
,,	Ditto difference in the 24 hours,	8°	
,,	Least ditto ditto,	3°	
,,	Average ditto ditto,	53°	
,,	Highest when exposed to the sun,	115°	When exposed outside.
,,	Lowest when exposed to the weather,	55°	
,,	Extreme variation when exposed outside,	60°	

December. Weather.—Very cool and delightful the entire month : indeed at times very cold ; and while the rain lasted, damp and chilly, scarcely any sun, and the wind keen and bracing.

Wind.—N. E. ; at times E., occasionally varying to N.

Rain.—Rained thirteen days, but indicated only on 7th, 8th, 14th, 15th, 18th, 19th, 20th, 21st, 27th, 28th and 29th, and 4 inches 80 cents fell.

Dew.—Generally heavy in the morning.

Clouds.—Much cloudy weather, especially the days it rained.

Haze.—Mornings mostly hazy.

Fogs.—Three or four foggy mornings.

Health.—Regiment healthy.

Prevailing diseases.—Hepatitis, rheumatism, and dysentery.

Deaths.—None.

Thermometer.	Extreme range during the month, from	67° to 75°	Exposed in the house.
,,	Ditto difference in the 24 hours,	7°	
,,	Least ditto ditto,	2°	
,,	Average ditto ditto,	3° to 8°	
,,	Highest when exposed to the sun,	124°	Exposed outside.
,,	Lowest when exposed to the weather,	55°	
,,	Extreme variation when exposed outside,	69°	

January, 1845. Weather.—Cool, agreeable, and most delightful ; mornings and nights delightful.

Wind.—Easterly, North-east, and once or twice Southerly and South-east.

Rain.—Rain fell four days, indicated 1st, 3rd and 4th, and one inch 55 cents fell.

Dew.—Generally heavy in the morning.

Clouds.—Cloudy mornings first week, then clear.

Haze.—Hazy till nine o'clock, then clear.

Fogs.—About eight foggy mornings.

Health.—Corps very healthy.

Prevailing diseases.—Hepatitis, rheumatism, and dysentery.
Deaths.—None.

Thermometer.	Extreme range during the month, from	65° to 78°	Exposed in the house.
,,	Ditto difference in the 24 hours,	7°	
,,	Least ditto ditto,	2°	
,,	Average ditto ditto,	4° to 22°	
,,	Highest when exposed to the sun,	123°	Exposed outside.
,,	Lowest when exposed to the weather,	59°	
,,	Extreme variation when exposed outside,	64°	

February. Weather.—Mornings cool and delicious, days rather warm; but the air cool, and the weather delightful and fine: evenings agreeable, and nights cold.

Wind.—Easterly and North-east the entire month.

Rain.—None.

Dew.—Heavy till middle of month, then light, or none at all.

Clouds.—Scarcely any all the month.

Haze.—A few hazy mornings.

Fogs.—Three foggy mornings.

Health.—Corps very healthy.

Prevailing diseases.—Hepatitis, rheumatism, and dysentery.

Deaths.—One, disease of colon, and Captain Chambers shot himself.

Thermometer.	Extreme range during the month, from	73° to 81°	Exposed in the house.
,,	Ditto difference in the 24 hours,	7°	
,,	Least ditto ditto,	4°	
,,	Average ditto ditto,	53°	
,,	Highest when exposed to the sun,	125°	Exposed outside.
,,	Lowest when exposed to the weather,	62°	
,,	Extreme variation when exposed outside,	63°	

March. Weather.—Mornings cool, but the days getting hot and close; sun powerful; evenings and nights agreeable, but at times hot.

Wind.—Easterly till about the 22nd, then variable or Westerly A.M., and Easterly P.M.

Rain.—Only 16th and 17th and night of 31st, and 1 inch 75 cents fell by gauge.

Dew.—None all the month.

Clouds.—Occasionally middle of the month.

Haze.—A few hazy mornings, &c. 10th to 25th, but light.

Fogs.—One morning.

Health.—Corps healthy, but admissions more numerous.

Prevailing diseases.—Hepatitis and dysentery.

Deaths.—One death, dysentery.

Thermometer.	Extreme range during the month, from	75° to 87°	Exposed in the house.
,,	Ditto difference in the 24 hours,	8°	
,,	Least ditto ditto,	2°	
,,	Average ditto ditto,	55°	
,,	Highest when exposed to the sun,	129°	Exposed outside.
,,	Lowest when exposed to the weather,	66°	
,,	Extreme variation when exposed outside,	63°	

Scale of Thermometer exposed in the open Air for 1844-45.

Months.	Lowest. 6 A.M.	Highest. 3 P.M.	Lowest. 8 P.M.	Average. 6 A.M.	Average. 3 P.M.	Average. 8 P.M.	Greatest difference in 24 hours.
April, 1844.	64°	126°	74°	64°	118°	73°	62°
May, ...	63	124	73	62	120	77½	61
June, ...	62	124	69	63	110	71	62
July, ...	59	112	66	61	109	67	53
August, ...	59	124	62	61	107	64	65
September, ...	60	126	62	63	112	64	66
October, ...	63	113	62	63	109	63	50
November, ...	55	115	59	60	113	61	60
December, ...	55	124	58	61	107	63	69
January, 1845.	59	123	66	61	108	67	64
February, ...	62	125	67	64	114	69	63
March, ...	66	129	72	67	127	73	63
Annual Average, ...	60°6	122	65°8	62°5	112°5	67°9	61°5

Scale of Thermometer in the House for 1844-45.

Months.	Lowest.	Highest.	Greatest difference in 24 hours.	Least difference in 24 hours.	Average difference in 24 hours.
April, 1844.	77°	88°	8°	4°	6°1
May, ...	74	88	8	2	5°11
June, ...	72	83	7	3	4°25
July, ...	70	78	6	3	4°10
August, ...	70	79	6	3	4°9
September, ...	71	81	6	3	4°11
October, ...	70	79	6	1	4°2
November, ...	6[illegible]	79	8	3	5°3
December, ...	67	75	7	2	5°8
January, 1845...	65	78	7	2	4°22
February, ...	72	81	7	4	5°3
March, ...	75	87	8	2	5°3
Annual Average, ...	70°7	81°3	7	2°6	4°74

General Observations.

The past twelve months have been cool, and, we may add, very healthy. The mortality has been small, and we have had no epidemic affection. This may be referred to the very low average difference of temperature in the house, only $4\frac{3}{4}$ degrees, whereas it is usually 7 degrees. Hence, with good Barracks thoroughly ventilated, and the absence from exposure to the sun, and a suitable covering for the head, and bedding at night, it would give this station an exemption and immunity from disease possessed by few places within the tropics.

We have had twelve deaths during the year, but two shot themselves in Barracks, and one was killed by his horse throwing him against a bandy. This at once illustrates, what has so often been urged. Here out of 723 men at Head Quarters, only nine have died from disease in Hospital. Some of these would have died in any part of the world, others have fallen a sacrifice, to remaining out of Hospital till disease had induced organic change: and we are thus led to the conclusion, and to the confirmation of the statistical reports* in other parts of the world, that an elevation of 3000 feet even within the tropics, renders that place as salubrious as Great Britain itself.

Table of Humidity, from 1st April 1844 to 31st March 1845.

Months.	Quantity.		Number of rainy days noted by the rain gauge.	Number of rainy days not noted by the gauge.	Total number of rainy days.	Remarks.
	Inches.	Cents.				
April, 1844.	1	30	5	4	9	
May,	5	32	12	1	13	
June,	1	95	14	5	19	
July,	3	65	16	7	23	
August,	4	0	20	5	25	
September,	5	90	13	2	15	
October,	2	30	12	6	18	
November,	0	0	0	0	0	
December,	4	80	13	3	16	
January, 1845.	1	30	4	1	5	
February,	0	0	0	0	0	
March,	1	75	3	1	4	
Total,	32	27	112	35	147	

If the annual fall of rain be compared for a series of years, it will be found subject to great fluctuation, as may be seen from the accompanying Table.

* By Major Tulloch.

Table of the Humidity, from January 1835 *to March* 1845.

Months.	1835.			1836.			1837.			1838.			1839.			1840.		
	Quantity.			Quantity.			Quantity.			Quantity.			Quantity.			Quantity.		
	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.
Jan.	..	..	1	..	..	..	..	..	..	..	..	..	..	92	2	..	..	..
Feb.	..	..	..	..	20	2	..	..	..	..	..	1	..	..	..	..	..	..
March	..	35	1	..	..	..	..	12	2	..	52	3	..	21	1	..	..	..
April	4	16	13	1	38	2	..	66	3	1	07	9	..	45	5	1	20	8
May	5	89	15	2	58	9	5	52	14	3	69	11	6	02	13	8	40	19
June	3	24	20	2	43	18	4	..	14	2	66	15	2	86	13	1	85	17
July	5	88	18	4	15	16	3	36	16	..	30	17	4	58	25	3	65	21
Aug.	4	13	27	3	66	26	6	07	24	4	02	19	7	19	28	5	21	13
Sept.	13	97	23	10	37	22	..	68	10	3	97	17	3	10	19	5	25	18
Oct.	5	10	16	..	85	2	5	72	15	1	32	8	2	61	11	5	65	16
Nov.	1	30	12	3	..	6	9	93	20	..	80	6	..	35	6	..	70	8
Dec.	..	..	1	..	..	..	1	85	2	..	..	2	..	..	..	..	..	..
Total,	44	02	147	28	62	103	37	90	120	37	90	120	28	33	123	31	95	120

Months.	1841.			1842.			1843.			1844.			1845.		
	Quantity.			Quantity.			Quantity.			Quantity.			Quantity.		
	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.	Inches.	Cents.	No. of rainy days.
Jan.	..	..	..	..	25	3	1	1	5	..	..	1	1	30	4
Feb.	..	..	..	..	..	..	..	..	..	..	20	3	..	..	..
March	..	..	1	..	20	2	1	50	6	1	10	4	1	75	3
April	1	70	2	..	5	1	..	35	2	1	30	5			
May	2	95	15	5	..	15	7	20	15	6	32	12			
June	3	25	25	7	..	16	5	40	14	1	95	14			
July	2	25	20	1	..	24	1	65	16	3	65	16			
Aug.	9	35	22	1	85	12	1	75	16	4	..	20			
Sept.	12	15	20	10	60	19	5	60	14	5	90	13			
Oct.	8	35	23	6	65	16	8	40	21	2	30	12			
Nov.	1	42	6	..	95	11	..	..	..	..	..	..			
Dec.	..	..	..	..	..	..	5	65	8	4	30	12			
Total,	41	42	134	35	56	139	38	51	117	50	52	113			

Section II.

Position of Barracks and Hospitals, with the extent and the nature of the accommodation they afford—Means of ventilation, &c.

Description of Barracks.

Site elevated and dry, on a gentle slope: erected in 1808, and consists of eight ranges running north and south, calculated to hold 672 men.

Were it not that the married families live in patcherries, and for the number of men in hospital or on duty, they would be incapable of holding 712 men, the present strength of the corps, without injurious crowding.

Each room is 224 feet long, 20 wide, 12 high, having eight doors and thirty-two windows, surrounded by an 8-feet verandah: at the corners are four rooms for non-commissioned officers, with one door and three windows each.

The ranges are 126 feet apart, and 58 feet from the south, and 400 feet from the north wall; this latter space being used for parade, &c.

The whole is surrounded by a 9-feet high wall, having three entrances and one wicket, and contains Barrack rooms, officers' guard-room above the archway, standard guard-room, three rooms for prisoners, serjeant-major's quarters, solitary cells, orderly room, ball court, artificers' and tailors' shops, sadler-serjeant's quarters, skittle alley, theatre, canteen, privies, armourer-serjeant's quarters, school-room, school-master's quarters, married soldiers' huts, regimental serjeant-major's quarters, trumpet-major's quarters, defaulters' room, gram godown, regimental store-room, two wells and eight bathing rooms.

The horses are picqueted on the outside in the open air on the south parade. The Barracks are good, but the verandahs are too narrow, and almost useless from being unenclosed, and badly ventilated from the doors and windows being of solid plank, and admission of fresh air being attended with pernicious currents; and this remark applies to all the buildings occupied by the Regiment, except the hospital, which has been enclosed, and the new guard-house.

The married families occupy a patcherry, an assemblage of mud-huts, in our opinion, in every way most objectionable; they are low, often very dirty, badly constructed with mud-floors; and are confined, ill ventilated, and take the soldiers from under the care of their non-commissioned officers, and are, it is alleged, a concealment for much depravity, traffic, and the sale of spirituous liquors.

We should therefore recommend the families being accommodated in barracks, as is done in Bengal.

The faults of the barracks are generally,

1st. The verandahs are not enclosed.

2nd. The verandahs are too narrow for real utility.

3rd. The doors and windows being of solid plank, when they are shut there is no light or air; when open, the glare, the wind loaded with dust and sand, or injurious currents of cold damp air are admitted; they are in consequence not only ill ventilated, but incapable of being well ventilated; the ventilators lately made in the roof of each barrack are of little use.

4th. The roofs themselves are bad, the bamboos decayed, and swarming with bugs; the application made use of to destroy those vermin was but a very temporary benefit.

There are two urine tubs to each Troop, enclosed by a wall adjoining the wash-houses; they are emptied and cleaned twice a day. There are eight small bathing or washing-houses: that they are of use it is needless to deny; but that they are too small for real utility, too far from a supply of water, and ineligibly situated, too close to the barrack rooms, between the ranges, preventing ventilation, is alike evident and objectionable, the water running from them causing injurious exhalations. These baths should have been large buildings, situated near the patcherries, with wells made close to them, so as to insure a sufficient supply of water, and of easy access to all classes, including the women and the children.

The water for drinking, cooking, bathing, washing utensils, and the married families, is brought by Puckallies, of which sixteen are allowed to the Regiment, and each is calculated by the Quarter-Master to bring 160 gallons daily, a quantity we should say in a hot climate, quite inadequate to the consumption of 721 men, 137 women, 181 children, and such of the followers as are employed within the Barrack Square, for all the purposes of domestic economy and cleanliness.

Barrack Furniture.

In India.	In England.			
Tables and Forms. 1 Cot, or bedstead for each Man, consisting of 3 teak boards placed upon 2 trestles of the same wood.	1 Iron pot and lid, 1 Trivet, 2 Pot hooks, 1 Iron ladle, 1 Flesh fork, 2 Meat dishes, 2 Water cans,	For every eight men.	1 Bason, 1 Plate,	For every man.

The foregoing contrast will shew the relative situation of the soldier at home and within the Tropics at Bangalore.

Those trestles or bedsteads are so infested with bugs, that we should recommend iron cots to be substituted; these bedsteads are placed in pairs, quite close to each other, without any intervening space; at the distance of 6 feet are two more, with a window or a door intervening.

The soldier has no bedding, he has merely a cotton quilt renewed every two years, which serves the double purpose of bed and covering. It is totally inadequate either for comfort or for health; he has no means of change, and consequently no means of promoting cleanliness; and as a soldier is often covered with perspiration and dirt from the very nature of his duties, it may well be imagined what their state must be in a hot climate, at the end of two years, saturated as they must be with filth and sordes.

At home the Royal Warrant provides them with one iron bedstead, one palliasse, one bolster, two blankets, one rug, two sheets, and these washed or changed, as they become soiled or useless.

Description of the Hospital.

Built in 1808, on a high dry slope about 320 feet to the east of the Barracks, and consists of two buildings, the largest, 3 sides of a square surrounded by an enclosed verandah 12 feet wide, with venetians and glass above; but the ends are not enclosed, which materially detracts from the appearance of the building and the comfort of the sick.

The building consists of four wards; the largest to the south is 101 feet long, 18 wide, and $12\frac{3}{4}$ high, with three ventilators; the one to the east is 61 feet long, 81 wide, and has two ventilators; that to the west is divided into two wards, which are respectively 24 and 27 feet by 18 in width, and are appropriated for the women and the worst cases. These wards are well ventilated and very comfortable.

To the north, and detached, at a distance of sixty-three feet, is the convalescent ward; it is 84 feet long, 18 wide, and $12\frac{3}{4}$ high, and has been altered and surrounded with a 12 feet enclosed verandah, similar to the rest of the hospital.

The hospital is calculated to contain 60 patients; but in the event of an emergency, the verandahs being now enclosed, it will contain as many more. The hospital is surrounded by a wall 9 feet high, and forms an oblong, 279 feet from north to south, and $199\frac{1}{2}$ feet from east to west. The distance from the hospital to the wall on the east, west and and south, is about 33 feet, and on the north 43 feet. It contains the hospital Serjeant's quarters, the guard-room, cook-room, surgery godown, or store-room, privy, and dead house; in the centre is a shed for holding water, or for shower baths.

As a general remark, the wards of the entire hospital are too narrow and also too low, which gives them a confined appearance, and leaves no room for tables for the patients at which to eat their meals; the compound is too small, and the space is insufficient for the convalescents to take exercise.

The Riding School, on two sides close to the hospital wall, is a great nuisance, from the noise and dust; it destroys that quiet and repose so necessary in all well regulated hospitals. The compound should be extended, and new out-offices erected. Application for building a conjee house for the reception of noisy, turbulent, and mad patients was made last year, and has been sanctioned by Government.

The hospital bedding consists of a wooden painted cot 6½ feet long and 3 wide, which takes to pieces, and is taped; it is in every respect a most suitable, clean, soft, elastic bedstead; the beds are stuffed with straw, with a cotton quilt, and Europe blankets and sheets; only 10 per pair per 100 of effective strength, however, are allowed and Surgical cases are excluded from the benefit of clean linen.

The Guard-house lately erected is a splendid building and well ventilated, with sufficient room for prisoners; it answers the purpose for which it is intended, and consists of guard-room, cells for defaulters and a capacious verandah.

The guard-room, 22 feet high, 20 wide, and 50 feet long with arched doorways. The cell is 22 feet high, 20 wide, and 20 long, with a verandah in front 17 feet high, 12 wide, and 71 long. It affords ample accommodation, is cool, flat-roofed and free from vermin. The new cook-houses erecting, also conjee house and prisoners' guard are very superior buildings, but not completed.

The men on line guard have temporary guard houses, which have had a favourable influence on the health of the men employed on that duty. On several of the sentry walks however the men are much exposed, and more or less likely to contract disease, either from direct exposure to a vertical sun, the heat and glare reflected from the walls, the damp dews at night, or pernicious currents of air, and miasmatic exhalations.

Section III.

Rations and Diet, detailing the nature of the Soldiers' meals and facilities the Station affords for improvement in this respect.

Rations of Diet.

The diet for the troops is furnished by Government, and consists of 1 pound of bread, 1 pound of meat, 4 ounces of rice, $1\frac{1}{2}$ oz. of sugar, 5-8ths of an oz. of tea or coffee, 1 chittack of salt, with allowance of 3 pounds of wood for cooking. Beef is supplied two days, and mutton every third day.

Each troop is divided into 3 messes, and the men have three meals per day. For breakfast a pint of coffee, occasionally tea, with bread. For dinner a pound of meat cooked according to directions given by each man in his turn, with a proportion of vegetables, roots, &c. For supper one pint of tea with the residue of any of the cold meat and bread left at dinner. The bread and meat are of excellent quality, and supplied by the Commissary as per G. O. of 8th July 1840, and are inspected by the Orderly Officer, and Quarter-Master previous to issue. The rations are so cheap, that it would conduce to health and comfort were these articles of the best or first quality.

The cooks are placed under the general superintendence of a man selected from the Regiment, who is struck off duty for that purpose. These meals appear plentiful and nourishing, and afford a reasonable variety, and have had a beneficial influence on the health of the men; it however would be an improvement, if it were imperative that a portion of the meat were daily made into good broth with vegetables, &c.

The water is brought, as already stated, by Puckallies, and when allowed to stand and filtered, is very good.

Section IV.

Duty and employment—specifying whether these are in any respect so severe as to be likely to prove prejudicial to the health of the Troops.

Duty and Employment.

This subject has been considered in the Sanatory report: here we shall enter more into the detail, as well as quote from the report to the Secretary at War.

Dr. Burke alludes to the greater sickness in Cavalry Corps in the Bengal command, and this we consider attributable, in this country, to the nature of the duties the Dragoon has to perform, for even with every care, attention and modification, it entails much exposure. That those performed by the 15th Hussars have been mild, is evinced by the small proportion of acute disease and few deaths; had the rigour of severe, harassing, or protracted drills been superadded, it must soon have had an unfavourable influence.

The duty and employment must vary and fluctuate, therefore the following is given as the nearest approximation to those usually ordered.

Days.	Morning.	Evening.
Sunday, ...	Church parade, Line duties, and Surgeon's Inspection at 10 A. M.	Line duties.
Monday, ...	Riding School, or Adjutant's drill and Line duties, ...	Inspection drill for awkward men, and line duties.
Tuesday, ...	Brigade exercise and line duties.	Do.
Wednesday, ..	Watering order and line duties.	Do.
Thursday, ..	Squadron drills or Riding school and line duties.	Foot parades under arms and line duties.
Friday, ...	Field exercise, or Adjutant's drill, and line duties, ...	Instructing drill for awkward men, and line duties.
Saturday,.. ..	Watering order and line duties. ..	Inspection of saddlery, or necessaries and line duties.

The Barrack and Line Guards alone take nearly 50 men for those duties, and the sentries are much exposed, whereas in Bengal most, if not all, exposed duties are done by Sepoys. This becomes important to note, as the Forage cap in use with the the 15th Hussars, appears but an imperfect protection to the head, and may have had much influence in predisposing to the numerous cases of paralysis during the past two years, and was therefore noticed in the Sanatory Report.

The following is the Commanding Officer's scale of guard for the past year.

" *The daily detail of duty generally performed at this station, by the Regiment under my command has been as under.*"

	White Troops.						
					Sentries.		
	Serjeants.	Corporals.	Trumpeters.	Privates.	By day.	By night.	Officers.
Guard at Barrack Gate, ...	1	1	1	30	10	10	1
——,,——Hospital, ...	0	1	0	6	2	2	0
——,,——Lines, ...	1	2	0	18	6	6	0
——,,——Mess and Paymaster, ...	0	2	0	6	0	2	0
——,,——As Police, ...	1	2	0	9	0	3	0
Total.	3	8	1	69	18	23	1

The Mess Guard and Pay Master's guard we havė only seen at this presidency, but the men on that duty have now a comfortable guard house, still we should recommend their abolition.

The foregoing detail of duty is very large for a tropical country, yet it does not give an accurate statement of the actual duty performed by the men, who are thus actually occupied, and the following table will illustrate this.

Return of men variously employed in addition to the daily detail of duty in the return A. No. 3 of the Sanatory Report.

		Serjeant Major.	Trumpet Major.	Serjeant.	Corporals.	Farriers.	Privates.	Total.
Daily.	Staff,	1	1	5	1	0	0	8
	Regimental orderly,	1	0	1	0	0	0	2
	Room Guard,	0	0	0	0	0	8	8
	Barrack Police,	0	0	1	1	0	9	11
	Orderly Sick Corporal,	0	0	0	1	0	0	1
Weekly.	Defaulter's room,	0	0	0	2	0	0	2
	Sick line orderly,	0	0	1	0	0	0	3
Permanent.	Canteen,	0	0	1	0	0	1	2
	General Store,	0	0	1	0	0	0	1
	Orderly room,	0	0	1	0	0	4	5
	Band,	0	0	0	0	0	21	21
	Bat men,	0	0	0	0	0	20	20
	Tailors,	0	0	1	0	0	2	3
	Riding department,	0	0	1	0	0	3	4
	Drill ditto,	0	0	1	0	0	0	1
	In charge of Cooks,	0	0	0	0	0	2	2
	Saddler's Shop,	0	0	0	0	0	3	3
	Total.	2	1	14	5	2	73	97

All those who are noted in this table, should be taken from the gross strength of the Regiment, and though it may be in a slight degree influenced by a few other employeès being in hospital, yet as these will generally be replaced from those detailed in return A. No. 3, of the Sanatory Report, it shews that in estimating the actual detail of duty performed by the Regiment, the whole of the foregoing details, should have due consideration, as well as the average number of sick in hospital, in estimating the influence of a conjoined agency of the effects of a particular duty and climate on the health of the soldier in India :—

Thus the Commanding Officer's state gives,	57
Detail of men on other duties, ...	97
Annual average daily sick, ...	53
Making a total of	207

to be deducted from 722 men, the average strength of the Corps during the year, which leaves 515 men for the duties of guard, lines &c. Hence the great necessity of attention to guard room accommodation, head dress, and exposure, &c. on the sentry walks.

The guards usually mount at 10 o'clock, an hour certainly too late in this country, and entailing an exposure which nothing but absolute necessity should sanction.

Section V.

Internal Economy, particularly as regards the measures for repression of Intemperance—the prevalance or rarity of Crime and Punishment among the Troops and—Measures employed to furnish them with healthy exercise and amusements.

There have been 269 acute cases treated during the year, of which only 26 appear to have been caused by intemperance. Drunkenness therefore apparently has had more influence as a predisposing, than an exciting cause of the soldiers' maladies. Facilities for obtaining intoxicating drinks always exist.

It is the same at all stations throughout India; a variety of fermenting substances are easily obtained, and the natives are adepts at converting them into alcoholic potations. The abkarry contract legalizes the sale of spirits to the Natives, and thence the Europeans can, and do obtain it, notwithstanding the prohibitions which exist to such sale. Some impute much of the intemperance to this source, though others, for whose judgment we entertain great respect, consider that the abkarry contract secures a better kind of spirits, and rather conduces to health by substituting a less pernicious beverage, for the poisonous trash concocted by the natives.

There has been, according to the Commanding Officer's return, an increase of crime and punishment, as compared with the preceding year. 61 have been tried and sentenced, which is greater than the number in the previous year, as 61 is to 55, but as there has been only the same number of deaths and less sickness, the increase of crime does not seem to have influenced disease.

The cells for prisoners in the Barrack Square are in good repair and well ventilated, but those in the Fort, now seldom used, are highly objectionable, being close, confined, with little light, and quite unventilated.

The mid-day punishment drills continue, and the objections formerly urged against them still exist, and indeed increased so far, as they may have contributed, with other causes of exposure, to our numerous list of paralytics, and tendency to cerebral diseases in the Regiment, particularly last year.

There is a Skittle Alley, and Racket Court, and the men occasionally amuse themselves at Cricket, Long bowls and Quoits, every requisite being furnished at the expence of the canteen fund, and in the Serjeant's room of the Canteen there is a Bagatelle Board.

The men of certain troops get books from their troop libraries, of which there are three established in the Regiment, and supported by the men of those troops. The rest of the Corps get books from the Station Soldiers' Library, and the Theatre has just been converted into a Library, Reading and Coffee room.

We have already reported our sentiments on the dress regulations; it is however but very seldom that the Hussar is decorated in full panoply, but it would be an improvement if he had a peak to his Forage Cap, as he is much exposed; indeed the Sanatory Report of last year will shew the importance we attach to this subject, whilst endeavouring to account for the numerous cases of paralysis. The following general observations from our Sanatory Report for the Secretary at War, may be introduced in this place.

It is proved by the Statistical Report, published by order of the British Government presented to both Houses of Parliament by command of Her Majesty, that all intertropical stations for H. M. Troops, enjoying an elevation of 3,000 feet, possess an immunity to disease as great, as if serving in England. Hence Bangalore, from its elevation, its coolness, its freedom from swamp, jungles, and all sources of malaria, should be equally healthy, as is evinced by the comparative healthiness of Natives and European women and children. There is however much sickness, and chiefly confined to the soldiers, and it is therefore much in the power of Government and its officers to preserve the health and efficiency of the troops.

The following suggestions are consequently submitted for consideration.

1st. Enclosed verandahs to the Barracks, similar to those of the Hospital, as a means of promoting ventilation and comfort.

2nd. The dress regulations to be modified and strictly enforced, agreeably to Sir Stamford Whittingham's order. The Forage Cap to be made of a useful size, worn well on the head, and furnished with a peak.

3rd. Suitable protection to the men on the several sentry walks, by erecting thatched sheds.

4th. The abolition of Mess and Pay Master's, and all superfluous day and night guards.

5th. The deficiency of bedding must be, and is, a source of privation and discomfort, as well as of filth and disease, in a hot climate; it is recommended that the quantity be assimilated to that in use in H. M. service at home and abroad.

6th. The roofs of the Barracks to be constructed of proper materials, to avoid that great source of irritation and loss of rest, from bugs.

7th. The abolition of the miserable, small, low, badly constructed, huts with mud floors, called "patcherries," used for married soldiers and their families, often the receptacles for vice, infamy, and sale of liquors, &c.

8th. Native Hospitals should be established, which might receive diseased females, especially in a country where there are no public institutions for their cure, and the entire resources and revenues are appropriated for the use of the State.

9th. The removal of all vegetation and unauthorized temporary erections from within the Barrack Square, as well as the extermination of all dogs, goats, poultry and other sources of vermin and filth.

10th. The exposure to the sun at this station is known to be so prejudicial, that no duty should be exacted during the hot months, that exposes the soldier after 8 A.M. or at any period after 9 A.M., or a little before 5 P.M. during the entire year.

11th. Men should not be employed at Lines before it is light, as they get cold and chilled, and its injurious consequences are fully borne out by the obstinacy, inveteracy, and frequency of rheumatic diseases.

12th. All that can distress the mind in health or harass the frame in disease, or disturb that order and quietness so essential to the economy of a well regulated Hospital, should be avoided, such as large funeral parties, signing accounts in Hospital (now dispensed with in most Corps), or visits by the various religious ministers for spiritual and religious purposes, being employed for temporal purposes.

Section VI.

The average strength of the Force throughout the year, distinguishing White from Black Troops, and showing any changes in its composition by the removal of one Corps and the arrival of another: followed by a detail of the Deaths and Admissions into Hostipal—also distinguishing White from Black Troops.

The annexed tables of White and Black Troops composing the force at the Station throughout the year, are separately arranged, so as to afford at two views the information required under this head. These tables have been prepared with considerable labour, requiring no fewer than 300 distinct calculations.

Table of White Troops at Bangalore from 1st April 1844 to 31st March 1845.

Months.	H. M. 15th Regiment, or King's Hussars.					Horse Brigade of Artillery.					1st Madras European Regiment.					2nd Madras European Infantry.					B. Company 2nd Battalion Artillery.					Garrison details.				
	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.
April 1844.	706	57	...	8·0	...	142	21	1	14·7	0·7	...	...	...	...	...	908	69	...	7·7	...	101	11	1	11·0	1·0	87	3	...	3·4	...
May, ...	707	68	...	9·6	...	142	15	...	10·5	...	...	...	...	...	...	902	91	1	10·0	0·11	101	6	...	6·0	...	78	2	1	2·5	1·3
June, ...	702	76	4	10·8	0·56	140	19	...	13·4	...	...	...	...	...	...	900	66	...	7·3	...	101	8	1	8·0	1·0	80	2	...	2·5	...
July, ...	701	60	...	8·5	...	136	22	...	16·9	...	...	...	...	...	...	903	90	2	9·9	0·22	117	13	...	11·0	...	81	2	...	2·5	...
August, ...	700	60	1	8·5	0·14	135	15	...	11·0	...	...	...	...	...	...	902	70	1	7·7	0·11	116	9	...	7·7	...	81	6	...	7·4	...
Sept. ...	374	35	1	9·3	0·27	165	16	1	9.7	0·6	...	...	...	...	...	908	77	...	8·4	...	116	7	...	6·0	...	80	4	...	5·0	...
October, ...	374	37	...	9·6	...	33	21	1	63·6	3·0	...	...	...	...	...	907	88	2	9·7	0·22	128	9	...	7·0	...	84	1	...	1·2	...
Nov., ...	738	56	1	7·6	0·13	34	2	...	5·7	...	...	...	...	...	...	912	59	...	6·4	...	117	6	...	5·0	...	83	1	...	1·2	...
Dec., ...	737	47	...	6·3	...	37	5	...	13·5	...	...	...	...	...	...	883	62	...	7·0	...	116	11	...	9.4	...	85	...	...	1·2	...
Jan., 1845.	737	47	...	6·3	...	38	5	...	13·0	...	RW 468	20	...	4·3	...	...	...	...	...	...	114	5	...	4·3	...	98	1	...	1·0	...
Feb., ...	739	51	1	6·9	0·13	134	15	...	11·0	...	817	66	1	8·0	0·12	...	...	...	...	...	116	3	...	2·5	...	86	2	...	2·4	...
March, ...	743	87	1	11·7	0·13	133	8	...	6·0	...	810	135	...	16·6	...	...	...	...	...	...	123	8	...	6·5	...	89	2	...	2·2	1·1
Aver. of year.	663	5·67	0·75	8·6	0·13	105	13.6	0.25	15·7	0·36	698	733	0·3	9·6	0.04	903	75	0·07	8·2	0·07	114	8	0·1	7·0	0·1	84	2·16	0·1	2·7	0·2

Table of Black Troops stationed at Bangalore from 1st April 1844 to 31st March 1845.

Months.	E. Troop Horse Artillery.					3rd Regiment Light Cavalry.					B. Company 2nd Battalion Artillery.				
	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.
1844. April,	104	4	...	3.7	...	512	31	...	6.0	...	114	4	...	3.4	...
May,	107	10	...	9.3	...	512	21	...	6.1	...	108	3	...	2.7	...
June,	110	16	...	14.5	...	512	27	...	5.2	...	108	8	...	7.4	...
July,	109	14	...	12.8	...	512	36	...	7.0	...	107	9	...	8.4	...
Aug.	113	17	...	15.0	...	512	19	...	5.7	...	107	6	...	5.6	...
Sept.,	75	5	...	6.6	...	512	12	...	2.3	...	107	4	...	3.7	...
Oct.,	75	8	...	10.6	...	512	26	...	5.0	...	67	...	...	...	...
Nov.,	110	17	...	15.0	...	503	40	...	8.0	...	122	6	...	5.0	...
Dec.,	110	6	...	5.4	...	...	...	...	...	...	110	8	...	7.2	...
1845. Jan.	111	8	...	7 2	...	...	...	...	...	...	110	3	...	2.7	...
Feb.,	112	11	...	9.8	...	...	...	...	...	...	111	4	...	3.6	...
Mar.,	112	9	...	8.0	...	...	...	...	...	...	112	3	...	2.6	...
Avr. of year.	104	10.4	...	9.8	...	511	26.5	...	5.4	...	107	4.8	...	4.35	...

Months.	Sappers and Miners.					8th Regiment Native Infantry.				
	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.
1844. April,	214	37	...	1.26	...	1167	65	1	5.6	0.08
May,	299	28	...	9.4	...	1152	115	1	9.1	0.08
June,	327	27	1	8.2	0.3	1153	156	...	13.5	...
July,	320	29	...	9.0	...	1153	116	2	10.0	0.16
Aug.	318	26	...	8.1	...	1159	106	...	9.1	...
Sept.,	314	27	1	8.5	0.3	1168	73	1	6.2	0.08
Oct.,	344	23	...	9.4	...	1127	108	1	9.5	0 08
Nov.,	237	46	...	19.0	...	1014	93	...	9.0	...
Dec.,	267	37	...	13.8	...	...	...	...	...	...
1845. Jan.	281	24	1	8.5	0.3	...	...	...	...	...
Feb.,	227	19	1	8.6	0.4	...	...	...	...	...
Mar.,	289	37	1	12.8	0.3	...	...	...	...	...
Avr. of year.	278	29	0.04	10,6	0.13	1136	104	0.75	8.8	0.06

Months.	23d Regiment Native Infantry.					Garrison details.				
	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Ratio died per cent. of strength.	Strength.	Admitted.	Died.	Ratio admitted per cent. of strength.	Rato died per cent. of strength.
1844. April,	...	...	...	...	...	380	12	...	3.1	...
May,	...	...	...	...	...	447	9	...	2.0	...
June,	...	...	...	...	...	458	6	...	1.3	...
July,	1033	82	2	8.0	0.2	386	7	2	1.0	0.5
Aug.	1030	85	1	3.3	0.1	514	6	...	1.0	...
Sept.,	1035	22	...	2.1	...	434	5	...	1.1	...
Oct.,	1035	28	...	2.7	...	451	48	...	10.0	...
Nov.,	1033	23	2	2.2	0.2	646	24	1	3.7	0.15
Dec.,	1092	29	2	2.6	0.2	619	5	2	0.8	0.32
1845. Jan.	1092	20	...	2.7	...	517	4	...	0.7	...
Feb.,	1071	33	1	3.0	0.1	614	6	...	0.97	...
Mar.,	1187	20	1	1.6	0.1	360	3	...	0,47	...
Avr. of year.	1067	32	1.0	3.1	0.1	512	11	0.4	2.18	0.08

Section VII.

Remarks as to the principal classes of Diseases, by which the sickness and mortality have been occasioned: any peculiarity either as regards the form in which they present themselves, or rarity as compared with former years, or other stations to be carefully noted.

Prevailing Diseases.

The most prevailing diseases have been the usual endemics of the country.

The period embraced by this Report has been free from all epidemic diseases, and the following table would show that disease has not increased during the last four years except Paralysis, which has more than doubled itself.

Table of Diseases admitted into Hospital from April 1840 *to May* 1845.

Diseases.	1840-41.		1841-42.		1842-43.		1843-44.		1844-45.	
	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.	Treated.	Died.
Febrile affections, ...	132	2	106	3	81	1	86	0	49	1
Pulmonic, ...	32	0	16	0	26	4	28	2	33	1
Hepatic, ...	92	7	87	6	72	2	53	1	32	2
Dysenteric, ...	176	4	121	3	119	5	78	5	140	4
Rheumatic, ...	66	0	72	0	59	0	42	0	46	0
Paralysis, ...	0	0	2	0	3	0	4	0	10	1
Venereal, ...	506	0	357	0	202	2	159	0	184	0
Wounds and accidents, ...	236	2	243	2	252	0	175	1	173	0
Other diseases, ...	469	3	365	2	278	5	183	0	75	0
Total, ...	1708	18	1369	16	1092	19	808	9	843	9

Particular Affections.

Dysentery. There have been 140 cases with 4 deaths.

Average period in hospital, ...	30 days.
Greatest quantity of blood drawn, ...	40 ounces.
Average ditto, ...	20 ditto.
Greatest number of leeches applied, ...	No. 250.
Average ditto, ...	No. 40.
Greatest quantity of calomel taken, ...	240 grains.
Average ditto, ...	80 ditto.

Fevers. 49 cases treated, with 1 death.

Average period in hospital, ...	16 days.
Greatest quantity of blood drawn, ...	32 ounces.
Average ditto, ...	24 ditto.
Greatest number of leeches applied, ...	No. 82.
Average ditto, ...	No. 78.
Greatest quantity of calomel, ...	154 grains.
Average ditto, ...	52 ditto.

Hepatitis. 32 cases treated, with 2 deaths.

Average period in hospital, ...	36 days.
Greatest quantity of blood drawn, ...	30 ounces.
Average ditto, ...	30 ditto.
Greatest number of leeches applied, ...	No. 140.
Average ditto, ...	No. 40.
Greatest quantity of calomel taken, ...	180 grains.
Average ditto, ...	70 ditto.

Rheumatism. 44 cases treated, with no death.

Average period in hospital, ...	60 days.
Greatest quantity of blood drawn, ...	40 ounces.
Average ditto, ...	30 ditto,
Greatest number of leeches applied, ...	No. 160.
Average ditto, ...	No. 60.
Greatest quantity of calomel taken, ...	150 grains.
Average ditto, ...	70 ditto.

General Observations.

There are few general observations needed. It will be seen by the tables, that acute disease has not increased, and that disease in the aggregate has greatly diminished during the last two years.

Mortality has also decreased, and the deaths in hospital have been reduced nearly one-half since 1843.

Paralysis has been frequent: it merits attention in consequence of being confined entirely to the 15th Hussars, indicating that the sources of the disease, whatever they may be, are in some measure confined to the Regiment.

The first year we have no case; the second, two cases; the third, three cases; the fourth, four cases; and last year, the fifth, we have eight cases—total seventeen cases. Whereas the 13th Dragoons, the first year, had no case; the second year, one case; third year, no case; fourth year, one case—making two cases in four year. This contrast needs no comment.

We shall now briefly illustrate the causes or supposed exciting causes, so far as we possess the materials. Such tables if kept for a series of years must be useful, shewing as they will do the influence of external and internal causes, and, above all, their impressions on the sick; for although these be fallacious, yet as the remote or predisposing causes prove a direct influence, they will lead to important practical results.

Table of causes or assigned causes of acute disease from 1st April 1840, *to* 31*st March* 1845.

	Causes or supposed exciting causes.	*During the years.* 1840-41.	1841-42.	1842-43.	1843-44.	1844-45.	Total.
1.	Who impute their diseases to cold caught by exposure to currents of air on line or Barrack guard, or lying on damp bed,.. ..	11	7	3	4	10	35
2.	Who impute their diseases to cold caught in their posts on the different Regimental guards, at early lines 4½ A.M., or by going round with the relief, ...	7	11	7	6	7	38
3.	Who impute their diseases to cold caught by exposure to the night air, or by sleeping opposite to doors and windows left open in the Barracks, or while prisoners in the guard room or defaulter's room, or on Police or Paymaster's guard, or going to privy, or shoeing horses on the line of march, or by lying under trees, ...	30	27	33	30	38	158
4.	Who impute their diseases to cold caught, but cannot particularize how, ...	42	35	33	20	40	170
5.	Who impute their disease to cold caught in the rain, when at watering order, ball practice, going round with relief, washing horses and bathing, ...	23	19	8	6	6	62
6.	Who impute their diseases to cold caught by change of the weather, cold mornings, neglecting to put on their flannels, or changing clothes when perspiring, ...	5	3	7	5	2	22
7.	Who impute their diseases to drinking cold water, buttermilk, or lemonade, when heated,	5	2	3	4	1	15
8.	Who impute their diseases to superintending boiling gram, or getting ears picked, ..	0	0	2	0	0	2
9.	Who impute their disease, to exposure to the sun while on sentry, or barrack line, or gram guard at lines, midday punishment drills, and heat of weather, ...	4	7	3	5	8	27
10.	Who impute their diseases to diet, as having eat curry and rice, bacon and eggs, pork, mangoes, mango puddings, cucumbers, water melon, guavas, sour oranges, bad coffee, porter, cold water, or ginger beer, ..	15	6	6	5	6	38
11.	Who impute their diseases to riding or falls or kicks from their horses, or blows, or costiveness, or blowing on instruments in the band, or coughing, and the bite of a mad dog, ...	12	12	12	6	1	43
12.	Whose diseases were caused by intemperance,	14	14	36	21	28	113
13.	Who know no cause for their diseases, but have been drinking, ...	5	4	6	6	2	23
14.	Who know no cause for their diseases, ..	290	243	205	173	96	1007
15.	Who imputes his disease to cold caught when sitting up with race horses, ...	0	0	0	1	0	1
16.	Who impute their diseases to cold caught in the rain while carrying orders to officers' quarters, walking without shoes, getting wet at funeral parties, or coming from the canteen, ...	0	0	0	0	10	10
	Diseases re-admitted from the above, changing to other acute affections, ...	13	21	19	10	14	77
	Total, ...	476	411	383	302	269	1841

Tables of causes, or assigned causes, of 269 *acute Cases admitted into the Hospital of Her Majesty's* 15*th Hussars, from* 1*st April* 1844 *to* 31*st March* 1845.

No. and Diseases.	Causes or supposed exciting causes.	Of each.	Total.
Fever, 48.	To cold caught on line, mess, and bazar guards, ..	5	
	,, by lying opposite doors or windows left open in Barracks, ...	1	
	,, by lying in verandah, ...	4	
	,, by exposure to night air and lying in a wet cloak, ...	1	
	,, by getting wet in the rain, but cannot tell when, ...	7	
	,, by lying on damp ground, ...	1	
	,, at early lines and field exercise at 4 A. M., ...	2	
	To exposure to the sun on duty at stables 10 A. M.	1	
	,, while walking in the bazar 11 A.M.	4	
	,, while out shooting, ...	1	
	Know no cause for their diseases, ...	15	
	Intemperance, ...	6	
			48
Dysentery, 89.	To cold caught on Barrack guard, ...	2	
	,, by lying opposite doors and windows left open in Barracks, ...	6	
	,, by lying in the verandah, ..	4	
	,, by lying on the cold flags, hospital guard,..	2	
	,, cannot tell how, ...	13	
	,, by getting wet in the rain at funerals	6	
	,, ditto coming from canteen, ..	1	
	,, at early morning lines, ...	3	
	,, by exposure to a current of air when in a perspiration, ...	1	
	,, by drinking cold-water in a perspiration, ...	1	
	To eating cabbage for dinner, ...	1	
	Know no cause, ...	42	
	Intemperance, ...	7	
			89
Hepatitis, 34.	To cold caught by lying opposite open doors and windows at night, ...	6	
	,, by lying on cold flags, ...	1	
	,, by getting wet in rain while carrying orders to officers' quarters, ..	2	
	,, by walking without shoes on the cold flags, ...	1	
	,, but cannot tell how, ...	6	
	Know no cause, ...	18	
			34
Rheumatism, 45...	To cold caught on line guard, ...	3	
	,, by pulling off their jackets when in a perspiration, ...	2	
	,, by opposite doors or windows left open,..	4	
	,, but cannot tell how, ...	7	
	,, by a current of air when shoeing horses,..	1	
	,, by getting wet in the rain, ..	3	
	,, by lying on cold flags, ...	2	
	To a jerk when on horseback, ...	1	
	To intemperance, ...	3	
	Know no cause, ...	19	
			45

Tables of causes, or assigned causes, of 269 acute Cases admitted into the Hospital of Her Majesty's 15th Hussars, from 1st April 1844 to 31st March 1845.—(Continued.)

No. and Diseases.	Causes or supposed exciting causes.	Of each.	Total.
Diseases of lungs, 15	To cold caught by exposure to night air, ..	1	
	,, by lying on cold ground, ...	2	
	,, but cannot tell how, ...	3	
	,, by getting wet returning from privy,	1	
	,, after exposure to the sun, ...	1	
	Intemperance, ...	2	
	Know no cause, ...	5	
			15
Cholera, 11.	To cold caught by doors and windows being left open, ...	2	
	To eating cabbage for dinner, ...	1	
	Know no cause, ...	6	
	Intemperance, ...	2	
			11
Colica, 25.........	To eating salad and cabbage, ...	2	
	,, potatoes, ...	2	
	Know no cause, ...	7	
	To cold caught by exposure to wet and damp on the march, ...	2	
	,, on line guard, ...	2	
	Intemperance, ...	6	
	To cold caught but cannot tell how, ...	4	
			25
Delerium Trem., 2,	To intemperance, ...	2	2
	Grand Total, ...		269

Venereal Disease.

Syphilis has decreased in a marked manner. This may have arisen from two causes: first, the women either getting themselves cured, or those affected with the worst forms dying, or the men avoiding those from whom they had previously suffered; second, from the disease itself partaking of the general healthiness of the past year, and from the men's improved habit of body, since it is well known that only certain habits and constitutions are subject to the worst form of venereal disease.

The decrease of numbers, however, must arise from the decrease of disease, whatever may be the cause of the improvement.

We have just noticed, that venereal has been less frequent. The following table illustrates the subject more fully than any detailed history we could give of its nature, frequency and treatment.

Table of Venereals, admitted from 1st April 1844 to 31st March 1845.

No.	Treatment.
	Of 60 *Syphilis primitiva.*
23	Were treated without Bubo and without mercury.
6	ditto ditto and with ditto.
17	ditto with Bubo and without mercury.
4	ditto ditto and with mercury.
	ditto without Gonorrhœa and without mercury.
	ditto ditto and with ditto.
8	ditto with ditto and without ditto.
2	ditto ditto and with ditto.
60	*Of* 10 *Syphilis consecutiva.*
2	Were treated without primary symptoms and without mercury.
6	ditto with ditto and with ditto.
2	ditto ditto and with ditto.
10	*Of* 25 *Bubo simplex.*
18	Were treated without mercury.
7	ditto with ditto.
25	*Of* 71 *Gonorrhœa.*
53	Were treated without mercury.
8	ditto with Bubo and without mercury.
10	ditto with Syphilis and without mercury.
71	

Statistical Tables shewing the treatment adopted in the Hospital of H. M. 15th Regiment, or King's Hussars, from 1st April 1844 to 31st March 1845.

No. 1.

Of 269 acute cases, averaging 26 days in hospital, 9 died.

35	were only bled,	,,	22	,,	0
52	had only leeches applied,	,,	24	,,	0
178	both bled and leeched,	,,	30	,,	8
4	neither bled nor leeched,	,,	27	,,	1
269					9

No. 2.

Of 269 acute cases treated, averaging 20 days in hospital, 8 died.

213 were bled from the arm, averaging 22 days in hospital, with 8 deaths.

12	were bled between the 1st and 6th hour of attack, averag.	31 days.	0
9	,, 6th and 12th ,,	9	0
5	,, 12th and 18th ,,	9	0

20	were bled on the	1st	day of attack, averag.	19	days in hospital, with	2 deaths.
47	,,	2nd	,,	20	,,	1
51	,,	3rd	,,	24	,,	3
24	,,	4th	,,	15	,,	1
8	,,	5th	,,	11	,,	0
9	,,	6th	,,	9	,,	0
9	,,	7th	,,	16	,,	0
3	,,	8th	,,	14	,,	0
3	,,	9th	,,	15	,,	1
1	,,	10th	,,	15	,,	0
3	,,	12th	,,	16	,,	0
1	,,	14th	,,	18	,,	0
2	,,	15th	,,	25	,,	0
1	,,	17th	,,	21	,,	0
1	,,	21st	,,	23	,,	0
3	,,	30th	,,	38	,,	0
1	,,	61st	,,	70	,,	0
213						8

No. 3.

Of 213 bled from the arm, averaging 22 days in hospital, with 8 deaths.

187	were bled once,	,,	26	,,	8
25	,, twice,	,,	25	,,	0
1	,, three times,		201	,,	0
213					8

No. 4.

Of 213 men bled from the arm, averaging 22 days in hospital, 8 died.

3	lost from 8 to 10 oz.	,,	14	,,	0
60	,, 10 to 20 do.	,,	19	,,	2
74	,, 20 to 30 do.	,,	18	,,	2
52	,, 30 to 40 do.	,,	15	,,	3
18	,, 40 to 50 do.	,,	12	,,	1
5	,, 50 to 60 do.	,,	66	,,	0
1	,, 60 to 70 do.	,,	201	,,	0
213					8

No. 5.

Of 269 acute cases treated, averaging 26 days in hospital, 8 died.
230 had leeches applied, averaging 20 days in hospital, with 8 deaths.

10	had from	5 to 10 leeches,	averag.	20 days in hospital,	with	8 deaths.
59	,,	10 to 20 do.	,,	15	,,	0
47	,,	20 to 30 do.	,,	12	,,	1
27	,,	30 to 40 do.	,,	17	,,	0
30	,,	40 to 50 do.	,,	14	,,	1
15	,,	50 to 60 do.	,,	16	,,	0
11	,,	60 to 70 do.	,,	18	,,	1
7	,,	70 to 80 do.	,,	31	,,	0
10	,,	80 to 100 do.	,,	35	,,	1
6	,,	100 to 120 do.	,,	80	,,	2
4	,,	120 to 140 do.	,,	104	,,	0
2	,,	140 to 160 do.	,,	17	,,	0
1	,,	210	,,	22	,,	1
1	,,	250	,,	115	,,	1
230						8

No. 6.

Of 269 acute cases treated, averaging 26 days in hospital, 9 died.
266 took calomel, averaging 26 days in hospital, 9 deaths.

36	took from	5 to 10 grains,	,,	9	,,	0
59	,,	10 to 20 do.	,,	12	,,	1
48	,,	20 to 30 do.	,,	15	,,	1
46	,,	30 to 40 do.	,,	17	,,	0
34	,,	40 to 50 do.	,,	27	,,	1
12	,,	50 to 60 do.	,,	14	,,	0
18	,,	1 to 2 drams,	,,	45	,,	3
8	,,	2 to 3 do.	,,	62	,,	2
2	,,	3 to 4 do.	,,	138	,,	0
2	,,	4 to 5 do.	,,	164	,,	1
1	,,	12 drs. 29 grains,	,,	253	,,	0
266						9

No. 7.

Of 269 acute cases treated, averaging 26 days in hospital, 9 died.

266	took calomel,	,,	,,	,,	with	9 deaths.
3	,, no calomel,	,,	,,	,,	,,	0
269						

Of the foregoing 266, that took calomel, with 9 deaths,

10	had ptyalism,	with	3	deaths.
41	had their mouths sore, but without free ptyalism,	with	3	,,
6	had only their gums affected,	,,	1	,,
151	had not their mouths affected,	,,	2	,,
266			9	

Of 10 who had ptyalism, with 3 deaths,

2	took from	30 to 40 grains of calomel	with	0
3	,,	40 to 50 do.	,,	0
1	,,	50 to 60 do.	,,	0
1	,,	1 to 2 drams,	,,	1
1	,,	2 to 3 do.	,,	1
1	,,	3 to 4 do.	,,	0
1	,,	4 to 5 do.	,,	1
10				3

Of 41 who had their mouths sore, but without free ptyalism, with 3 deaths,

9	took from	20 to 30 grains,	,,	,,	0
11	,,	30 to 60 do.	,,	,,	0
17	,,	1 to 2 do.	,,	,,	2
2	,,	2 to 3 do.	,,	,,	1
1	,,	4 to 5 do.	,,	,,	0
1	,,	12 to 13 do.	,,	,,	0
41					3

Of 64 who had their gums affected, with 1 death,

44	took from	20 to 40 grains,	,,	0
13	,,	40 to 60 do.	,,	1
6	,,	1 to 2 drams,	,,	0
1	,,	2 to 3 do.	,,	0
64				1

Of 151 who had not their mouths affected, with 2 deaths,

34	took from	5 to 10 grains,	,,	0
58	,,	10 to 20 do.	,,	1
27	,,	20 to 30 do.	,,	1
20	,,	30 to 40 do.	,,	0
8	,,	40 to 50 do.	,,	0
2	,,	50 to 60 do.	,,	0
2	,,	1 to 2 drams,	,,	0
151				2

Recapitulation of the foregoing Tables.

Numbers.	Effect.	Quantity taken.											Average quantity.	Total number of deaths.	Proportion of deaths.
		5 to 10 grains.	10 to 20 grains.	20 to 30 grains.	30 to 40 grains.	40 to 50 grains.	50 to 60 grains.	1 to 2 drams.	2 to 3 drams.	3 to 4 drams.	4 to 5 drams.	12 to 13 drams.			
10	Ptyalism, ...	..	..	..	2	3	1	1	1	1	1	..	81	3	1 in 3
41	Mouth sore, but without free ptyalism, ...	..	..	9	11	..	..	17	2	..	1	1	84	3	1 in 14
64	Gums affected only, ..	..	..	44	..	13	..	6	1	..	..	..	37	1	..
151	Gums not affected, ..	34	58	27	20	8	2	2	..	..	..	..	24	2	1 in 75
3	Have had no calomel, ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Total, ..	34	58	80	33	34	3	26	4	1	2	1	58	9	1 in 30
269	Deaths, ..	..	1	1	..	1	..	3	2	..	1	..	..	..	..

Abstract of the average period in Hospital, with treatment, &c., of 277 acute cases admitted into Hospital from 1st April 1844 to 31st March 1845.

	Diseases.											
	Fevr. Intermittent.	Febr. Remittens.	Febr. C. C.	Hepat. acut.	Rheumatism acute.	Dysentery acute.	Disease of lungs.	Cholera Ind.	Colica.	Delirium tremens.	Paralysis cerebral.	Total.
Total number of acute cases admitted,	4	9	35	34	45	89	15	11	25	2	8	277
Ditto ditto, ..	..	..	1	2	..	3	5	1	..	..	1	9
Average period in Hospital, .. days,	11	25	15	36	60	30	90	20	15	20	150	
Greatest quantity of blood drawn, ounc.	30	32	30	50	40	40	40	32	20	40	70	
Average ditto, .. ditto,	20	30	20	30	30	30	20	20	15	20	32	
Greatest No. of leeches applied, No.	82	74	80	140	160	250	120	80	80	100	210	
Average ditto, ...	40	30	46	60	60	40	60	20	30	50	100	
Greatest quantity of calomel taken in grains, ...	40	154	40	180	150	240	70	60	60	30	749	
Average ditto, ...	23	40	20	70	70	80	30	30	30	25	70	

A case of Paralysis. Private Kirby, still in Hospital.

Section VIII.

A detailed notice of any Epidemic which may have visited the station in the course of the year, the circumstances under which it appeared, and its subsequent progress, and if it was attended by any atmospherical phenomena.

The past 12 months, or period embraced by this report, has been free from Epidemic disease in the regiment.

Section IX.

If sufficiently extensive materials are possessed, show whether the sickness and mortality at the station has most affected young soldiers or those advanced in life, and whether it has fallen in a higher proportion on those recently arrived than on the long resident.

This will be ascertained by comparing the number alive at each age and each period of residence in the station, with the numbers of the same class who have died in the course of the year.

These calculations however are not required, unless at least 1000 men have been under observation at the station, but the Principal Medical Officer at the station will always be expected to furnish it in his general summary and abstract of all the returns of the command.

Detail of Admissions and Deaths in H. M. 15th Hussars according to Service Abroad, with strength of each class, from 1st April 1844, to 31st March 1845.

	Years of Service Abroad.																								
	Under 1 Year.			1 to 2			2 to 3			3 to 4			4 to 5			5 to 6			6 to 7			7 to 8			
	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Total.
Fevers, ...	4	..	..	1	..	..	1	..	..	6	..	..	31	1	..	4	..	..	1	..	..	1	..	..	49
Diseases of Lungs, ...	7	..	..	3	..	..	..	..	..	7	..	..	12	..	..	2	1	..	..	..	..	1	..	..	32
,, of Liver, ...	5	..	..	8	..	..	1	..	..	4	..	..	8	2	..	3	..	..	1	..	..	2	..	..	32
,, of Stomach and Bowels,	7	..	..	5	..	..	4	..	..	11	..	..	101	1	..	6	1	..	..	..	..	5	2	..	139
,, of Brain, ...	..	..	..	2	..	..	2	..	..	12	..	..	12	..	..	5	1	..	1	..	..	1	..	..	35
All other diseases, ...	5	..	..	4	..	..	3	..	..	44	..	..	163	..	..	173	..	..	2	..	..	116	..	..	510
Total, Admissions, ...	28	..	..	23	..	..	11	..	..	84	..	..	327	..	..	193	..	..	5	..	..	126	..	..	797
Deaths, ...	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	3	..	..	..	..	..	2	..	9
Strength, ...	..	..	43	..	..	17	..	..	5	..	..	22	..	..	124	..	..	422	..	..	2	..	..	86	721

Detail of Admissions into Hospital and Deaths in H. M. 15th Hussars according to Age, from 1st April 1844, to 31st March 1845.

Diseases.	Admissions, Deaths, and Strength of each Class not exceeding																					
	20			25			30			35			40			45			50			
	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Admitted.	Died.	Strength.	Total.
Fevers, ...	4	..	..	8	..	..	19	..	..	9	..	..	7	1	..	2	..	..	..	..	..	49
Diseases of Lungs, ...	2	..	..	3	..	..	15	1	..	6	..	..	4	..	..	2	..	..	..	..	..	32
,, Liver, ...	3	..	..	4	..	..	13	1	..	5	..	..	6	..	..	1	..	..	..	..	..	32
,, Stomach and Bowels,	39	..	..	68	..	..	26	2	..	4	1	..	1	1	..	..	..	..	1	..	..	139
,, Brain, ...	41	..	..	8	..	..	17	1	..	5	..	..	1	..	..	..	..	..	..	..	..	35
All other diseases, ...	40	..	..	206	..	..	173	..	..	84	..	..	6	..	..	1	..	..	..	..	..	510
Total, ...	92	..	..	297	..	..	263	..	..	113	..	..	25	..	..	6	..	..	1	..	..	797
Deaths, ...	..	..	..	..	1	..	..	5	..	..	1	..	..	2	..	..	..	..				9
Strength, ...	..	..	20	..	..	148	..	..	350	..	..	98	..	..	80	..	..	24	..	..	1	721

Section X.

Vaccination.

Fifty-nine children have been vaccinated from 1st April 1844 to 31st March 1845, of whom ten failed, but these were re-vaccinated, when they proved successful.

Section XI.

Detailed histories of such cases as have been particularly worthy of notice, with the symptoms, diagnosis, and mode of treatment pursued and post mortem examination.

No case requiring especial detail during the period embraced by this report. Forty-one recruits joined from England, and one was enlisted at head-quarters, all bearing marks of previous vaccination.

Volunteers,..........None.

Invalids, ...Ten have been invalided from Poonamallee, whose cases are detailed in a separate return.

Officers,............During the period six joined, one exchanged, and two died at head-quarters, and one (Captain Chambers) committed suicide.

Out of thirty-five officers there have been fifty admissions, which give a ratio of 143 per cent. Of the individual cases no detail is required, one having been killed by a fall from his horse, the other from hepatic abscess.

Women,............Out of 137 women, forty-nine have been treated, with one death. The cases of the women have been mild, and they appear to possess an extraordinary immunity to the endemics of the country as compared with the officers and men.

Children, ...Of 181 children there have been 108 admissions, with seven deaths, six from Dysentery and one from Febris Remittens; no case requires especial notice. Fevers, Catarrh, Dysentery have been the most frequent diseases; Ophthalmia appears every year; it is at times very prevalent, and always exists in the Bazar; it is known as the country sore eye, and is highly infectious.

J. MOUAT, M.D.

Bangalore, 1*st April*, 1845. *Surgeon H. M.* 15*th Regt. or King's Hussars.*

Removal of a portion of the Liver from the living human subject. By JOHN MACPHERSON, *M.D.*

The only notices that I have met with, on the subject of the excision of portions of liver, are the following.

In Blanchard's "Anatomia Practica Rationalis," Amsterdam, 1688, is to be found the case of a soldier, who was wounded by a sword in the hepatic region; the wound was succeeded by a profuse hæmorrhage and deliquium: on the cessation of the hæmorrhage, a morsel of the substance of the liver was removed by the forceps, and the patient recovered after many threatening symptoms. At the end of three years he died of fever. On dissection, a small portion of the lower part of the wounded lobe of the liver was observed to be wanting; the other viscera were sound.*

Professor Dunglison quotes a case from Dieffenbach's Journal, in which a boy fell on a knife, and a portion of the liver protruded. Without being aware of its nature, the surgeon in attendance cut it off with his scissors: no bad effects followed. Americ. Medic. Intelligencer, vol. 1, p. 191.†

The history of the second of these cases is very imperfect, and in both the portion of liver removed seems to have been very small.

I now proceed to the case which has fallen under my own observation, and which appears to be the first case of the kind of which a complete history has been published.

A Hindoo, aged between 60 and 70, was in June last brought in, a distance of six miles, to Howrah, with a spear wound in the abdomen, about 3 inches above the umbilicus, and 2 inches to its right, through which a triangular portion of liver protruded, of about the size and shape of the four fingers of the hand, lying side by side. The wound itself did not

* Quoted in Hennen's Military Surgery.

† See Beck's Medical Jurisprudence.

exceed an inch in length, and was completely choked up by the liver. The man stated, that he had been stabbed in the dark about 12 hours previously, and that the liver came through the wound, as the spear was drawn out. It was added, that there had been very copious hæmorrhage, but the liver itself was not wounded, and though the patient was in considerable pain, the pulse was very little depressed.

My friend, Dr. C. M. Henderson, who was present, agreeing that it would be impossible to return the protrusion without enlarging the wound to the extent of several inches, it was resolved, rather than wait for the tedious process of sloughing, to remove it by the knife.

To prevent hæmorrhage, a ligature was applied tightly round the base of the protrusion, which was then cut off. Nevertheless, two arterial twigs bled very freely, and it was found necessary to take them up, and a double ligature was also passed through the stump, and tied on either side, when all bleeding ceased. No attempt was made to return the portion of liver which still filled up the wound, as it was of course desirable to prevent all risk of blood or of bile being extravasated into the cavity of the abdomen. For a day or two the patient was rather low, and had slight irritative fever, and the bowels remained costive. These symptoms, however, yielded to a few doses of purgative medicine, and in nine days the ligatures came away along with a small slough of liver, the wound granulated and healed, and the man returned to his home in three weeks. No bilious discharge occurred from the granulating surface of liver. The portion of liver removed, after having lost its blood, and being in spirits for some weeks, weighed 1¼ oz. Its surface is uneven, though not torn, and it is probably a portion of the edge of the right lobe, from near the notch between it and the left.

It is difficult to explain how so large a portion of liver could have protruded through so small a wound, even if allowance be made for the size of the wound being diminished by the contraction of the abdominal muscles, and for the protruded portion becoming congested.

It is unnecessary here to allude to wounds of the abdomen generally, or of the liver in particular, (for in this case the liver does not seem to have been wounded,) or to the extraordinary recoveries from almost every variety of them. Such cases are innumerable.

It has long been known, from the experiments of one of the Munros, that rabbits have suffered very little from having portions of their livers cut off. It was also known, that patients live for years after the loss of very considerable portions of liver by hepatic abscess, and may exist for months, with the whole liver converted into a mere cyst; but the actual removal of a considerable portion of the liver from the human subject, with so very little constitutional disturbance, even allowing for the patient being a native, is a fact of considerable interest in medicine and in physiology.

I may add, that the patient complained of a good deal of pain when the surface of the liver was touched, but that cutting through its substance hardly caused him any.

The old man appeared two months after, as prosecutor in his own case: he was in perfect health; there was a little puckering in of the skin about the wound, and the liver was evidently adherent beneath.

Lithiasis; its endemic origin in the geological nature of the soil, and its connection with the formation of the osseous system. By John Macpherson, M.D.

According to the researches of Dr. Heusinger, lithiasis prevails throughout some of the more recent calcareous formations: for instance, 1. In the part of Russia, which belongs to the chalk formation. 2. In the North East of England, on the chalk formation. 3. In Germany, within the range of the Jura limestone, by the boundaries of which its prevalence is sharply defined, and, 4. In Dalmatia, whose mountains belong to the Jura or Chalk formations. Regarding Italy in which calculus is so common, we want sufficient information. But we know of Upper Italy, that it is very rare in some granitic districts, as in Sondrio, and very common in some limestone ones, as in Cremona. The Mauritius is no exception to this general rule, as, although its mountains are volcanic, it is, like all volcanic islands, surrounded with a girdle of coralline limestone, on which the towns are built.

Hence it happens, that almost all the calculi of the pathological Museums of St. Petersburg, of Moscow, and Charkow, have been obtained from patients sent in from the province of Kursk, in which only calcareous rocks are found : and we can thus understand how a living surgeon, Dr. Hildebrand, has practised the operation of lithotomy with his own hands as often as two thousand times in one hospital in Moscow.

In the muschel kalk (of the new sandstone group,) and in dolomite, upon which goitre is so common, calculus is less frequent.

According to V. Walther, the cause of lithiasis is the production by the system of a fluid of a very binding nature, and bearing nearly the same relation to calculus, that gelatine does to bone. Stark, in his general pathology, has pointed out by reference to comparative anatomy, the relation that exists between the kidneys and the osseous system. The more imperfectly the osseous system is developed, the larger are the kidneys, or in other words, the kidneys are the converse of the osseous system. In the latter, the salts of lime and of phosphorus are deposited in a solid form : the former excrete them in a fluid state.

In the system of every animal we observe a most strongly marked antagonism between the expressions of the universal and of the individual life, between the formation of hard and of soft parts, between the development of the skeleton and the formation of the muscles and glands. The general tendency of the animal system is organically indicated by the organs of assimilation, of motion, and of sense; the individual tendency, by the brain and osseous system. The degree of development of these two antagonistic formative powers distinguishes in reality, and partly defines the varieties of the human constitution. The first tendency to the formation of bone in excess, is favoured by the newer formations from the Jura limestone upwards, and so also is the tendency to tubercular deposits. The second tendency occurs in the older formations up to the Jura, and it predisposes to scrofula in all its varieties. Dr. Escherich considers the formation of urinary calculi to be a symptom of the former tendency, of the phosphatic diathesis, as it were a *complement to excessive formation of bone.* Excessive formation of bone diminishes the activity of the kidneys, and sparing secretion of urine favours the prevalence of lithic acid in the urine, which is almost the invariable nucleus of urinary calculi. Lithiasis and endemic tendency to tubercles, agree in geographical distribution, with this difference, that in the same district, the first is found in only 1 per cent. of the inhabitants, while the last occurs in 15 per cent. It is also much more easy to counteract the tendency to stone (especially by drinking abundantly,) than the other one. V. Walther's account of the antagonistic action of the skin and kidneys agrees with these views, as calculi and cutaneous eruptions do not occur together(?), which is explained by the co-existence of a thick, strong epidermis with the tendency to formation of bone. Further, in accordance with these views, is the fact in comparative anatomy, that almost all the rodentia, in whom the osseous system predominates, for instance rats, have as a rule, stone in the bladder. (Calculi have also been found in tortoises and in other chelonian reptiles.)

But there is much difficulty in recognising lithiasis as a complement of the osseous system, as a result of excessive formation of bone, from the fact, that these concretionary formations have not yet been distinguished from their opposites, in which the formation of lime appears as a *supplement of defective formation of bone.* Instances of this are in man,—tartar on the teeth, salivary calculi, gall-stones, ossification of the ovaries, &c., which appear in the most different individuals, and under the most opposite constitutional and geographical relations. We find many analogies in the lower animals, in the formation of concretions and of pearls by mollusca, of the stones in the intestines of the crab, of the salivary concretions of the cetacea, &c. That they must be regarded as supplements to defective formation of bone, is plain from the following facts : 1. Their occurring most frequently under those circumstances, and among those classes of animals and individuals, in which this deficiency is most obvious. 2. Their periodical appearance and disappearance in accordance with the changes in the osseous system, for instance the stone in the crab, with the changing of its shell. 3. The entirely different chemical constitution of the *supplementary* from the *complementary* concretions. The connecting organic matter is also of much less importance and in less quantity, and bears a small percentage to the whole mass.

The foregoing observations are compiled from papers by Drs. Heusinger and Escherich. The interesting, but rather vague views thrown out by them, are intended merely as possible hints towards a rational pathology of calculous diseases. A careful enquiry into the diffusion of lithiasis in India, (like that of Mr. M'Clelland, into the diffusion of goitre in Kumaon) would be valuable, as at present we possess no accurate information on the subject.

In 1831, Mr. Burnard wrote an interesting paper, controverting the received opinion in Europe, that Calculus was rare in India, as in all tropical countries. About that time it had been suggested, that the frequency of stone in Norfolk might depend upon the diet of its inhabitants, consisting chiefly of what is termed "Norfolk dumpling." Mr. Burnard remarks, that the *chepatees* of the Hindoos of the Upper Provinces are a very similar kind of food, and may at least have some secondary influence in the production of stone. This opinion has been repeated by later writers.

From information kindly afforded by Mr. Forsyth, it would appear, that Calculus is more common in the Upper Provinces than in Bengal, and that operations for stone have been most common at Cawnpore, Agra, Muttra, and Delhi. They have not been unfrequent at Benares, Allahabad, Bareilly and Jubbulpore, but have been far more frequent at Delhi than at any other station. It would be curious to ascertain whether the prevalence of Calculus at most of these places may not be connected with the kunkur, and at Jubbulpore, with the beds of limestone which prevail to some extent in the coal formation; but we cannot venture to theorise on the subject.

As connected in some degree with this subject, we quote as follows from the "British and Foreign Medical Review" for July, in a notice of a Thesis of Dr. Falck's on Bronchocele:—

"1. Although different authors have found bronchocele to be accurately confined in certain districts to particular strata of rocks, as in Kumaon, according to M'Clelland, to transition limestone: in Wurtemberg, and according to Riedle, to shell limestone: in England and in Siberia to magnesian limestone: in Hesse to shell and magnesian limestone: in Switzerland to transition limestone and nagelflugh, yet in several districts situated on similar formations, as in Wolfhagen and Hof Geismar, bronchocele rarely occurs.

"2. The assertion of M'Clelland that bronchocele is infrequent in districts where the primitive strata prevail, is opposed by the observations of Dr. Falck in Hesse. He has further been informed that bronchocele is frequent in the districts of Schierke, Lehrbach, and Neuwerk, in the Hercynian forest, which are situated on primitive and transition rocks: and similar observations are recorded by Humboldt, De Vert and Iphofen."

Dr. Falck's negatives, even if based on more complete data, cannot affect the positive results of Mr. M'Clelland; they can at most only limit the extent of their general application.—J. M. P.

ELECTRO-CULTURE.

(From the Agricultural Gazette.)

I am obliged to you for having inserted, and to your correspondent, "A. H.," for having written the letter that appears in your *Gazette* of the 17th instant, for these reasons:—1st. It affords me an opportunity of laying before your readers a few of the facts and experiments both ancient and modern, for and against the assertion that plants are influenced by electricity, artificially applied. 2ndly. It enables me to give some rules to be observed in the height of poles and size of plots, &c.; and lastly, to correct errors that have crept into the various papers and journals, when speaking on this subject.

Your correspondent, "A. H.," places much importance on the period of Ingenhouss's experiments and book (with a variation, however, in so short a letter, of ten years). If your readers will refer to the "Encyclopædia Britannica," vol. vii., pages 800 and 801, they will find that one of the earliest experimenters on plants with electricity was Mr. Maimbray, of Edinburgh, in 1746; and as far as he went, they were decidedly in favour of its utility in promoting growth and earlier development; also, see "Priestley's History," Part 8, section 4. The next of the earlier savans who studied this subject was the Abbé Nollet, as detailed in his "Recherches," and in "Priestley's History." He made "some comparative experiments on the germination of seeds," with the electric fluid and without it, and the result was "similar to that of Mr. Maimbray's." Then, continues the same Encyclopædia—"Similar experiments were made by M. Achard, of Berlin, and several other philosophers, but still with the same result; until Dr. Ingenhouss instituted a very complete set of experiments," &c., "which were attended with very opposite results,"—on which alone "A. H." is disposed to rely, although they were at the time opposed, and severely animadverted upon by M. Duvernier.

"A. H.'s" statement that Dr. Ingenhouss found "that electricity, even in its most concentrated form—that is, as lightning conducted by iron—produced no sensible effects on vegetation," requires comment; for we are admitted to the belief that a too powerful and too transient application of this vital fluid was employed—similar to the mode of Nairne, Banks, and other members of the Royal Society, except that they produced very sensible effects—decay and death—which analogy would have predicted by referring to the evil of the superabundance of stimuli on all creatures.

To resume: Dr. Carmoy, the Abbé D'Ormoy, after Ingenhouss's caveat, and subsequently, and with great force, the Abbé Bertholon, give further coincident testimony from their experiments of the value and benefit of this agent. How is it that these seven, and several others, are to be disbelieved? and Ingenhouss, and his echo, M. Swankhardt, believed? The presumption, I humbly suggest, is that the use of this agent was not laid aside as incapable of useful application, but that, by a reference to the time, it was swept from the memory of man, and many of its early experimenters from the face of the earth, by the French Revolution and its consequences—want of free communication between countries and individuals, and the high prices of the succeeding struggle.

Having cited many of the older experimenters, I will now give a few of the later ones, who, from experiment, favour my opinions:—Messrs. Crosse, of Broomfield, near Taunton; Pine, of Maidstone; Weekes, of Sandwich; Walker, (I understand) of the "Electrical Magazine;" M. Wyatt, your correspondent on Onions electro-cultured, as in your Paper of the 10th instant, signed "Beta;" and many others experimenting with the fluid obtained by the galvanic arrangement, amongst whom the Dutch Tulip growers, in giving richness of colour to the flower, &c., should not be omitted.

Your readers will forgive me if I again recite my distinct experiment made last year on the Eastern eight-pole plot. It was electro-cultured with poles 4 feet high; when the Barley was 6 inches high it was very decidedly of a darker green colour than the surrounding Barley. On reaching a foot in height it lost this deeper colour, as its points collected all the electricity within the reach of the suspended wire's power of attraction; and the colour was partially, but equally clearly restored to it by two suspended wires, and more lofty poles being adjusted. This fact was to me the most conclusive of all, and many persons saw it beside myself.

If I add the evident benefit effected by electricity this year on six plots of one-third and one-fourth of an acre each, in the front and back lawns of this house, which any person may see, and any "mortal" has the power of equalling; if he possesses also the necessary command of ground, seed, and firmness of purpose, the matter may safely be left to the discerning agriculturist.

Lastly, as to the proper height of the poles, or rather of the lowest suspended wire, where more than one is employed. The rule is to have the lowest wire fully 6 to 8 feet above the highest probable altitude of the vegetable under experiment, when at its full growth; and if more than one wire is required for wider or larger plots, there ought to be a space of 3 feet in elevation between them. The reason for these proportions depends on the relative attractive powers for the electric fluid that many electricians have proved to exist between the points of plants, and points or edges of metals; the former being three to four times more powerful than the latter. And the preference given for one line of wires arises from the convenience of being then enabled to harrow and plough without removing any of the arrangement and of having far larger areas in one plot. This removes the doubt expressed by your correspondent "Beta" as to it being most likely that electro-culturing will only be found possible in narrow plots. As to using the fluid obtained from zinc, copper, &c. in agriculture, the expense alone would suggest their inappropriateness.

The following are the areas for plots as given by me. Many errors having been observed in periodicals on this point, it may be advisable to send them to you :—

For a plot of	2 acres	129 by	75 yards (this is deficient 5 yards.)
	1 acre	88	55 exact.
	$\frac{3}{4}$ of an acre ..	$82\frac{1}{2}$	44 ditto.
	$\frac{1}{2}$ ditto	$73\frac{1}{3}$	33 ditto.
	$\frac{1}{4}$ ditto	55	22 ditto.
	$\frac{1}{8}$ ditto	36	$16\frac{3}{4}$ ditto (wants 3 yards.)

And similar proportions for larger areas, in which, of course, it will be necessary, as suggested above, to have two, three, or more suspended wires.

By referring to pages 87, 88, and 89 of Mechi's "Series of Letters on Agricultural Improvement," except as above corrected, it is possible to pursue experiments this year with accuracy, and, I believe, a certainty of success. Even "A. H." may be induced to try, in spite of Ingenhouss's startling discoveries. That such may be the result is the expectation of your early and constant reader.—R. Dewey Forster, *Findrassie, May* 22.—*From the Elgin Courant, June* 6, 1845.

A Treatise on the Forces which produce the Organization of Plants. By J. W. Draper, M.D., New York. London, Wiley and Putnam.

The phenomena connected with the processes of vegetation are so curiously complicated, and so singularly interesting in their beautiful developments, that they have naturally excited the attention of all observant and reflecting minds. The Botanist, the Physiologist, and the Chemist have therein found extensive scope for their inquiries and experiments; and almost every branch of Natural Philosophy has been brought to bear on the investigations which have been made into the causes operating in the production of the organization of plants. Still, however, considerable obscurity hangs over the question, which can only be cleared away by patient experiments and unwearying habits of observation.

Dr. Draper professes to explain many of the most remarkable phenomena connected with vegetation. This treatise is evidently the work of an industrious experimentalist, and the production of a comprehensive mind; and as such, it must be reviewed with respect. Many of the views, indeed, therein put forth are opposed to the received opinions of modern philosophers; but to this we are not at all disposed to object. We would, however, protest against the dogmatic style in which the author's doctrines are promulgated, and the constant arrogation of the discoveries and the ideas of other investigators to himself. The cause of Truth is materially damaged by this; less reliance is placed on the author's investigations than they probably deserve. Hence even striking facts have to struggle against awakened prejudices; and thoughts and suggestions, valuable in themselves, are treated with undeserved contempt; unkindly feelings are generated, and the investigator of Nature, in consequence, rapidly degenerates, in his vain endeavour to support a false position, into a partizan. Having done our duty in pointing out this unfortunate mistake, to use no severer term, we proceed to the more agreeable task of examining the question under consideration,—and this we hope to do with fidelity and candour.

Dr. Draper, in the first place, ventures on the exploded speculation of some naturalists of the last century, who fancied that, under the influence of certain unknown "vital forces," inorganic matter was converted into an inorganic body; and he refers this change to the action of the solar rays. Although "the sun may breed maggots in a dead dog," it cannot now-a-days be admitted that either animal or vegetable life can be produced from pounded flints or fragments of marble. Indeed, the author himself at length, even against his own previous reasoning, appears to admit the necessity of an organized germ. The influence of the sun's rays in the development of the confervæ from their germs must be admitted; and the explanation given, referring their growth to the decomposition of the gaseous elements of water, is satisfactory. We cannot, however, say the same for the author's notices of the general processes of germination, although these are founded on his own experiments. The statement that light—and that, too, to take the author's own ideas, light deprived of the principles of heat and chemical action—is beneficial to germination, is contrary to experience. Every one knows that the covering of the soil, insuring darkness, warmth, and moisture, are the essentials required. This is more strikingly shown in the process of malting than even in the natural condition; and it is only by the most scrupulous attention to these points that the required change can be produced in the seed. The question whether the luminous or the chemical rays are the most beneficial to the growth of plants, is still open for examination. Dr. Draper states positively, as the result of his enquiries, that the luminous rays alone act in producing the decomposition of carbonic acid by plants, and in forming the colouring matter of the leaves; whilst the chemical rays are active in producing motion—that is, that the bending of plants towards the light is due to their influence. Upon these points he is at issue with other investigators, who have stated the very reverse of these results. We hope that the question will be set at rest by some careful experiments on both these points. The circulatory system of plants is another point which is brought under consideration. The rise and fall of the sap, in obedience to laws regulated by the changes of the seasons, are phenomena upon which there has been much speculation, and some very good experiments. When we consider the force necessary to lift a column of water sixty or seventy feet, we shall perceive that no unimportant power is brought into action in raising the sap to the "topmost twig" of the tallest trees. Capillary attraction has been called in to aid the ascending current; but this, it has generally been admitted, is an inadequate power. Vital action—a term to which no very definite meaning can be attached—is brought to the aid of capillary attraction. With these powers several theoretical writers have been satisfied, and the world has rested somewhat contentedly with an explanation which it could not understand. It is not unfrequent that we are content to hide our ignorance under a sounding epithet. Dutrochet and Porret discovered the peculiar power of organized diaphragms in raising water above its natural level. More recent investigations have shown that this power is not confined to organized tissue, but that any porous body, with its two sides in opposite electrical conditions, has the power of *endosmose* and *exosmose* to a remarkable extent. The force with which this principle will overcome resistance is exceedingly great. To this action, then, associated with capillary attraction, Dr. Draper is inclined to refer the rise of sap in the vessels of plants. This, indeed, seems to be the most probable explanation of the mechanical part of the phenomena; and with the assistance of electrical power, excited by the agency of solar radiations, much of the difficulty of the question disappears.

There are, however, many positions taken up by Dr. Draper, which we consider to be untenable. We might instance his argument, that the endosmose action is only another form of capillary attraction. It would be out of place to discuss this question here; and we will merely remark, that no capillary tube is ever found to overflow, whereas the fluids in all arrangements with the porous diaphragms are found to overflow with great mechanical force.

One-third of the above volume alone is devoted to the subject indicated by its title; and even of this part, two-thirds are irrelevant. The other portion of the volume consists entirely of reprints of papers which have been published by Dr. Draper in the 'Journal of the Franklin Institute,' and in the 'London and Edinburgh Philosophical Magazine.' These have, most of them, reference to the chemical action of light; and many of them certainly contain much curious information. Their purely scientific character, however, renders it impossible for us to do more than thus refer to them.—*Athenæum, June* 21, 1845.

SCIENTIFIC AND LITERARY.

ROYAL SOCIETY.—*June* 12.—The Dean of Ely, V. P. in the chair. —A paper was read, entitled, 'Electro-Physiological Researches: Memoir the First,' by Professor Matteucci. The author describes several arrangements by which he was enabled to make new experiments in confirmation of the law of muscular currents. He finds that in these experiments the employment of a galvanometer is unnecessary, as the sensibility of the electroscopic frog of Galvani gives sufficient indications of the electric current, without the use of that instrument. The general results obtained from these experiments are the following:—In the first place, the intensity and duration of the muscular current is independent of the nature of the gas in which the muscular pile is immersed. Secondly, it is altogether independent of the cerebro-spinal portion of the nervous system. Thirdly, the circumstances which exercise a marked influence on its intensity are the conditions of the respiratory and circulatory systems.

Fourthly, those poisons which seem to act directly on the nervous system, such as hydro-cyanic acid, morphia and strychnine have no influence on the nervous current. Fifthly, sulphuretted hydrogen has a decided influence in diminishing the intensity of the muscular current. Sixthly, the intensity of this current in frogs varies according to the temperature in which the frogs have been kept for a certain time during life; a result which, of course, is not attainable with animals which do not take the temperature of the surrounding medium. Lastly, the intensity of the muscular current in animals increases in proportion to the rank they occupy in the scale of beings; and, on the other hand, its duration after death is exactly in an inverse ratio to its original intensity. The author concludes by stating his belief, that the property of the muscles immediately connected with their electric currents is identical with that which was long ago denominated by Haller *irritability*, but which is at present more usually designated by the term contractility. He ascribes the development of this muscular electricity to the chemical actions which are attendant upon the process of nutrition of the muscles, and result from the contact of the arterial blood with the muscular fibre. He conceives, that in the natural state of the muscle, the two electricities thus evolved neutralize each other at the same points at which they are generated; while in the muscular pile contrived by the author a portion of this electricity is put into circulation, in the same manner as happens in a pile composed of acid and alkali, separated from one another by a simply conducting body.—*Ibid.*

Royal Society.—*June* 19.—R. Owen, Esq. V. P. in the chair.—'On the connexion between the Winds of the St. Lawrence and the Movements of the Barometer,' by W. Kelly, M.D., Surgeon R. N., attached to the Naval Surveying Party on the River St. Lawrence.—The author adduces a great number of observations, which are in opposition to the generally received opinion, that the mercury in the barometer has always a tendency to fall when the wind is strong. During a period of fifteen years passed in the Gulf and River St. Lawrence, he found that the barometer as frequently rises as falls under the prevalence of a strong wind; and that the winds often blew with a greater force with a rising than with a falling barometer. He gives a circumstantial account of the progress and course of various gales which came under his observation during that period, and from which he infers the existence of a steady connexion between the prevailing winds of this region and the movements of the barometer, and enters into an inquiry into the mode in which that instrument is affected by them. The extensive valley of the St. Lawrence is bounded at its lower part, for a distance of nearly 500 miles, by ranges of hills, rising on each side to a considerable elevation. Within this space the ordinary winds follow the course of the river; and in almost every instance where they approach from windward, the barometer rises with them; and when, on the other hand, the wind approaches from leeward, the barometer not only falls before the arrival of the wind, but continues to fall until it has subsided. An appendix is subjoined, containing extracts from the tabular register of the barometer and winds at various points in the valley of the St. Lawrence, during the years 1834 and 1835, accompanied by remarks on different points deserving notice in particular cases.

'On the Elliptic Polarization of Light by Reflexion from Metallic Surfaces,' by the Rev. Baden Powell.—In a former paper, published in the Philosophical Transactions for 1843, the author gave an account of the observations he had made on the phenomena of elliptic polarization by reflexion from certain metallic surfaces, but with reference only to one class of comparative results. He has since pursued the inquiry into other relations besides those at first contemplated; and the present paper is devoted to the details of these new observations, obtained by varying the inclination of the incident rays and the position of the plane of analyzation, and by employing different metals as the reflecting surfaces. By the application of the undulatory theory of light to the circumstances of the experiments and the resulting phenomena, the law of metallic retardation is made the subject of analytic investigation. A polariscope of peculiar construction, of which a description is given at the conclusion of the paper, was employed in the experiments; and tables are subjoined of the numerical results of the observations.—*Ibid, July* 5, 1845.

Institution of Civil Engineers.—*June* 10.—Sir John Rennie, President, in the chair.—The paper read was by Mr. J. Stirling, and described an air Engine, invented by his brother and himself. The movements are founded upon the well-known pneumatic principle, that air has its bulk or pressure increased or diminished in proportion as its temperature is raised or lowered. The application of this principle was exemplified by drawings, and a model exhibiting a machine composed of two strong tight air vessels, connected with the opposite ends of a vertical cylinder, in which a piston works in the usual manner. Within these air vessels are suspended two air-tight vessels, or plungers, filled with non-conducting substances, and attached to the opposite extremities of a beam, capable of moving up and down alternately, to the extent of one-fifth of the depth of the air-vessels. By this motion of the plunger, the air which is in a heated state below is moved to the upper part of the vessels, and in its transit traverses a series of vertical capillary passages between three metallic plates, which absorb the major part of the caloric. The remainder is taken up by a refrigerator of tubes filled with water. The air at the heated end is about 700 degrees, and has a proportionate pressure; when it arrives at the cooled end it is reduced to about 150 degrees, and the pressure diminished to a corresponding extent. Therefore, as the internal vessels move in opposite directions, it necessarily follows that the pressure of the condensed air in one vessel is increased, while that of the other is diminished. A difference of pressure is thus produced upon the opposite ends of the piston, and a reciprocating motion results, which communicates through a beam, connecting rod, crank, and fly-wheel to the machinery when driven. Machines on this principle were stated to have been worked, for some years past, at Dundee, with considerable saving of fuel, as compared to a steam-engine of similar power, and doing the same work. It is now proposed to adapt it to marine purposes, to which, from its simplicity and slight expenditure of fuel, it appeared well fitted.—*Athenæum, June* 21, 1845.

Entomological Society.—*June* 2.—The Rev. F. W. Hope, President, in the chair.—Various new species of insects were exhibited, including a fine species of Trictenotoma, from the Himalayas, by Capt. Parry, the male of the rare and singular *Dorthesia characias* by Mr. Weir, an apparently new Tortrix, by Mr. Douglas, and living specimens of the rare *Rhynchites cupreus*, by Mr. S. Stevens. The President alluded to the destruction caused by the white ants and other insects to the wooden sleepers of the railroads in India; and the kyanizing process having been alluded to, Mr. J. F. Stevens mentioned that he had observed *Thanasimus unifasciatus* on palings at Camberwell, but that they avoided the kyanized staves. A letter from Captain Boys, addressed to the secretary, was read, containing notes 'On the Economy of *Dorylus myrmeleon*,' a species of Tetrix, which swims with great agility, and other Indian insects, and also a paper by Mr. Westwood, 'On a new genus of Carabidæ from Ceylon.' —*Athenæum, June* 21, 1845.

Paris Academy of Sciences.—June 9.—M. Babinet read the report of a committee appointed to examine an apparatus for the production of artificial ice, the invention of M. Villeneuve. M. Villenueve produces the cold by dissolving sulphate of soda in chlorhydric acid. The process appears to be rather tedious. It requires an hour, and an expenditure of about two francs, to produce seven or eight pounds of ice.—M. Arago informed the Academy that he had received a letter from M. Colla, the director of the Observatory of Parma, informing him that on the 2nd inst., at about two in the morning, M. Colla discovered in the constellation of Perseus, a few degrees above the head of Medusa (B), a comet with a very brilliant nucleus and a tail of very nearly a degree in length, almost visible to the naked eye.—Three communications of systems of atmospheric railroads were made this day.—A communication was received from M. Ducard, relative to a new system of electrical telegraphs with the aid of mercury.—A letter was received from General Dembinski, giving an account of a simple, but powerful ventilation in use in Hungary. It is a girouette (weathercock,) the hollow cylindrical tube of which communicates with the apartment. This cylinder is connected with another horizontal cylinder, leaving a small round space between the two surfaces. The wind rushing into this space, puts the column of air of the internal cylinder in motion, and rapidly aspires the foul air of the apartment.

Cannel Coal.—It is not generally known that Cannel coal can be employed in the Fine Arts, and that for the bases of statues, plinths, and a variety of other purposes, for which black marble and other fossil substances are used, this fossil can be substituted at a less cost and with less difficulty in the cutting or carving. A very elegant vase of this material, something in the shape of the well-known Warwick vase, but flatter and partaking more of the patera shape, has been lately cut out of a block of Cannel coal, or rather "turned" out of the block by means of the lathe, and the tools are similar tools to those employed in the cutting of wood or brass. The artist is a Mr. J. Dallaway, to whom it would be less than justice not to say that he has produced a most elegant piece of work. The vase stands on a fluted column of the same material. The polish, which the material of which it is composed receives with very little labour, is surprising,—it appears like the finest *negro antico.* The block came from the estate of the Duke of Norfolk, near Sheffield.—*Times.*—*Ibid.*

Railway from St. Petersburg to Moscow.—The *Revue de Paris* says, that no European railway will go so directly to its terminus as this. The one great point was, to effect the journey between the two capitals in a single day; and this could only be done by keeping the road away from all the intermediate towns—carrying it over the steppe by a line like the bird's flight. The distance will, accordingly, be twenty-eight leagues less than by the Imperial highway. "There is," says the *Revue,* "something truly Muscovite in this idea of an iron road which nothing can turn out of its course, but which, across boundless solitudes, hurries on to its object, inflexible as destiny."—*Ibid.*

Migrations of Salmon.—About a year and a half ago, Lord Glenlyon, with the praiseworthy motive of deciding the long-agitated question as to whether the salmon, after returning to the ocean from its spawning-ground, again re-sought the same river on another return of the season, caused a number of *kelts,* or foul fish, to be caught and marked, by attaching a label, by a ring, to what is called the *dead* fin of each. Last summer a number of these were captured on various stations in the Tay, but, so far as we have heard, none in the Earn;

on Tuesday last, another was caught at the Rashbush, a fishing-ground below Inchyra. This fish was in excellent condition, and weighed 21 lb. The label bore as follows: "Lord Glenlyon, Dunkeld, No. 129."—*Perth Advertiser.—Ibid.*

Geographical Society.—*June* 23.—Lord Colchester, President, in the chair.—Six new members were elected. The paper read was 'Considerations against the supposed Existence of a great Sea in the Interior of Australia,' by E. J. Eyre, Esq.—"An opinion," says Mr. Eyre, "very generally prevails, that the continent of Australia is, comparatively speaking, little more than a narrow crust or barrier intervening between an outer and an inner sea. This opinion originated with Capt. Flinders, and is still entertained by Capt. Sturt, Mr. Windsor Earl and others. Mr. Eyre admits that the non-existence, at least as far as we know, of any large river, with the exception of the Murray, discharging itself into the sea, on the eastern, western, or southern coasts, to the southward of a line drawn from Moreton Bay to Shark's Bay, is the strongest argument in favour of the theory of an inland sea; nevertheless other and weighty considerations militate against this idea; and Mr. Eyre has come to the conclusion that the interior of New Holland will be found generally to be of a very low level, to consist of arid sands alternating with many basins of dried-up salt lakes or such as are covered only by shallow salt water or mud, as in the case of Lake Torrens; that there may be many detached and even high ranges, as the Gawler Range, interspersed among the arid wastes, and that in the midst of these ranges there may be rich and fertile spots. As far as Mr. Eyre's own personal observation goes, it supports the suggestion thrown out by Capt. Sturt, that Australia was formerly an archipelago of islands, and that their emergence from the sea is a comparative modern event. Be this as it may, Mr. Eyre founds his opinion against the existence of an inland sea, upon the following three circumstances: first, the hot winds, which in South Australia blow constantly from the north, or centre of the continent, and which he compares to the fiery and withering blasts from a heated furnace, and the little probability that such winds have been wafted over a large expanse of water; secondly, the accounts of the natives inhabiting the outskirts of the interior, who have no knowledge of any large body of water inland, either fresh or salt; thirdly, the coincidence observable in the physical appearance, customs, character and pursuits of the aborigines at opposite points of the continent, while no such coincidence exists along the intervening line of coast, connecting these points. The development of all the facts contained under three heads, and the mention of others, such as the arrival of parrots from the interior, &c., constituted the mass of Mr. Eyre's paper; but as mere abstracts would break the chain of reasoning adopted by the author, we must content ourselves with saying that, however plausible that reasoning may be, and it cetainly has great weight, nothing short of an actual examination of the interior can satisfy us as to the nature of that peculiar country.—It was stated at the meeting that Lieut. Ruxton had arrived safely and in good health at Walwich Bay; that he had hired hottentots and cattle, and was about to proceed on his exploration to the interior, intending to return by the Cape.—*Athenæum, July* 5, 1845.

Familiar Letters on Chemistry and its Relation to Commerce, Physiology, and Agriculture. By JUSTUS LIEBIG. *Taylor and Walton.*

Whatever may be the dispute between chemists and the public as to the position Liebig ought to occupy as a man of science, there can be no doubt of his relative superiority in the practical tendency of his mind. He has successfully pursued the most abstract principles of chemistry in their practical application to the daily occupations of man, in almost every branch of human exertion. We need but quote his larger works on agriculture and organic chemistry as proof of the truth of this statement, and in the little volume before us we have an additional illustration. A series of letters on the application of the principles of chemistry to the improving the mode of manufacturing many of the articles of daily use, such as glass, soap, sulphuric acid, sugar, &c., and suggestions for improving the treatment of disease, the feeding of cattle, and the manuring of land on chemical principles. Even those who do not understand chemistry will read this volume with interest, and we recommend it to all who take an interest in the productive resources of our own island, as pointing out in what way the labour of England can most profitably be employed. We would also draw attention to the views of the Professor on political economy, which seem to us as sound as they are liberal and enlightened. As a specimen, we extract the following passage from a letter on the trade in sulphur:

"It is no exaggeration to say, we may fairly judge of the commercial prosperity of a country from the amount of sulphuric acid it consumes. Reflecting upon the important influence which the price of sulphur exercises upon the cost of production of bleached and printed cotton stuffs, soap, glass, &c., and remembering that Great Britain supplies America, Spain, Portugal, and the East, with these, exchanging them for raw cotton, silk, wine, raisins, indigo, &c., &c., we can understand why the English Government should have resolved to resort to war with Naples, in order to abolish the sulphur monopoly, which the latter power attempted recently to establish. Nothing could be more opposed to the true interests of Sicily than such a monopoly; indeed, had it been maintained a few years, it is highly probable that sulphur, the source of her wealth, would have been rendered perfectly valueless to her. Science and industry form a power to which it is dangerous to present impediments. It was not difficult to perceive that the issue would be the entire cessation of the exportation of sulphur from Sicily. In the short period the sulphur monopoly lasted, fifteen patents were taken out for methods to obtain back the sulphuric acid used in making soda. Admitting that these fifteen experiments were not perfectly successful, there can be no doubt it would ere long have been accomplished. But then, in gypsum, (sulphate of lime), and in heavy-spar, (sulphate of barytes), we possess mountains of sulphuric acid; in galena, (sulphate of lead), and in iron pyrites, we have no less abundance of sulphur. The problem is, how to separate the sulphuric acid, or the sulphur, from these native stores. Hundreds of thousands of pounds weight of sulphuric acid were prepared from iron pyrites, while the high price of sulphur consequent upon the monopoly lasted. We should probably ere long have triumphed over all difficulties, and have separated it from gypsum. The impulse has been given, the possibility of the process proved, and it may happen in a few years that the inconsiderate financial speculation of Naples may deprive her of that lucrative commerce. In like manner Russia, by her prohibitory system, has lost much of her trade in tallow and potash. One country purchases only from absolute necessity from another, which excludes her own productions from her markets. Instead of the tallow and linseed oil of Russia, Great Britain now uses palm oil and cocoanut oil of other countries. Precisely analogous is the combination of workmen against their employers, which has led to the construction of many admirable machines for superseding manual labour. In commerce and industry every imprudence carries with it its own punishment; every oppression immediately and sensibly recoils upon the head of those from whom it emanates."—*Ibid.*

Asiatic Society.—*June* 21.—Sir G. T. Staunton, Bart., M.P., in the chair.—R. Alcock, Esq., was elected a Corresponding Member.

Mr. A. Bettington, of the Bombay Civil Service, read a paper on certain fossils procured by himself on the Island of Perim, in the Gulf of Cambay; more particularly on a gigantic ruminant, having some affinities to the Sivatherium and the Giraffe. After adverting to former notices of fossils obtained on this island, the writer described its situation in the midst of the gulf stream of Cambay, which separates it from the main land, and deposits large quantities of alluvium brought down by the rivers emptying themselves into it. These rivers, in the present day, in the freshes, transport into the Gulf large trees, and the bodies of oxen, deer, bears, and other animals; and in the great floods of past ages are considered to have brought down and deposited, as now discovered, the remains of ruminants and pachydermata, some extinct and unheard of, others having, in the present day, their living congeners in the Indian rivers. The bed from which the writer obtained the fossil specimens exhibited is below the usual water mark, and inaccessible except at the ebb of spring tides. A portion only of those obtained were brought to England, the remainder were left in India. The most remarkable of those in this country was a large skull, which is now, by competent judges, pronounced to be the first specimen of a new genus. The mass of conglomerate which contained it weighed about 170 lb., and the separation of the skull from near 100lb. of matrix occupied Mr. Bettington many weeks. The skull, on the whole, is well preserved, though a portion has suffered from the action of water. The lines of teeth on the two sides of the palate are unconformable; and it has been conjectured that the head must, at this part, have suffered from violence, but there is no appearance of fracture. For the purposes of comparison, Mr. Bettington had made a close measurement of every part of the Perim fossil, of the sivatherium, and of the skull of the adult giraffe in the British Museum ; from all which it appeared that the Perim fossil is the smaller. The teeth are similar in number and character to those of the sivatherium, and are somewhat smaller, as the comparative size of the heads would lead us to expect. A marked distinction between the two is found in the excess in width of the cranium at the vertex, being in the sivatherium 22 inches, and in the Perim fossil little more than 11 inches, in which character the latter approaches nearer to the giraffe. But the greatest point of difference is in the form and position of the horns. In the sivatherium the horns bear somewhat the same relation to each other as in the four-horned antelope; whereas, in the fossil under consideration, the anterior horns rise from a confluent base measuring twenty-five inches; the horns above the line of division measuring eighteen inches. This formation the writer considers to be without precedent in the animal kingdom, fossil or recent. The general character, cancellar structure, and extensive development of the protuberance at the lower edge of the transverse ridge of the occiput, compel the conviction that it was a posterior horn, " reflected" as in the common Indian buffalo, and must have produced an appearance truly monstrous. The whole formation indicates great force and power. Among the other fossils, there were some identical with those of the Sevalic hills, and others peculiar, as yet, to Perim. Among the latter was a new crocodilean. There were specimens of three species of mastodon, gariols, and rhinoceros; and the heads, horns, and teeth of stags, antelopes, oxen, &c. The writer concluded with the observation that there was still a rich field of research remaining at this deposit, and that he had sent to India, not only for some of the specimens before referred to, but was also making arrangements for prosecuting further research.—Dr. Mantell, who was present by invitation, remarked that the specimens afforded additional confirmation of the fact, first pointed out by Captain Cautley and Dr. Falconer, that in the tertiary formations of India were collocated the remains of several species of reptiles and mammalia, with those of extinct species and genera belonging to the most ancient European deposits of the same geological group (the *Eocene*) ; as, for example, the teeth and bones of the chiropotamus, and other pachyderms of the Paris Basin, with those of the existing garial of India. Dr. Mantell then offered some observations on the analogy which the specimens from Perim, as well as those from Ava, and from the Sevalic hills, presented in their mineralogical condition, and the mechanical action to which they had been subjected, with those more ancient fossil bones and teeth that abound in the Wealden deposits of the south-east of England; particularly with those obtained from the conglomerate and grits of Tilgate Forest. The Indian and the British fossils are alike mineralized by iron, and have an investment of indurated, ferruginous sand, interspersed with quartz, pebbles, and rolled fragments of other rocks; and the bones are, for the most part, mutilated, and much water-worn, proving that previously to their mineralization they had been exposed to abrasion from streams and rivers, and were transported from a great distance by currents. Dr. Mantell dwelt on the discrepancy between the Faunas of the two epochs, although that of the Wealden was as decidedly of a tropical character as that of the tertiary strata of India; but in the latter large mammalia prevailed, while in the far more ancient secondary formation of England mammalia were absent, and the place of gigantic ruminants and pachyderms was occupied by herbivorous reptiles of appalling magnitude.

Fourteenth Meeting of the British Association for the Advancement of Science. York: September 28th, 1844.

(Concluded from page 293.)

Section A.—MATHEMATICAL AND PHYSICAL SCIENCE.

The discussion of the difference of opinion between Prof. Forbes and Mr. Hopkins, as to the mechanism of the motion of Glaciers was resumed, and occupied three hours. As the views of the parties have been for some time before the public, we need not further enter on the subject.

'On the Geodetical Operations of India,' by Lieut.-Col. Everest, late Surveyor-General of India.—A series of triangulations, on the most magnificent scale, has for many years been conducted in India, by Col. Lambton up to the year 1823, and after his death, by Col. Everest (who had, for some years previous, been his chief assistant) up to the close of 1843, when this officer resigned the charge to Capt. Waugh, of the Bengal Engineers. As the Court of Directors of the East India Company have directed the publication of Col. Everest's labours, it is unnecessary to enter into the important details laid before the Section. It is to be regretted that the series of triangles and several others which are described in Col. Everest's paper, have not been filled up by any secondary triangulation, or made available to any of those social purposes to which accurate district maps are so important. In Colonel Everest's concluding words, "It is to be hoped that the powers who govern India will see the necessity of taking early measures to cause all these series to be filled up with topographical details, in keeping as to accuracy with the material now on record. At present, the principal triangles are, in many places, mere skeletons, instruments of mighty power lying useless. But it seems very clear, that without accurate and specific detail, whether as relates to topographical or statistical knowledge, no state can be well governed; and the maps in the possession of the governing power ought, for this purpose, to lie within certain and decided limits of error."

Col. Everest also described an instrument, called a Barometer Pump, for filling barometer tubes *in vacuo*. This was a single acting air-pump, so arranged as to exhaust the air from the tube to be filled, while a capillary tube, dipping into a reservoir of mercury, and curved at the end next the tube, dropped the mercury into the tube as it rose above the bend, (after the exhaustion had been carried as far as possible), by dipping a glass rod into the reservoir. The mercury as it comes into the tube is heated to a temperature sufficient to boil it, and it is desiccated by a bottle of strong sulphuric acid, which is made to communicate with the canal into which the tube to be filled and the capillary filling tube are luted. Col. Everest mentioned, that the best material for the valves of an air-pump was the swimming bladder of a fish.

A Comparison of the Rain which fell at the seat of the Earl of Enniskillen, Florence Court, from July 6th, 1843, to July 6th, 1844, with that which fell at Belfast during the same period, by Mr. W. Thompson.—Belfast and Enniskillen are seventy-two miles apart; one towards the east, the other towards the west, of the north of Ireland.

	Inches.
The total depth of Rain which fell, was	
At Florence Court, ...	40·6
At Belfast, ...	30 34
Monthly average at Florence Court, ...	3·38
,, Belfast, ...	2·53
The greatest Monthly fall, was	
At Florence Court, in November, ...	6·051
At Belfast, in October, ...	5·046
The fall at Florence Court, during October, ...	5·943
,, Belfast, during November, ...	3·943
The least fall happened in May 1844, at both places,	
At Florence Court	0·041
At Belfast, ...	0·273

The only singular discrepancy which occurred was that, in the month of September, 1843, only 0·51 inch fell at Belfast, while at Florence Court, in the same month, 2·759 fell. This, when explained by Lord Enniskillen's steward, who keeps the register, was found to arise from a very heavy fall which took place in one day. The month was generally very dry at both places.

'On the Irregular Movements of the Barometer,' by T. Hopkins.—Mr. Hopkins maintained that the *irregular* movements of the barometer arise, not from alterations of surface temperature, but from the condensation of aqueous vapour, and the consequent formations of rain. This (he said) caused local heatings of the atmosphere and considerable reductions of its pressure in the locality, particularly in the colder latitudes. Within the tropics, the barometer does not ordinarily fall as much as in colder latitudes, notwithstanding the abundant rains which take place there, because the condensation occurs, and the temperature is increased at a greater height in the atmosphere, and the reduction of the incumbent pressure in the part is spread over a wider area. The condensation takes place too at an elevation, where the air, from being subjected to inferior pressure, is more attenuated, and the heating is consequently more diffused. Rain is formed in certain latitudes, say at an average height of 3,000 feet, where the air has a density proportioned to that height, and where the whole effects of the local heating are confined to an area of moderate extent, thus reducing the pressure of the atmosphere on the barometer in every part of that area in a considerable degree; whilst, in other parts nearer the equator, the condensation which produces rain takes place at an average height of, say 6,000 or 9,000 feet, where the air is rare in proportion to the height; the heating effects are, therefore, diffused to a corresponding extent, whilst the reduction of pressure at the surface is spread over a wider area. It follows, that with equal amounts of rain, the fall of the barometer will be the greatest, and confined to the smallest area, in the coldest climates. Mr. Hopkins also represented that the *diurnal* oscillations of the barometer arise from, first, the condensation of aqueous vapour into cloud, and then from the evaporation of the particles of water that constitute that cloud. He stated, that the morning sun warmed the lower air, and caused it to rise until condensation formed cloud, and liberated heat sufficient to warm a mass of the atmosphere, and thus to cause the barometer in the locality to begin to fall at, say about ten o'clock in the morning, which fall continued until about four o'clock in the afternoon, when condensation ceased. From this time, evaporation of the cloud commenced which cooled the air in the part—made it heavier—and caused the barometer to rise until about ten o'clock, P. M., by which time the cloud was evaporated. The cooled and heavier air now descended to the surface, from which it absorbed a portion of heat, and became somewhat warmer. From this second warming of the air, and from a reduction of the quantity of aqueous vapour in the atmosphere, as is evidenced by the fall of the dew point, the barometer again fell, and from the operation of these two causes, continued to fall until four in the morning; from which time, those general cooling influences that operate in the absence of the sun, caused the barometer again to rise till ten in the morning, thus completing the two risings and two fallings in the twenty-four hours. This was shown to be in general accordance with the tables of the Plymouth observations for three years, and with those made at Madras and Poona. The fact, also found in the Plymouth observations, that the dew-point rose with the temperature until eleven o'clock, A. M., when, although the temperature continued rising, the dew-point did not rise higher, showed that the vapour formed during the hottest part of the day was expended in supplying that which was condensed in forming the daily cloud. According to these tables, also, the dew point at the surface continued stationary until four o'clock, P. M. when it began to fall, and continued falling with the declining temperature until the great cold resulting from evaporation ceased. The diurnal fluctuations were also shown to be the least, when the irregular were the greatest (as observed by Mr. Birt), because rain was then produced, and evaporation prevented from cooling the air at the regular diurnal period, and in that way prevented the rise of the barometer at that recurring period.

Mr. Byrne gave an account of a new proportional Compass, which by a vernier at the centre, and a means of adjusting the points, could, by the aid of tables, multiply, divide, and compare lines, surfaces, solids, and angles, with considerable precision.

FRIDAY.

SECTION B.—CHEMISTRY AND MINERALOGY.

'On a peculiar Condition of Zinc, produced by a long continued high temperature,' by Dr. Tilley.—Dr. Tilley presented a specimen of zinc, which had undergone a remarkable change in its arrangement, from being kept at a heat above that of fusion for a considerable time. This change was thought to bear some analogy to the alterations which sulphur and some other bodies are known to undergo at different temperatures. The condition of the zinc was singularly crystalline. The zinc in this state was found to have the same chemical condition as the ordinary zinc of commerce, and, although its oxides and salts had not been examined, it was found, that when distilled, the zinc was restored to its original texture. It was suggested, that many interesting examples of similar molecular changes in other metals might be detected by subjecting them to similar conditions to those in which this sample of zinc was placed.

Mr. Patterson entered into an explanation of his process, by which silver was separated from lead, and stated, that he had observed similar molecular changes in those metals.

Report on a Hydrogen Furnace for Vitrification, and other applications of Heat in the Laboratory,' by the Rev. W. V. Harcourt.—At the request of the British Association, Mr. Harcourt had undertaken some years since to make experiments on vitrification. Dr. Faraday, in his experiments on glass, had the greatest difficulty in procuring perfectly homogeneous masses, arising in most cases from the almost impossibility of procuring a regulated heat in the ordinary furnaces. Mr. Harcourt, impressed with the advantages which might be gained for optical purposes, by procuring glasses formed by other salts and bases, instituted some experiments with a view of ascertaining this point. It was considered, that if a tribasic phosphate formed a glass, and the bibasic phosphate formed a glass, we should have, in all probability, glasses having different optical properties. Finding difficulty in proceeding with these experiments, at the heat given by ordinary furnaces, and the risk to which the platina crucibles were exposed, he was induced to try the effects of hydrogen burning in common air. Dr. Dalton was consulted on the construction of the first hydrogen furnaces, and he suggested the difficulty which was found to arise in practice—that hydrogen gas burning, through small orifices, with great pressure, would blow itself out. This difficulty was, however, overcome in the management of the apparatus brought before the Section. This apparatus consisted of an iron tube, in which the gas was generated by the addition of 15 ounces of zinc to three-quarters of a pint of oil of vitriol and ten pints and a half of water. The gas produced was found to be in ten minutes under a pressure of 21 atmospheres, in sixteen minutes and a half under a pressure of 25 atmospheres, and in eighteen minutes under a pressure of 26 atmospheres. The gas was conducted into another cylinder, and from thence to the jets, over which was suspended a platina crucible. The gas being ignited at these jets, maintained, with the above charge, the platina crucible at a white heat for twenty minutes. Gems had been fused by the heat thus generated. Several kinds of jets were used, as it might be necessary to surround the crucible with heat, or only to apply the heat to the bottom of it. Experiments with this apparatus have been made upon the phosphates of antimony, zinc, barytes, and cadmium. The results have not been, however, quite satisfactory. In some the striæ interfered with the transparency of the glass formed; and in the case of the monobasic phosphate of zinc, it was found that, to whatever heat the compound may have been exposed, the glass thus formed was deliquescent. The reading of this Report was accompanied by some experiments with the hydrogen furnace in question, for the purpose of showing the intense heat which could be produced.

Dr. Faraday bore testimony to the advantages of this arrangement. He had found in all his experiments on glass, in which the elements were chemically combined, that crystallization took place. He regarded all common glass as examples of solution, rather than of chemical combination. Borate of lead and silicate of lead, if fused in small quantities, so that they cooled quickly, were transparent, but if fused in masses, which required a longer time, they were in a crystalline condition.—Mr. Harcourt remarked, that in the monobasic phosphate of zinc, which was transparent when vitrified, the quantity of acid was probably exceeding small, but this glass was striated.—Dr. Faraday said, that some of the purest specimens of American ice show similar striæ although it was in a state of exceeding purity, yielding the purest of all water when liquefied.—Some remarks were then made by Mr. Pearsall, on the action of hydrogen on platina. An experiment was named by Mr. Harcourt, in which a platina tube was destroyed by an attempt to fuse ultramarine in it. Prof. Liebig stated, that platina was soon fused if exposed to a charcoal fire, from the action of the silicon contained in the charcoal.

'The Measure of Nervous Force developed by a Current of Electricity, by Prof. Matteucci.—This communication, which was delivered in French, detailed some experiments which had been conducted with a view of detecting the amount of nervous excitability. This was effected by calculating the number of contractions produced in the limbs of a frog in a given time by the power of a galvanic battery, the force of which was known. A frog was prepared in the usual manner for galvanic experiments, and being suspended by a pair of nippers, a weight was attached to its limbs, and the animal connected with a galvanic battery, a voltameter being interposed in one part of the circle. This voltameter gave a correct measure of the power of the battery, and, under the influence of the same current, the weight being raised over a graduated scale by the contractions of the muscles, gave a measure of the nervous force developed in the animal. Some other contrivances were also named, by which the same end could be obtained, but none of them appeared so simple as the one above described.

Prof. Grove suggested the substitution of a galvanometer, which is easily affected by weak electrical currents, for the voltameter, which requires the force of a powerful battery.

'On Specific Heat,' by J. P. Joule.—After examining the law of Dulong and Petit, that the specific heat of simple bodies is inversely proportional to their atomic weights, the author proceeded to detail the attempts made by Haycraft, De la Rive, and Mercet, to discover the specific heats of gases and liquids. The observations of Newmann and Regnault on the specific heats of simple and compound bodies were next examined. Mr. Joule then exhibited to the Section a table, in which the theoretical specific heats of a variety of bodies impartially selected were calculated on the hypothesis, that the capacity for heat of a simple atom remains the same in whatever chemical combination it enters. On the whole, the coincidence between the theoretical and experimental results was such as would induce a belief that the law of Dulong and Petit, with regard to simple atoms, is capable of a greater degree of generalization than chemists have hitherto been inclined to admit.

'On the alternate Spheres of Attraction and Repulsion noticed by Newton and others, and on Chemical Affinity,' by the Rev. T. Exley.—

An attempt to establish a new atomic theory, involving two principles —first, that every atom of matter consists of an indefinitely great sphere of force, varying inversely as the squares of the distance from the centre; second, that atoms are of different sorts, when their absolute force or spheres of repulsion are unequal. It is imagined, by the author, that there are four distinct classes of atoms, viz. tenacious, electric, etherial, and microgenal atoms.

SATURDAY.

'On the Limestones of Yorkshire.'—These limestones may be comprised under the four following classes, viz.—

1. The Mountain Limestone.
2. The Magnesian Limestone, including both the upper and lower beds.
3. The Oolitic Limestone.
4. The Chalk.

The Mountain Limestone is developed, to a great extent, in the district of Craven and in other parts of the north and north-west portions of the county. It is of a dark grey colour and hard in texture, breaking with a species of conchoidal fracture. Its specific gravity is about 1·70. According to analysis, the following are its principal constituents, viz.—

Carbonic Acid, ...	43·00
Lime, ...	55·50
Foreign Matter, ...	1·50
	100·00

It thus appears to contain about 98·50 per cent. of carbonate of lime, and consequently would appear to be an excellent limestone for the purposes of agriculture.

The Magnesian Limestone.—The lower portion of this formation is found in immediate succession to the coal measures. It is of a yellowish white colour, and breaks with a dull earthy fracture. Its specific gravity is about 2·64.

A specimen from Conisbrough, near Doncaster, gave the following as its chief constituent ingredients, viz.—

Carbonic Acid, ...	46·50
Lime, ...	35·00
Magnesia, ...	17·75
Red Oxide of Iron, ...	0·75
Insoluble Matter, ...	....
	100·00

Another specimen from the village of Wheldon, adjoining the York and North Midland Railway, near Castleford, gave the following as its principal ingredients, viz.—

Carbonic Acid, ...	46·00
Lime, ...	35·04
Magnesia, ...	17·50
Red Oxide Iron, ...	0·90
Insoluble Matter,..	0·50
Loss, ...	0·06
	100·00

This limestone appears then to consist of 62·32 per cent. carbonate of lime, and 36·75 carbonate of magnesia, or approaching nearly to the constitution of dolomite, containing 1 atom carbonate of lime and 1 carbonate of magnesia. From the above statement, it would appear that this species of limestone is not well calculated for agricultural purposes, except perhaps, under peculiar circumstances, and applied in small quantities.

The Upper Magnesian Limestone is in immediate succession to the lower one, and directly beneath the new red sandstone. It is found in considerable abundance at Knottingley, Brotherton, and, no doubt, in other localities in this county. Its specific gravity is about 2·64. It is of a greyish brown colour, much harder in texture than the preceding variety. According to analysis, the following are its principal ingredients, viz.—

Carbonic Acid, ...	42·35
Lime, ...	51·61
Magnesia, ...	a trace.
Red Oxide Iron, ...	1·42
Insoluble Matter, ...	4·50
Loss, ...	0·12
	100·00

As this limestone appears to contain about 93·96 per cent. carbonate of lime, it would seem to be tolerably well adapted for the purposes of agriculture, as the very small proportion of magnesia that it appears to contain, can scarcely be supposed to exert much deleterious influence.

The Oolitic Limestone is the next in order to the magnesian, and is found in considerable abundance in the neighbourhood of Malton. It is of yellowish white colour, and appears to be composed of innumerable small round particles, and hence it is commonly called roe-stone. The specific gravity is about 2·59. According to analysis, its principal constituents are—

Carbonic Acid, ...	44·35
Lime, ...	53·53
Red Oxide Iron, ...	0·69
Insoluble Matter, ...	1·26
Loss, ...	0·17
	100·00

From the large proportion of carbonate of lime contained in this limestone, it appears to be well calculated for agricultural purposes, and is used to a considerable extent.

The Chalk formation occupies a considerable extent in the eastern part of the county, forming that peculiar feature in it known as the Wolds. This substance scarcely requires any description. It is, as is well known, of a white colour, and easily scraped with a knife, and readily soils the fingers. Its specific gravity is about 2·55. According to analysis, its chief ingredients are—

Carbonic Acid, ...	43·00
Lime, ... : ..	55·42
Insoluble Matter, ...	1·10
Loss, ...	0·48
	100·00

This, like the preceding variety, appears to contain a large proportion of carbonate of lime, and consequently affords, by burning, a similarly large proportion of lime, and hence is particularly adapted for agricultural purposes, although it is said not to produce so strong a lime as the oolitic limestone.

Sir J. Johnstone remarked on the very injurious effects produced, in many districts, on the crops, by the use of the magnesian limestone, and wished to know if chemists could at all account for the very remarkable differences, which agriculturists found to exist in limestones, which gave nearly the same products by analysis.—Prof. Daubeny observed, that it was probable that the difference might be found in the fact, that one limestone contained a larger portion of the phosphates than another. In ordinary analysis, the phosphate of lime, being soluble in muriatic acid, was very generally overlooked.—Dr. Playfair stated, that the existence of iron, in the state of protoxide in one stone, and of peroxide in another, would explain the difference in the observed effects of different limestones. He adduced some instances in which clays, from the same pit, being used as manures, were found to possess beneficial or injurious properties as it contained the iron in the higher or lower degree of oxidation.

'On the Energiatype and the Property of Sulphate of Iron in developing Photographic Images,' by Mr. R. Hunt.—In a former number of the *Athenæum* [*ante*, p. 500] the author communicated the discovery of a new photographic process of great sensibility, to which the above name was given. It consisted essentially in the development of a dormant photographic image, formed on a paper prepared with succinic acid and nitrate of silver, by the deoxidizing power of sulphate of iron. Numerous failures had been communicated to the author, which appeared to arise from the varying rates of solubility possessed by succinic acid obtained from different manufacturers. It was now recommended, that five grains of succinic acid should be put into a fluid ounce of distilled water, and allowed entirely to dissolve—the salt and gum is then to be added to this solution, and the author believes that, with care, the effects will be certain. Recent researches have, however, proved that this property of the sulphate of iron may be made available on *any photographic paper.* On paper merely washed with the nitrate of silver, good camera pictures have been thus obtained in a few minutes, and on papers prepared with the chloride of sodium, bromide of potassium, particularly the iodide of potassium, camera views are procured in less than a minute. Mr. Hunt exhibited a great number of specimens procured on the above and many other salts of silver—the most beautiful being procured on papers covered with the acetate, the benzoate, the citrate, and other organic salts of silver. These drawings were all fixed by washing with moderately strong ammonia.

Prof. Grove called the attention of the Section to a new photographic process, by which pictures might be obtained by one operation. Papers were prepared with the iodide of potassium, nitrate of silver, and gallic acid, in the same manner as for Mr. Fox Talbot's calotype process, and then allowed to darken. The paper is again washed over with the iodide of potassium in solution, and dried. When required for use, it is to be immersed in a weak solution of nitric acid in water, and then exposed to light. In a very few minutes, copies of engravings could be procured.

'On Guano,' by Mr. Warrington.—This was a notice, intended particularly to draw attention to the imperfect manner in which the estimation of the nitrogen in the analysis of guano, was given to the agriculturist. On the quantites of nitrogen depended, in a great degree, the value of a given sample, whereas in general the quantity of ammoniacal salts was

›nly given. It appears, from the use of guano in the production of he prussiate of potash, that the quantities of this element are always ınderstated.

A conversation ensued as to the relative value of the Peruvian and African Guano. It was remarked, that in some cases it had been found, hat the weight of the ear produced by the use of guano, was too great or the stalk to support; consequently it fell, and the grain was injured; nd information as to a means of giving greater stiffness to the straw, vas much to be desired.—Mr. Hunt stated, that it had been found in he west of Cornwall, that the use of the China stone, a decomposed granite, the felspar of which contained much silicate of potash, produced a traw of a very remarkable degree of stiffness.—Mr. Warrington suggested that silicate of soda might be very readily formed at all places ear the sea, by calcining together sea-sand and common salt. This led o a conversation on the power which plants possessed of substituting oda for potash in different districts.—Prof. Liebig said, he had been ngaged in the analysis of plants growing in different districts extending from Giessen to the sea. It was found that corn, peas, beans, and rass, contained a larger portion of soda as they grew nearer and nearer he sea coast: thus satisfactorily proving, that plants could substitute oda for potash, without injury to their growth. No plants were found n which there was not potash, but there were many in which there was o soda. It had been asked in what proportions soda and potash were ound in the animal economy? Soda existed largely in the bile and lood—potash was found most abundantly in the muscles, hence the eason was evident why the use of soda (common salt) with the ood of man, was universal. It was quite evident that plants could substitute one constituent for another—it had been even found, that in the obacco plant lime had been replaced by potash.—In answer to other inuiries, Prof. Liebig remarked, that the alkalies in plants were not in ombination as organic constituents; they could be dissolved out. Caron, on the contrary, formed a part of their structure. Carbonic acid as absorbed by plants, and served, uniting with hydrogen and with ater, to form a series of compounds containing varying proportions of hese elements. An organized body is formed by the action of chemical orces; its structure shows it is not the result of physical force. We ave the formation first of the vegetable acids of sugar, &c.; oxalic cid, tartaric acid, and citric acid were vehicles of transfer, combining s they did with the potash or soda of the plants, from which were at ength separated the carbon which went to the composition of the vegeable structure.

Sir John Johnstone observed, that the value of guano was supposed to depend on the quantity of uric acid it contained: he begged to inquire if any experimental evidence existed as to the qualities of this acid as a stimulant or otherwise.—Prof. Liebig stated, that there was not a single experiment on uric acid—that all which had been said as to its advantages, was mere assumption.—Dr. Tilley made some remarks on the fact, that the skin of the leg of a gull had been found by him in guano, the entire bone of the leg being dissolved out; seal skin had also been found, but no bones.—Mr. Hunt stated, that of two cargoes of African guano which arrived at Falmouth, one entire cargo consisted of decomposed seals. In this he found the skin with the fur quite perfect, and a great number of bones far advanced in decomposition. It appeared, on inquiry in various quarters, that half a century since the seal fishery was carried on most extensively on that coast, the seals were all taken to the shore, the oil extracted, and the remains thrown into large heaps—thus, on this particular spot, had accumulated those immense heaps, which they had been removing as the production of birds. Its value as a manure was not less than that of true guano; analysis giving very nearly the same results in the two samples examined by Mr. Hunt from these ships.

Saturday.

Section C.—GEOLOGY AND PHYSICAL GEOGRAPHY.

'On the Microscopic Structure of Shells, &c.' by Dr. W. B. Carpenter. —Dr. Carpenter gave an abstract of his Report on the microscopic structure of recent and fossil shells, &c. He stated that, with the aid of the grant last year voted to him by the Association, he had made upwards of 1000 sections and other preparations of shell-structure; and that, in many instances, he had examined the *entire* structure of shells, which presented the most characteristic features, in order to anticipate the objection that varieties of structure might exist in different parts of the same individual. Dr. Carpenter then explained, with the aid of a series of large coloured drawings, his views on the formation of shell. In regard to the *prismatic cellular structure,* he pointed out a series of striæ, crossing the long prismatic cells; and present also on the calcareous prisms (casts of the interior of these cells,) which may be obtained by the disintegration or fossil Pinnæ, and sometimes even from recent shells. These striæ he believed to indicate the points where a series of flattened cells, arranged in a pile, had coalesced to form a single long prismatic cell. He pointed to the alternation of deeply-coloured and colourless strata, in a single layer of *Pinna nigrina,* as proving that the formation of this layer was not accomplished at once, but was continued for some time; and adduced other facts in support of his view. Dr. C. then described the *cancellated* structure of the Rudistes; to which there is nothing very analogous among recent shells; this structure is composed of a series of cavities, lying between the external and internal layers of the shell, and separated by shelly partitions disposed with considerable regularity. These cavities may have been filled, in the living shell, with animal matter. The *Pleurorhyncus hibernicus* was stated by Dr. C. to possess this structure in common with the Rudistes; which is a confirmation of the views of those who, on other grounds, had referred them to that group. Dr. C. then stated, in regard to the Terebratulæ, that the examination of a considerable number of species had confirmed his previous statement, that the *non-plicated,* and *slightly-plicated* species are characterized by the possession of the perforations in the shell first described by him; whilst these are absent int he *deeply-plicated* species. They exist in all the known recent species, except *Terebratula psittacea*; which has, on other grounds, been separated from the rest, and has been referred to the genus Atrypa, several species of which, examined by Dr. C., are also characterized by the absence of perforations. Dr. C. further alluded to several cases, in which this mode of examination had furnished characters of great importance in classification, and in the recognition of fossil shells; and he concluded by drawing attention to certain structures contained in the shell of the crab, and in the skeletons of the Echinodermata. With the continued assistance of the Association, he hoped to be able to present, next year, a detailed report on these classes. His present report embraces the structure of the shells of the Brachiopoda; and of the families Placunidæ, Ostraceæ, Pectinidæ, Margaritaceæ, and Unionidæ, among the Lamellibranchiate bivalves. In conclusion, he requested the aid of his auditors towards the prosecution of his researches, by the transmission of fragments of recent and fossil shells (named) for examination; and he mentioned that the smallest fragment might be of essential service to him.

Prof. Phillips observed that this paper was an example of the manner in which doubt was gradually removed, and certainty obtained in geological inquiries. One object of these investigations was to ascertain the true affinities of recent and fossil grades of animal life, and, by this means, a knowledge was also obtained of the corresponding problem of the condition under which animals and plants formerly lived. In these researches the aid of the zoologist was most important; and Mr. Phillips contended, that calling in the aid of the naturalist and the chemist was respectful to the advocates of those sciences, was a legitimate way of advancing geological inquiries, that it appealed to right reason, and its results were as much deserving of confidence as any other branch of knowledge.—Prof. E. Forbes remarked the great value of microscopic investigation to the physiologist and systematic naturalist, but at present he should hesitate to found conclusions on the isolated facts of a research at present in its infancy.

Sir H. De la Beche exhibited the Ordnance Map of South Wales and the South-West of England, and a section through the Silurian rocks in the vicinity of Builth. The vicinity of Builth is one of much geological interest, as showing the connexion between the Silurian rocks at Ludlow, Wenlock, and other localities on the N. E., with the same deposits in Brecon, Carmarthen, &c., and as affording considerable instruction relative to the intermixture of sedimentary and igneous rock at this early period. The section described by the author is part of one now making by the Geological Survey between the old red sandstone of the Black Mountains in Brecon and the sea N. of Aberystwith. Sir H. De la Beche then compared this developmeut of the Silurian rocks with that in Salopia, and observed, that although the Wenlock limestone is but a trace near Builth, and the Aymestrey limestone little else, still there is a general resemblance to the sequence described by Mr. Murchison, at Malvern, Woolhope, &c. It is at the base of the Wenlock shales the greatest modification is found; instead of the Caradoc limestone and sandstone are the shales and slates with Asaphus Buchii, and beneath these a mixture of conglomerates, sandstones, &c., with similar fossils, so that either the sandstones representing the Caradoc, are included in the Llandeilo flags, and one appellation must be applied to both, or the Caradoc sandstone must be supposed to have thinned off, so as not to occur in the Builth and western sections.

Mr. Murchison stated that every group of rocks, when traced into a distant region, must be expected to present a difference in its fossils. He considered the upper Llandeilo flag series the complete equivalent of the Caradoc sandstone, and expressed his belief that in no country would be found fossiliferous rocks older than the lower Silurian system.—Mr. Sedgwick described the various modifications presented by the carboniferous strata of the north of England, Devonshire, &c., and by the Silurian rocks of North Wales, and the typical region of Shropshire, with the same series in Cumberland and Westmoreland. He contended that the term Silurian should be confined to the Ludlow and Wenlock rocks, which formed a complete system, with distinct mineral structure and organic types. The Caradoc sandstone and Llandeilo flags ought never to have been included with these; they belonged to the great system of North Wales and Cumberland, consisting of many successive universal masses of very different character, and containing groups of fossils developed as one common type; the Professor thought some general name ought to be applied to them, such as the geologists of Europe and the rest of the world would accept. They constituted a true Protozoic group, as far at least as England was concerned; and the absence of fossils in the rocks below them, shows that the end of the story had been reached as far as regarded animal life.

1. On the Silurian region of the counties of Galway and south of Mayo: 2. On the Fossiliferous Slate district of the counties of Waterford, Wexford, Wicklow, Kildare, &c., by Mr. R. Griffiths. The series of rocks described in the first of these communications occupy a district usually known as Connemara, bounded on the north by Clew Bay, in the county of Mayo, south by Galway Bay, west by the Atlantic, and east by Lough Corrib and Lough Mask, which separate it from the great carboniferous limestone field of Ireland. In the second communication, Mr. Griffiths describes the extensive slate district situated between the east coast of the counties of Waterford, Wexford, and Wicklow, and the granite district of Wicklow and Carlow.

FRIDAY.

SECTION D.—ZOOLOGY AND BOTANY.

A report 'On the Marine Zoology of Corfu and the Ionian Isles,' by Capt. Portlock, R.N.—The researches of Capt. Portlock, by means of the dredge, were confined to the channel between Corfu and Vido, to a narrow strip beyond Vido, and to a similar narrow strip extending from Cape Sidero to Castraves. The bottom of the sea in these districts was mostly clay, and consequently bad for dredging.

Prof. E. Forbes observed, that although the paper indicated much zeal and labour, yet it was defective. Many of the species described as new were not new species at all, and Capt. Portlock had been led into error by the want of books. It was also not stated from what depth the animals were dredged up, and yet this was one of the most important points. What was wanted in such reports were not critical remarks on species, but a statement of what had been found, or specimens which might be examined.

The Report of Messrs. Alder and Hancock, on Nudibranchiate Mollusca, was then read. The reporters alluded to the researches of M. de Quatefages on the Nudibranchiate Mollusca, and especially his placing some of them under a new order, which he called Phlebenterata.

But not agreeing with the views of M. de Quatefages, they remained content to consider the Mollusca Nudibranchiata as still forming one entire group, divisible into two sections, distinguishable from each other by external characters, and probably equally so by physiological peculiarities, the limits of which have not yet been ascertained in the several genera. These animals were much neglected till the time of Cuvier, who, however, only dissected specimens preserved in spirits, and fell into some errors. In Great Britain little was known till recently, but through the researches of Prof. E. Forbes, Mr. W. Thompson, of Belfast, and the authors, the species now amounted to seventy-five. The Report then proceeds to examine the distribution of these seventy-five species, which is a greater number than is given for any other part of the world, on the coasts of the British islands. This is followed by an account of their development, their minute structure, and a list of all the known British species.

Professor Allman mentioned a new genus, approximate to the genus *Venillia* of Messrs. Alder and Hancock, which he obtained from a salt-marsh in the south of Ireland.

Report of the Dredging Committee for 1844.—This Report consisted of two parts: 1st, of the records of a series of dredging operations conducted round the coasts of Anglesea, in September 1844, by Mr. M'Andrew and Prof. E. Forbes, exhibiting the distribution of the marine animals procured in various depths down to thirty fathoms, and the state of the sea-bed in the localities explored. Among the more interesting facts recorded in these papers were the following: rolled specimens of *Purpura lapillus,* a shell which lives only above low-water mark, were found in 28 to 30 fathoms water on the gravelly bed of a line of current, at the distance of eight miles from the nearest shore. In the same line of current it was found that the few mollusca which lived there, such as Modiolæ, and Limæ, had constructed nests, or protecting cases of pebbles, bound together by threads of byssus; and one species, the *Modiola discrepans,* had made its nest of the leaf-like expansions of *Flustra foliacea* cemented together. The attention of the dredgers was directed, among other subjects, to the distribution of Serpulæ, and the results of their researches were confirmatory of the statements recently advanced by Dr. Phillippi, of Cassel, namely, that no dependence could be placed, even as to the genus, on the shell of a serpula, perfectly similar shells being constructed by animals of different genera. Thus they found all the serpulæ of a particular form in 12 fathoms water to be a species of Eupomatus, whilst exactly similar shells in 20 fathoms proved to be the habitations of a species of the genus wanting opercula, of which *S. tubularia* is the type. All the triangular serpulæ they met with were *Pomatoceros tricuspis.* In 12 fathoms, at the entrance of the Menai Straits, they dredged the shell of *Helix aspersa*, the common snail, covered with barnacles and serpulæ, and inhabited by a hermit crab.

'On the Reproduction of Lost Parts in the Crustacea,' by H. D. S. Goodsir.—That all the species of crustacea are endowed with the power of regenerating parts of their body which have been accidentally lost, is a fact which has long been known. The manner, however, in which these are developed, and the organ also from which the germ of the future leg is derived, has never yet been either properly explained or examined. If one or more of the distal phalanges of the leg of a common crab be torn forcibly off, the animal instantly throws off the remaining parts of the limb. This is effected with little apparent exertion, and always takes place at one spot, which is marked externally by a delicate line, covered with an annulus of thinly scattered hairs. The phalanx on either side of the ring is considerably contracted; and when the shell is taken carefully off, so as to expose the contents, they are found to consist of a fibrous, gelatinous, glandular-looking mass--the organ which supplies the germs for future limbs. Some hours after the limb is thrown off, the small foramen becomes gradually filled by a small rounded body—the germ of the future leg—which gradually increases in size, so as to push out before it the cicatrix which had been formed on the raw surface after the injury, and now forms the external covering of the young limb. As the germ increases in size, the inclosing membranes become thinner and thinner, until they burst, when the young limb, which has hitherto been bent upon itself, becomes extended and has all the appearance of a perfect limb, except in size.

'On the Fishes of Yorkshire,' by T. Meynell.—The total number of species which have been detected as inhabiting the shores or frequenting the fresh waters of Great Britain, are stated by Mr. Yarrell's supplement to be about 250, of which number Mr. Meynell presented a list of 140 species as frequenting the waters of Yorkshire.

Dr. Carpenter then communicated to the Section some observations on the position which he deemed ought to be given to the compound ascidians in the zoological scale. In opposition to Milne Edwards, he considered that the compound ascidians should be placed with the Mollusca, and the ascidian polyps with the Radiata.

Prof. Allman did not think the polyps should be classed with the Radiata. They were not zoophytes—they were not mollusca.—Prof. E. Forbes agreed with Dr. Allman, that we were not in a position to change the place of compound ascidians in the zoological scale.

SATURDAY.

The attention of the Section was this day devoted to Botany.

Chevalier Schomburgk read a series of papers, the first of which was entitled 'Description of *Alexandra Imperatricis*, a new genus of Papilionaceæ.'—This tree, in appearance, is one of the most beautiful and gorgeous of the family of Leguminosæ, and was discovered by the author at the foot of the northern ridge of sandstone mountains in the pluvial basin of the River Cuyuni, in Guiana, and reaches a height of from 100 to 120 feet. The flowers are developed directly from the trunk and woody branches, in large clusters, and the racemes, pedicels, and calyces are of rich crimson, the petals bright orange, striped with crimson, the vexillum of a deep purple, and ascending. The pod is from 18 to 20 inches long, and contains several seeds.

The President inquired what was the largest tree the Chevalier had observed in the forests of Guiana.—Mr. Schomburgk replied, the *Mara excelsa* was the highest tree.

The next paper by Mr. Schomburgk was a description of a new species of Barbacenia.—This plant grows on the table-land from which Mount Roraima rises. It reaches frequently a height of 10 or 12 feet, branching in a dichotomous manner, and bears a number of flowers, which, in their appearance, are liliaceous, and 5 to 6 inches long. They are, outside, of a delicately purplish hue, and deliciously fragrant. It differs from the species of hitherto described Barbaceniæ, in possessing 18 fertile stamens. The difference in the number of stamens is not, however, allowed to be generic in allied species of Velloziæ, and, therefore, the author has placed this plant with the Barbaceniæ.

'On the *Ophiocaryon paradoxa*, the Snake-nut tree.'—In a former communication Mr. Schomburgk had called the attention of naturalists to the peculiar seed of this tree. The seed is covered over with a membrane, which, on being removed, presents the embryo elongated and twisted in a spiral manner, so as to give it the form of a snake. From a recent examination of the flowers of this tree, the author had found that it belonged to the natural order Sapindaceæ. The embryo is twisted in other members of this order.

On the *Calycophyllum Stanleyanum*.—There are several genera of the natural family of Rubiaceæ, as Calycophyllum, Mussænda, Pinkneya, &c., where one of the teeth of the calyx expands into a coloured petioled leaf, of a membranaceous texture. In this tree it is very remarkable; and as these bract-like organs are of a rose colour, they give a very beautiful aspect to the forests where they grow. This appendage only grows after the flower has dropped off, and develops itself with astonishing rapidity. The tree grows on the banks of the rivers Rupununi and Takutu, in the third parallel of north latitude.

Mr. Schomburgk then communicated a paper, entitled 'Description of *Lightia lemniscata*, a new genus of the family Buttneriaceæ.—The Buttneriaceæ are very common in Guiana, and in some districts the author met with whole forests of the chocolate nut tree, a plant belonging to this family. The Lightia belongs to this family. The great peculiarity of this plant is, that the petals have an elongated appendage, which hangs down from the cluster of flowers, like ribbons, and hence its specific name. This tree attains a height of 20 or 24 feet, and produces its flowers directly from the stem, below the axis of fallen leaves. Only three specimens of this tree were discovered in Guiana by Mr. Schomburgk.

The last paper by Mr. Schomburgk was 'On two New Species of the family Laurineæ, from the forests of Guiana.'—The first is a tree which affords timber which is brought to England, and known by the name of Greenheart. This tree was found, by Dr. Rodie, to possess febrifugal properties, and Dr. Maclagan has published an account of two new alkaloids which he had obtained from it by chemical processes. These alkaloids may be used instead of quinine. The second tree has long been known, and yields an aromatic fruit, known by the name of the Accawai nutmeg, and is extensively used in Guiana as a remedy in diarrhœa, dysentery, and other intestinal diseases. The author succeeded in obtaining flowers and seeds, and had found this tree to be a species of Acrodiclidium, to which he has given the specific name, Camara. It appears to be restricted to the sandstone mountains of Roraima, between the fifth and sixth parallel of north latitude.

Mr. Schomburgk exhibited dried specimens and drawings of most of the plants he described, as also of the *Strychnos toxifera*, a plant which produces the true Wouraili poison of Guiana.

Prof. Balfour stated, that the Greenheart was much used for building vessels on the Clyde. The alkaloid obtained from this tree was called by Dr. Maclagan bibirine, but its insolubility rendered it unfit for medical uses.— Prof. Tilley stated, that although Dr. Maclagan had named two alkaloids as being present in the wood of the greenheart, subsequent experiments had led him to conclude, that there was but one, and this he called bibirine. This alkaloid presented a similar chemical constitution to quinine. It was not, however, combined with an organic acid.

Mr. Babington then exhibited to the Section specimens of three plants which had been added to the list of British plants during the summer of 1844. These were, 1. *Alsine stricta,* discovered on Widdybank Fell, in Teesdale, Durham; 2. *Carduus setosus,* growing near the shore of the Frith of Forth, in the neighbourhood of Cullrow; 3. *Galium Vaillantii.*

Mr. O. A. Moore read a report 'On the Flora of Yorkshire,' written at the request of the Council of the Yorkshire Philosophical Society, the drawing up of which had been intrusted to himself and Mr. Baines. In this list were included 1,117 species and 158 varieties, exclusive of a few whose claims to be regarded as Yorkshire plants rest on insufficient grounds. Of these about 87 species and 81 varieties were mentioned, which had not previously appeared in any general list.

Mr. Babington observed, that the occurrence of *Orobanche rubra* in Yorkshire proved that this plant was not, as supposed, sometimes confined to basaltic formations. It was always found growing on the roots of *Thymus serpyllum.*

The President stated, that a paper ought to have been brought before the Section, 'On the Phosphorescence of Mosses,' by Mr. Fox Strangways, but this paper had unfortunately been lost.—Mr. Babington said, that he had observed the light called phosphorescence in mosses, particularly in the *Schistostega pennata.* He could not explain the cause of the occurrence of this curious phenomenon.—Prof. Balfour referred to some recent papers on this subject, and spoke of the curious light given out by flowers of an orange and red colour. It was well known that many cryptogamia gave out light during their decomposition.—Chevalier Schomburgk had been frequently surprised in the forests of Guiana at the bright light given off by plants belonging to the fungi. He had also seen it occur during the decomposition of the cassava roots.—Dr. Lankester stated, that it had been supposed that *Schistostega pennata* exhibited the appearance of phosphorescence on account of its crystalline structure. Mr. Edwin Quekett and himself had, however, examined the moss in vain for crystals. He believed that the phenomenon of phosphorescence might be referred to the union of oxygen with the tissues of the vegetable, producing a low form of combustion, and in which light was emitted.—Prof. Allman considered the light observed to issue from colored flowers an optical delusion. If it were real phosphorescence it would be seen better in the dark than in the twilight, which was not the case. He did not consider that this kind of light had any analogy with that which appeared from the stems of decaying trees and cryptogamia.

Mr. Allis, of York, whose exhibition of living ferns in the gardens of the Yorkshire Philosophical Society, caused so much astonishment, from the number, variety, beauty, and rarity of the ferns cultivated, read a paper 'On the Mode he had adopted in cultivating the Ferns, as well as Notes on the rarer Species.'—At the conclusion of the paper the President and Members of the Section, accompanied Mr. Allis to the tent in the gardens in which his ferns were deposited, where he described the characters and modes of cultivating some of the rarer and less known of the family of ferns.

Friday.

Section E.—MEDICAL SCIENCE.

A paper was read, received from Prof. Peretti, of Rome, 'On the Bitter Principles of some Vegetables.'—The greater part of those vegetables, he observed, which contain a bitter principle not depending on an alkaloid, owe it to an alkaline resin; they are decomposed by large quantities of water, by acids, and by earthy salts. By the processes he adopted (and which he described in detail), the Professor obtained the bitter principle of wormwood, quassia, coffee, gentian, &c., and also the pure bitter of bile. The bitter princple which attracted his chief attention was that of the *Absinthium Romanum*, which he stated to have much power in allaying severe irritation of the stomach, and he had successfully used it as a remedy in sea-sickness, half an ounce of the solution being enough to prevent it, or stop it if it had commenced. The Professor detailed several of the chemical properties of these resinates. The so-called resins he stated to be bi-resinated alkalis; such are the resins of jalap, guaiacum, &c. The gum resins he stated to be combinations of resinate and bi-resinate of potash with resinates of lime and magnesia. The paper concluded by observations on some other points of vegetable chemistry, and the announcement of the discovery of a new alkaloid derived from a new species of Pereira, the *Cryptocaria pretiosa*, different from the bark of the true Pereira, examined by M. Pelletier.

The next paper, by Dr. S. W. J. Merriman, was on a physiological subject of purely professional interest.

Saturday.

Dr. Hodgkin read a paper 'On the Tape-Worm as prevalent in Abyssinia.'—He also gave some particulars of the plant called Kosso in Abyssinia, but known by different names in other regions of Africa, the flowers of which are powerfully purgative, and are used as a specific remedy for the endemic prevalence of worms.

Dr. Williams presented two specimens of Tænia, one of which had been removed by the use of spirit of turpentine, after the male fern root (*Aspidium flix mas*) had failed, and the other by the latter remedy, after the turpentine had failed.

Dr. Fowler stated, that he had found turpentine in conjunction with tincture of opium of great value, not only in suspending an expected paroxysm of ague, but in also removing the disease.

Dr. Laycock read a paper 'On the Reflex Function of the Brain.'—The object was to show that the reflex function, as possessed by the spinal nerves and ganglia, is also manifested by the cerebral ganglia, and the cerebral nerves of sensation, the optic, acoustic, olfactory, &c., —that in fact, as the cerebral masses and the cerebral nerves are properly to be considered as a continuation of the spinal, they are furnished with the same endowments and subject to the same laws. He reviewed the doctrine of the reflex function, and the facts on which it was founded, as taught by Dr. Marshall Hall. The excito-motary irritation may be applied either to the periphery or to the central axis in the spinal system, and may produce its effect independent of sensation or perception or volition. Yet consciousness and perception may, in some cases, be superadded to the organic effects of the irritation; examples of both those peculiarities of nervous action were alluded to: and Dr. Laycock contended, that if similar phenomena arose from mere cerebral excitement, they must be considered as reflex excited acts, accompanied by sensation and consciousness, these central cerebral irritations producing a series of changes, commencing in the posterior grey matter, and exciting what Dr. Laycock terms *ideagenous* changes; from thence the series of changes extends to the anterior grey matter, and kinetic change (κινεω, *moveo*) result, whence the harmonious muscular movements are produced. The points insisted on by the author were, that the cerebral nerves are *incident excitor*, and the brain an excitor of movements in all respects analogous to the reflex; the proof of this he thinks must be sought in pathological observations, as those nerves are not irritable by the ordinary stimuli of heat, mechanical violence, &c., as are the nerves of the spinal axis. The phenomena of hydrophobia and choræ, he contended, furnished those proofs: in the former the *sound*, or *sight*, or mere *idea* of water excited the convulsive paroxysm, and certain *odours* are known to excite convulsions. To show that the brain is the excitor of reflex acts, he referred to the case of choræa in the Medico-Chirurgical Transactions, and analyzed its phenomena. He also referred to spasmodic muscular movements of the face, trunk, and extremities, produced by neuralgia of the fifth pair of nerves. Cases of irregular choræa, and partial loss of memory from disease of the brain, confirmed this view of central excito-motary power; examples were adduced. The reason why mechanical violence to the central ganglia did not exhibit these phenomena (as in the experiments of Fleurens) was, because such an irritation was foreign from the true exciting influence of this part of the nervous system. The phenomena of hemiplegia were adduced as proofs of the author's position; and the imitative actions of animals were represented as true reflex acts, induced by irritable stimuli received through the cerebral nerves.

Dr. Bacchetti communicated the particulars of a case of extra-uterine pregnancy.

Dr. Fowler communicated some additional facts relative to the case of the blind and deaf mute, which he detailed at former meetings of the Association. She had been visited by Dr. Home (of Boston), the instructor of Laura Bridgeman, who found in her intellectual and moral manifestations a strong confirmation of the susceptibility of education possessed by those cases, which some doubted even after the instance of Laura Bridgeman. Several particulars relative to the instruction of the blind were given by the Rev. W. Taylor, and some details of the instruction of a blind and deaf mute, at Bruges, by the Abbé Carton.

Friday.

Section F.—STATISTICS.

'On the Statistics of Malton,' by Mr. Copperthwaite.—This paper detailed every particular connected with the social, moral and economic condition of the agricultural districts of Old and New Malton, in the North Riding of Yorkshire; but as such details can only have a local interest, we shall merely select some striking particulars. The population in 1831 was 5,377, and in 1841 it was 5,231, showing a decrease during the decennial period of 2·07 per cent., which is about the same rate of decrease as the "Occupations of the People" Report exhibits in a very large number of the agricultural districts. During this decennial period there has been an increase in the rate of mortality, but the per-centage of the number of persons above 60 years of age is double that of Sheffield or Manchester, though a little below the general average of the North Riding of Yorkshire. There has been an increase in the proportion of marriages; but a decrease in the per-centage of births, and a pregressive increase in the proportion of illegitimate to legitimate births. In the course of thirty years this proportion has risen from 5·3 to 9·4 per cent.; that is, it has nearly doubled. The labourers are paid at the rate of 12*s*. per week the year round, and in addition have an allowance of food in harvest. The rent, including tithe, amounts to 1*l.* 15*s.* per acre, and all the other charges to about 5*s.* per acre more. The allotment system has been introduced, with the approbation of the farmers, who deem it likely to keep down the poor-rate; small allotments are let at the rate of about 4*l.* per acre. Out of 1,417 persons between the ages of 3 and 15, there are 1,120 receiving education, a larger proportion than is found in any other part of the kingdom that has been statistically examined. Small lending libraries exist, and a Mechanics' Institute has been established. Mr. Copperthwaite entered at great length into all the details of farming produce, mode of cultivation, rotation of crops, &c.; but as the result showed nothing more than that the agriculture of the district is susceptible of improvement, we do not think it necessary to record the particulars.

The Rev. C. Drury read a paper entitled, 'Hints for improving the condition of Agricultural Labourers.' He recommended the establishment of provident societies, schools, allotments, religious instruction, and assistance in food and clothing.

Dr. Laycock read a 'Report on the Sanitary Condition of the city of York,' supplementary to that which he had drawn up at the request of her Majesty's Government, and which has been published. He exhibited a map of the city of York, constructed on a scale of sufficient magnitude to illustrate the levels, the density of population, the course and prevalence of epidemics, the state of ventilation, drainage, and other circumstances connected with public health. As all his communication had reference to this map, which would be unintelligible if presented on a small scale, we must confine ourselves to selecting some results of his inquiry, which possess general interest, and are not dependent on mere localities. The deaths in York on the average of the last five years were nearly 1 in 40, or 2½ per cent. annually. The deaths under five years of age amounted to 42 per cent. of the annual deaths, and the deaths of children under one year was 23 per cent. of the annual births. As this latter circumstance has been chosen by some eminent statisticians as a test of the sanitary condition of a district, Dr. Laycock prepared a table exhibiting a very extensive record of the per-centages of the deaths under 1 year of age to the annual births. We select the following examples:

York, ...	23·77 per cent. of deaths to births.
Liverpool, ...	25·57
Manchester, ...	20·19
Leeds, ...	16·80
North Riding of York, ...	10·27
All England, ...	14·48

Dr. Laycock found that the most sickly and injurious parts of the city of York were those which were built on the lowest levels; and he presented the following table, which will be found to embody the principal particulars connected with the health of towns to which the attention of statisticians has been directed.

From 1839 to 1844.	Mean Altitude.	Population on square rood.	Per-centage of deaths under one year of age.	Mean age at death.	Inhabitants to one birth annually.	Inhabitants to one death annually.			Deaths of Labouring Class.	Deaths of Labourers and Artizans.
						All causes	Epidemics.	Pulmonary disease.		
Best drained and ventilated parishes, ...	50	27	17·6	36·31	38 60	51·43	323·1	277·23	12·92	34·00
Intermediate, ...	43	40	20·0	28·37	28·71	40·80	303·4	235·23	21·73	51·07
Worst, ...	33	63	23·18	24·14	16·42	33·97	176·0	158·33	23·41	70·46

Dr. Laycock stated that he had investigated the records of the plagues and epidemics which had devastated York in the Middle Ages, from the corporation records and from the ecclesiastical registers, and had found that the localities which are now the most unhealthy, were those in which epidemics proved most fatal in ancient times. He illustrated this by the history of the sweating sickness in 1550, of the plague in 1640, and of the recent cholera.

SATURDAY.

Mr. Felkin read a paper on the statistics of the Hosiery manufactured by machinery in the United Kingdom, compiled from an actual census taken under his direction in the present year. He stated that before the age of Elizabeth, stockings were either knitted of coarse woollen thread or cut out of linen and silk tissue. Towards the close of the sixteenth century the Rev. W. Lee succeeded in producing the stocking-frame, and his ingenuity was appreciated by Queen Elizabeth, who visited him at his lodgings, and accepted specimens of his productions. Her kinsman, Lord Hunsdon, entered into a kind of partnership with Lee, and one of the Tudor family became the first stocking-maker's apprentice. James I. refused to follow the enlightened policy of Elizabeth; and Lee, neglected in England, accepted the offers made by the French minister Sully; he established a manufactory at Rouen, but after the murder of Henry IV. the patronage he had received was withdrawn, and he died of a broken heart. The stocking-frame spread rapidly over England, France, Spain, and the Netherlands; Lee's brother introduced the manufacture into London, where the "Frame-work Knitter's Company" still exists, though it has been long an empty name. Out of 660 frames, in 1669, there were 490 in London, three-fifths of the whole being employed in the manufacture of silk goods. In 1710 there were 100 frames destroyed in London on account of disputes about wages, and in 1714 there were 2,500 frames in London, 600 in Leicester, 400 in Nottingham, and about 8,600 throughout all England. From this time the trade began to leave London, probably from the vexatious nature of the company's regulations; and in 1753, when the total number of frames in England was 14,000, London had fallen to 1,000, while Nottingham had risen to 1,500, and Leicester to 1,000. The application of the stocking-frame to the manufacture of imitations of pillow lace, led the way to a great variety of ingenious inventions, and a consequent extension of the trade: in 1782 there were about 20,000 frames in England, of which 17,350 were in the midland counties. Though the stocking-makers and lace-makers started from the same point, their fate has been very different; the manufacturers of stockings are about the worst paid and those of lace among the best paid of the operative classes. Mr. Felkin stated that there are about 42,652 persons engaged in the manufacture of stockings, and as many more employed to wind, seam, and sew up the hose. He denied that as a class they were idle and negligent; he had known them from boyhood, having worked for his support at their frames, and he knew that they were no worse than hard work and small wages would make any class of the community. To explain the position of the stocking manufacturers, Mr. Felkin stated that the frames were rarely the property of the workmen, but belonged either to the hosiers or to a class of middlemen, who let them to the operatives. Foreign competition has had little effect upon this branch of industry, for the amount of the exportation of hosiery has never been important. There were only 147,507 dozens exported in 1843, and that was nearly double the amount of the preceding year. Mr. Felkin then referred to some diagrams exhibited in the Section to explain the nature of working the frames; the operation is one of considerable toil, but does not for ordinary goods require much skill and training; the employment is injurious to the sight. It is for the most part a domestic branch of industry, and has no connexion with the factory system. The total number of frames in the three midland counties is 39,442 employed and 4,598 unemployed. There are 1,572 frames in the rest of England, 265 in Ireland, and 2,605 in Scotland; and taking the whole of Great Britain there are 42,632 employed and 5,830 unemployed, (many of the latter, however, being under repair), making a total of 48,482 frames available for the machinery of the trade. The earnings of the frame-work knitters are subject to heavy deductions, for the rent of frames and other incidents, which frequently reduce the net earnings to a most miserable sum. The earnings, clear of shop deductions and expenses, range generally from 4*s.* 6*d.* to 7*s.* per week, and in some places, where cotton-hose is chiefly made, wages are even lower than the above minimum. Many cases of hardship from excessive frame-rent were recorded; and it deserves to be remarked, that frames are not perishable articles, many of those now in use having been manufactured in the reign of Queen Anne. The general condition of the frame-work knitters is described as very deplorable; they work generally from fourteen to fifteen hours per day, and their net earnings are generally inadequate to procure subsistence for themselves and their families. The ultimate results of the hosiery trade are to turn imported raw materials and those of home growth of the collective value of 705,900*l.* into the selling value of 2,562,713*l.* There are manufactured annually 84,000 dozen of silk stockings and socks, 2,164,000 of cotton, and 1,770,000 of worsted. Including gloves and other hosiery products, the annual production is 5,705,600 dozen, which would not give more than one pair of stockings and one pair of gloves for each inhabitant of Britain.

Dr. Thurnam read a paper on the statistics of Insanity, designed to refute Esquirol's theory that women were more predisposed to insanity than men in the proportion of 38 to 37. The discussion of this point turned chiefly on the corrections necessary to be made in statistical tables of insanity, by taking into account the rates of mortality, the proportions of male and female population, and the probability of recovery in the two sexes. Dr. Thurnam came to the conclusion that Esquirol's proportions ought to be reversed; but the question ultimately resolves itself into whether more confidence is due to the statistical returns of insanity in France or England.

In the discussion that ensued, Mr. Tuke entered at length into an examination of alleged disproportion of insane among the Society of Friends, tending to prove that the predisposition to mental alienation in that Society is less than in the general community.

In the absence of Col. Sykes, Mr. Heywood read his paper on the Lunatic Asylums of Bengal. They are chiefly remarkable for the rapidity with which they have improved since their first establishment, and the very trifling cost at which they are supported.

Mr. Bracebridge read a statistical account of the Union of Atherstone, principally designed to show the nature and amount of the information which could be procured through the agency of Boards of Guardians. The paper did not enter into such minute details as that describing Malton, and the author announced his determination to undertake further inquiries for the purpose of rendering it more perfect.

The Young of Sharks. From A Correspondent.

On the 27th of December 1840, when off the Coast of Luconia, the sea being perfectly calm, I and some of the officers on board were amusing ourselves with catching Sharks, and perceiving one with an apparently very enlarged abdomen, we were very anxious to secure it and, were at last successful. On opening its stomach, twenty young Sharks, perfectly well formed, and in high life, about 1½ foot in length, fell out; we kept some of them alive, several days, in salt water. I have one now preserved in spirits; the only peculiarity about it is, that between the side fins on the under part of the body is a cord about 1½ inch long, resembling an umbilical cord. I have never yet been able to meet with any good account of the natural history of the Shark, especially as relates to the production of its young; and I should be very glad to hear from you or any of your readers some remarks bearing on the fact above mentioned.

Note.—Cartilaginous fishes are all viviparous, the young being perfectly formed, and of very considerable size in proportion to the parent when produced. We have seen seven or eight young Sharks, each ten inches long, extracted from a parent about four feet in length; and we have seen a young Ray, which measured a quarter of its parent's size, and quite as well formed, taken from the uterus.—Eds.

THE

CALCUTTA JOURNAL

OF

NATURAL HISTORY.

Description of four new species of the Coleopterus Family of the Paussidæ, and notice of a fifth species forming the type of a new Genus. By W. H. Benson, Esq., *Bengal Civil Service.*

The following species are not contained in the interesting monograph of the Family of Paussidæ, lately brought to a conclusion by Mr. Westwood in his Arcana Entomologica, wherein he has done much to facilitate the study of these singular insects. The record of their characters in the Calcutta Journal of Natural History may not be devoid of usefulness, although it is not improbable that the specimens, or drawings of them, may eventually be forwarded to Mr. Westwood for illustration, should that naturalist determine on the continuation of the Arcana, or the publication of a supplement to the Paussidæ.

Section A. Prothorax quasi bipartitus.

a. Antennarum clavâ postice haud excavatâ.

1.—Paussus Baconis, nobis.

P. livido-succineus, antennarum articulo basali, clavæ angulis margineque, prothoracis lateribus posticis, femoribus, podice, elytrorumque plaga magnâ communi, piceis; abdomine elytrorumque marginibus, tibiis, tarsisque, castaneis. Antennarum clavâ obliquo-triangulari, basi emarginatâ in spinam longiorem externè productâ, posticê late impressâ, cavamine rugoso. Long 3/20 poll.

This species is so nearly allied to *Paussus rufitarsis* of Westwood, the habitat of which is unknown, that, beyond question, that insect is to be referred to the list of Indian species. I shall note the differences observable on a comparison of the two forms, as I proceed with the description. The antennæ in *P. Baconis* are lengthened, oblique, triangular, instead of being elongate-globose, and fall off more suddenly from the base to the apex, which forms an obtuse angle. On the inner basal side there is a much deeper emargination between the articulation of the joint and the spur, which is more produced than in *rufitarsis.* The anterior margin is acute, and the hinder face has a larger and deeper impression, sulcated longitudinally in the centre, and crossed by three raised ribs. Four obsolete ribs are apparent on the upper side of the disk near the superior margin ; the inner side is convex.

The clypeus is deeply emarginate in front, and a strong sulcus runs from it to the back of the head, widening considerably, and being more depressed behind the eyes, which are very minute, black, uniform when viewed laterally, and wide apart. The space between the eyes and central channel is much raised, and, somewhat in advance of the eyes, presents on each side a large and deep rounded depression, and immediately at the top of the elevation, between the eyes, is a small rounded depression on each side. In *rufitarsis* the central depression is isolated, instead of communicating with the emargination of the clypeus, by a deep sulcus.

The fore-part of the bipartite thorax which is livid-succineous, is obtusely angled at the lateral extremities, and depressed in the centre, the ridge is rounded, not angular, and it is about the same breadth as the head. The piceous sides of the posterior part are broader in front, equal in breadth to the fore-part, and furnished in front with a double prominence shewing a short sulcus between. In the centre, between the sides, are two succineous prominences, divided by a longitudinal sulcus. The elytra are polished, obsoletely erose-punctate, broader towards the apex, are margined all round with yellowish castaneous, and a piceous black patch occupies the disk, which is much darker than in *rufitarsis*. Instead of short tufts of hair, four on each side, and two at the apex, as in *rufitarsis*, the elytra are margined with long recurved spinous setæ, sometimes double, of which there are seven on each side, and a double row, with four in each row, at the apex of each elytron. The podex is piceous and protruded. The abdomen and under side are castaneous and glossy.

The tibiæ and tarsi are castaneous, the femora piceous, and much enlarged towards the extremities, especially in the intermediate pair, and are deeply and closely punctate.

The last joint of the labial palpi is very long and subulate; the antepenultimate joint of the maxillaries is even more inflated in the form, and disproportionate to the two terminal ones than in *rufitarsis*.

This interesting Beetle was taken in an excursion which we made to the Dhoon, or valley of Dehra, at the foot of the sub-Himalayan range, between the Ganges and Jumna, by Dr. J. F. Bacon, a zealous collector and field-naturalist, and the possessor of an extensive cabinet. I have named the species after him. It was captured on the 14th August, 1844, in a sweeping-net among grass and bushes, at the same time as a specimen of *Paussus pilicornis*.

b. Antenarum clavâ postice excavatâ.

2.—Paussus nauceras.

P. fusco-castaneus, prothoracis lateribus antice angulatis, parte postica elongatiuscula, tenuiori, picea. Elytris thoraceque setosis, illis elongatis, plaga magna communi picea præditis. Capite carinâ elevatiuscula, a clypeo emarginato egredienti usque ad nucham attingente; tuberculo ad verticem posito: clavâ antennarum naviformi marginibus denticulatis, denticulis inferioribus setigeris; carinâ centice versus apicem subangulata, versus basin profundè emarginatâ quasi scissâ. Tibiis mediocribus. Long 7/30 poll.

Hab.—In Indiâ orientali montibus sub-Himalayanis.

This species is closely allied to *Paussus denticulatus*, Westwood, Art. Ent. vol. 2. Pl. 92, fig. 1, and No. 1, of Capt. Boys' paper in No. 54, J. A. S. new series, in the latter of which the setæ of the denticulations of the antennæ are omitted in the engraving. It differs from it in the following particulars. The anterior angle of the keel, or fore-foot of the boat-shaped clava of the antennæ, is more prominent, and a deep emargination runs in under the counter, or basal part of the clava, just behind the insertion of the penultimate joint. The terminal denticulation and the four inferior ones, like the rowlocks of a boat, are alone setigerous, as in *P. denticulatus;* the other five are less prominent and rude. The setæ are whitish and not dark. The sculpture of both portions of the thorax is similar to that of *P. denticulatus*, but the proportions differ. In *P. denticulatus* the breadth of the inferior portion exceeds that of the upper part as well as its own length; in *P. nauceras* the angles of the upper portion project beyond the side of the hinder part, and the breadth of the latter is not greater than its own length. The chestnut edging round the black mark on the elytra is narrower in proportion in the new species, and the elytra are dull, not polished.

The clypeus in both species is emarginate. In Captain Boys' Nehor species there is merely an excavated tubercle on the vertex; in *P. nauceras* the tubercle of the vertex is papilioform, and is placed on a low keel running through it from the clypeus to the nape, and on either side a slight elevation proceeds obliquely from the tubercle to the base of the antennæ. The first joint of the antennæ is granulated. The legs are slender, and all the five tarsi are distinctly visible.

The description is taken from a specimen captured early in July 1845, at Green Mount, Mussoorie, by Capt. T. Hutton, while at rest on the under side of a leaf of night shade, and which was kindly made over by him to my collection. A specimen was taken by Dr. Bacon on the 5th July 1844, with a sweeping-net in grass on my grounds at Rockville, Landour, distant about three miles from Green Mount. On comparison it differs merely in the following particulars. The tubercle at the vertex shows something of an excavation in the centre, the basal part of the thorax is broader in proportion to the anterior part, the elytra are more lengthened, and it wants the loose incurved hairs on the podex which occur in my specimen, and which are probably a sexual distinction.

3.—Paussus ploiophorus, nobis.

P. fusco-castaneus, abdomine elytrorumque disco nigris politis, horum marginibus latè castaneis. Antennarum clavâ naviformi, fissurâ basali profundâ, angustâ, incisâ; cavaminis marginibus denticulatis, marginis inferioris denticulis setigeris; abdomine setarum brevium fasciculis duobus munito. Long 2/10 poll.

Hab.—Ad Moradabad, agris Rohillanis, ultra Gangem.

This species, which is of the size and habit of *P. denticulatus*, Westwood, is intermediate between it and *P. nauceras*. It resembles the latter in having a slit in the clava of the antennæ at the hinder base, more coarctate than in *P. nau-*

ceras, but the clava is shorter and more rounded towards the apex of the cavity than in *P. denticulatus,* the anterior edge or keel is deeper, and is obsoletely corrugated. The denticulations of the lower posterior edge of the excavation are setigerous as in the two allied species, and the setæ are black. The anterior apical angle is more rounded than in *P. nauceras,* and the base is less lengthened towards the penultimate joint; the termination of the base being square in *P. nauceras,* and oblique in *P. ploiophorus.*

The head has an emarginate clypeus, with a slight channel running up to a papilla placed in the centre rather in advance of the eyes. It is shagreened like the anterior part of the prothorax, which is slightly emarginate in the centre, nearly as broad as the posterior portion, and with the angulated ridge not running transversely across the broadest part as in *P. denticulatus,* but behind it; whence it results that the ridge is shorter. There is a deep and broad depression in the middle fore-part of the hinder portion of the thorax, of which the sides are elevated, broad and piceous, the posterior part has a short channel bounded on either side by an elevated ridge. The basal portion of the prothorax and the elytra are polished and devoïd of hair; in *P. nauceras* the elytra are dull and hairy.

The castaneous margin round the central common square patch on the elytra, is broad in *P. ploiophorus*; while it is very narrow in *P. nauceras,* and in the former it is beset all round with thickly set pale rufous hairs projecting backwards.

Abdomen elongate with a tuft of short straight black hair on each side, near the angle, quite unlike the long threads of loose curved hairs at the extremity of my specimen of *P. nauceras.*

The tibiæ are broader and shorter in proportion than in *P. denticulatus,* and the tarsal joints are more closely set, and more indistinct in the basal ones than in that species.

The specimen was taken in February 1845, by Dr. J. F. Bacon, at Moradabad in Rohilkhund, to the north of the river Ganges. It was drowned in a pool of water.

4.—Platyrhopalus intermedius, nobis.

P. rufo-castaneus, elytris angustioribus, singulo plagâ elongatâ triangulari irregulari ad latus externum prædito. Antennarum clavâ mediocri, subrotundato-quadrato, margine postico undulato, versus basin latè inciso, lingulâ acutâ armato. Capitis fronte rotundato, clypeo minimè emarginato. Tibiis latis oblique truncatis. Long 3/10 poll.

Hab.—Saharunpore.

This species unites characters of three different forms, viz. *P. angustus*, *P. nentidens*, and *P. Westwoodii*. With the first it agrees in habit, but differs from it and from the third, and agrees with the second in having no emargination of the clypeus. The form of the antennæ is more like *P. Westwoodii*, but on a smaller scale, and like that species, the hinder margin of the clava is sinuous, a character not to be found in the others. The hinder part of the prothorax has some shallow transverse furrows, not very conspicuous; the elytra have each a single lateral patch, which is not removed so much towards the base as in the typical specimen of *P. angustus*, but is rather in shape and situation like the lateral patch which shares the elytra in *P. Westwoodii* with a basal and a terminal spot.

This insect was captured on the 28th March 1845, at night. It flew to a light in a small bungalow on my grounds at Saharunpore, the capital of a district at the head of the Doab, and was subsequently obtained by me from the captor.

I might here add the description of a new form partaking of the characters of *Ceratoderus* and *Pentaplatarthrus*, two genera belonging to Westwood's 2nd Section of the *Paussidæ*, and distinguished by the curious tomentum-shaped clava of their antennæ, which consist apparently of six joints, of which the five terminal ones are soldered together so as to form a continuous joint. However, as two out of the three specimens which I had the good fortune to capture, are by this time in the hands of Mr. Westwood and the Rev. F. W. Hope, and as the former gentleman has probably described it, I shall refrain from giving a fully detailed account of the insect, which is likely to constitute the type of a new genus in the family, forming the Asiatic representative of the African genus *Pentaplatarthrus.*

The trophi approximate the form to *Pentaplatarthrus*, the last joint of the labial palpi being clavate and obliquely truncated, but the labial palpi do not exceed in length the maxillaries, as they do in *Pentaplatarthrus.* The two last joints of the maxillaries are very small, and are bent down like a hook, as in *Ceratoderus.*

The thorax is formed upon the model of the first division of the genus *Paussus*, being apparently bipartite, the basal portion being also the larger, and the anterior one wider and angulated at the sides, but provided with a small tubercle on each side below the angle, and not spined as in *Pentaplatarthrus.*

The club of the antennæ is narrower at its base than in *Ceratoderus*, and is deficient in the tooth or lingula observable at the base of the 2nd joint in that genus ; the edges also form an overlapping scale at the posterior junction of the joints of the clava. The head is like that of *Ceratoderus*, and the antennæ are not based on a ball, as they are in *Pentaplatarthrus.*

The Beetle is of a light rufous chestnut colour, with an irregular black triangular patch including a chestnut spot posteriorly, on either side of the elytra, and within a final one at the suture. The elytra are rough and wrinkled, deflexed

the sides, as in Ceratoderus, and fringed with short bris-
s; the head is shagreened, and has the two round depres-
ns between the eyes at the end of a short channel from
e clypeus, and not so far back as in Ceratoderus.

The femora and tarsi shew a connexion with Ceratoderus.
the tarsi the five joints are distinctly visible, and the basal
nt is nearly as long as the next three together.

If not already named by Mr. Westwood, I propose the
signation of *Leiomatocerus* for the genus, from Λειωμα
nentum, and κέρας corner.

I took two specimens under a brick on the 2nd January
44, at Bhitoara on the Ganges, the port of Futtehpore,
the lower Doab. They were in company with *Platyrho-
lus denticornis.* A third specimen, I had the good fortune
take on an ant's nest, under a stone, at Noushehra on the
nna canal, in the district of Seharanpore, at the head of
e Doab, on the 16th January 1845.

Already have fifty-one different species of this singular
l varied family been figured, the major part of which are
abitants of Asia, and nearly two-thirds of these of Bri-
Continental India, yet few examples are known of each
cies, and of some but a single specimen. The best fur-
ned European cabinets possess a very small number of
cies; any light therefore, which can be thrown on their
unts and habits, must be acceptable to Entomologists, and
apology will be required for the insertion of the following
ices of the capture of specimens by Dr. Bacon and myself.
pt. Boys has given notes of some eight or ten captures in
work above quoted, which might be added to these.

A vast number are doubtless annually destroyed during
warmer months in the vast extent of country which
Paussidæ inhabit, from the Himalaya to the sea, by
ing at night into the oil-lamps of the natives, which then
d the land; lights forming a great attraction to many
cies when the moon does not shine. Many others are

lost by falling into water, where they are liable to be devoured by the water-beetles which swarm there.

Out of thirty-three Paussidæ captured by my friends and myself, I have noted that, out of six Platyrhopali three were taken at lights by night. Of Paussi with a subcontinuous thorax eleven were taken, ten of which flew to lamps and candles. Of ten Paussi with a bipartite thorax only one was taken in this manner, and not one out of six specimens of Ceratoderus and its congeners. The preponderance of light-seeking individuals among the *Platyrhopali*, and their nearest relations among the true *Paussi*, would seem to indicate that they are more nocturnal in their habits than the others. Of eight taken on grass and weeds, five were Paussi with a bipartite thorax, two were Ceratoderi, and one a Platyrhopalus. Of three found drowned, two were Paussi of the same division, and one of the section with subcontinuous thorax. Of five found under bricks and stones, three were of the Leiomatoceratose type, and two were Platyrhopali.

Specimens taken by myself.

27th June, 1828.—Paussus, allied to *P. cognatus* or *P. Hearseyanus* from the description in my notes. Drowning in a rain-pool at Banda.

Ditto ditto, 1836.—Platyrhopalus denticornis, under a piece of brick-work on decayed hay where a stack had stood. Jounpore.

23rd January, 1844.—Platyrhopalus denticornis, under a brick beneath trees, among ruins, at Bhitoura near Futtehpore.

Ditto do. do.—Leiomatocerus ————. Same place, on the prone surface of a brick.

30th April, 1844.—Paussus thoracicus, drowned in a rain-pool at Futtehpore after a tremendous gale of wind and rain, which levelled some large trees to windward of the spot.

16*th January*, 1845.—Leiomatocerus ————. Found under a stone on an ant's nest, in an open spot at Noushehra below the Sewalik range, Saharunpore district.

27*th August*, 1845.—Paussus Hearseyanus. Came to light in a verandah. Dehra Dhoon.

28*th do. do.*—Platyrhopalus denticornis, a smaller and more highly coloured variety than the one taken at Bhitoura. It came to lights on the table. Dehra Dhoon.

31*st do. do.*—Paussus Hearseyanus. Came to lights on the table, at the same place.

3*rd September*, 1845.—Paussus Hardwickii. Came to lights, and settled on the wall of the room, at the same place. The previously recorded habitats of this species were Nipal and Almorah.

Taken by Dr. Bacon.

5*th July*, 1844.—Paussus nauceras. Taken in the middle of the day with a sweeping-net, on long grass, below Rockville, Landour, above 7000 feet.

14*th do. do.*—Paussus pilicornis, var. Taken with a sweeping-net in the day-time in a field near Rajpore, at the foot of the Mussoorie range, among grass and bushes.

14*th do. do.*—Paussus Baconis. Taken with the last.

Date not noted.—Platyrhopalus angustus, var. Taken at Moradabad with a sweeping-net.

Date not noted.—Ceratoderus bifasciatus, var. At the same place, on grass.

February, 1845.—Paussus ploiophorus. At the same place; drowned.

It appears from this list, that species have been taken in every month, except May, from January to September: in the earlier months under bricks, &c. or drowned in rain-pools; in the rainy months by sweeping herbage in the day-time, or at lights by night.

It may be noticed, that of the seven species sent to England by Capt. Boys, two were new, viz. No. 1, Paussus denticulatus, and No. 6, P. Boysii. The others described and figured in the same paper were, No. 2, Platyrhopalus angustus, var.; No. 3, Paussus Hearseyanus; Nos. 4 and 5, P. Fichtelii; No. 7, Ceratoderus bifasciatus, and No. 8, Paussus Hardwickii.

Rockville, Landour, Sept. 1845.

Postscript.

Since the above was written, I have received a communication from Mr. Westwood regarding my Leiomatocerus, on which a memoir has been read before the Entomological Society. Mr. Westwood was of opinion, that the insect (which he has named Bensonis) was, as I first conjectured, a Ceratoderus, but from the variations from the type observable in the new species, stated, that he "should either be obliged to give a new generic name, or else to call by the name of Ceratoderus, an insect which does not answer to that generic name."

Whether it may eventually be found convenient to separate my species from Ceratoderus, or to unite it with bifasciatus under a new generic title, the form Leiomatocerus, which refers to the structure of the antennæ, may equally be adopted.

15*th October*, 1845.

Contributions towards a Flora of Ceylon, being descriptions of several new species of Plants belonging to the Tribe CYRTANDREÆ. *By* GEORGE GARDNER, F.L.S., *Superintendent of the Royal Botanic Gardens, Ceylon.*

[Continued from page 352.]

In the 14th Vol. of the 'Linnæan Transactions,' Dr. Jack established *Cyrtandraceæ* as a distinct order, referring it to the neighbourhood of *Bignoniaceæ*. About the same time Mr. Don published an account of the same tribe of plants, under the name of *Didymocarpeæ*, in the 7th Vol. of the 'Edinburgh Philosophical Journal.' Lindley and De Candolle adopt Jack's name, following him in considering it related to *Bignoniaceæ;* while Blume, in his *Bijdragen*, considers it a section of the latter order. Mr. Brown was the first to point out the true affinities of *Cyrtandreæ* in his elaborate paper on the tribe in Horsfield's 'Plantæ Javanicæ Rariores;' and for the benefit of those who do not possess that work, I extract the following interesting observations:

"It is somewhat remarkable, that none of these writers should have reverted to the affinity of this new family to *Besleriaceæ* of Richard and De Jussien, now generally named *Gesneriaceæ*. This affinity, however, did not escape Dr. Von Martius, who in his elaborate account of *Gesneriaceæ*, published in 1829, considers *Cyrtandraceæ* as sufficiently distinct from that order in the absence of albumen, and in having an inverted embryo: the latter character he states on the authority of Mr. Don, who, in employing the term "embryo invertus," can only have intended to express its direction with respect to pericarpium; such at least is the real structure of those genera which he referred to his *Didymocarpeæ*, and it is certain that in the relation of embryo to hilum, both families entirely agree.

"Dr. Von Martius also notices the difference in the order of abortion of stamina between these two families, which is no doubt generally true, but admits in each, of at least one exception; *Sarmienta* in *Gesneriaceæ,* agreeing with *Cyrtandraceæ* in having only its two anterior or lower stamina antheriferous; and in this latter family *Aikinia* or *Epithema,* which, as in the greater part of diandrous *Gesneriaceæ,* has its two posterior or upper stamina perfect.

"There is, indeed, another, and that a very remarkable distinction, noticed in the position of the lobes of the stigma, which in *Gesneriaceæ,* according to Von Martius, are placed right and left in relation to the parts of the flower, and consequently opposite to the lateral parietal placentæ; while in *Cyrtandraceæ* the lips of the stigma,—for so it is necessary to express the fact in this family,—are anterior and posterior, and therefore alternate with the lateral placentæ; the latter being the ordinary relation in unilocular ovaria, where the placentæ and lobes, or rather lips, of stigma correspond in number. This difference, however, even were it fully established, would hardly be available here as a technical distinction, several genera in each family having an undivided stigma; unless in such cases the position of the confluent parts could be determined by that of the two vascular cords generally observable in the style, and continued into the axes of the lobes of a regularly bifid stigma, when belonging to an ovarium composed of two carpels. But even if this distinguishing character should be admitted to be general, it is certainly not without exception; and in the only cases that I have examined in *Gesneriaceæ,* where the lateral position of the lobes of the stigma may be supposed to exist, the apparent position arises from the extreme breadth and manifest division of the lips, the two vascular cords of the style being still anterior and posterior.

"The only point of difference remaining, therefore, is the existence of albumen in *Gesneriaceæ,* and its absence in *Cyrtandraceæ.* This character, however, is not absolutely constant, there being cases in *Cyrtandraceæ* where the remains of albumen are visible in the apparently ripe seed;

and in several *Gesneriaceæ* it exists so sparingly as to become a character of very little value, especially as it is not here connected with other more important differences.

"In describing the genus *Aikinia* (*Epithema* of Dr. Blume,) I regarded *Cyrtandraceæ*, or *Cyrtandreæ*, for the reasons now assigned, as a tribe merely of *Gesneriaceæ*, distinguishable from that portion of the order with hypogynous corolla, or *Beslerieæ*, by characters either of little importance, or which required confirmation. For although, in addition to the characters referred to, *Cyrtandreæ* differ very remarkably in geographical distribution from the rest of the family, yet this difference is not entirely without exception, as I have already noticed in my account of *Loxotis*. But whether these groups be considered as distinct families, or as tribes only, it will probably be admitted that in a natural classification *Cyrtandreæ* must stand next to *Beslerieæ;* while, on the other hand, they appear to be very nearly related to *Bignoniaceæ*, with which they are connected through *Incarvillea*, particularly with that section of it which in Dr. Royle's Illustrations I have described as a subgenus, and named *Amphicome*."

With regard to the geographical distribution of the natural order *Gesneriaceæ*, the tribes *Gesnerieæ* and *Beslerieæ* are entirely confined to the tropical parts of South America and the West Indian Islands; while *Cyrtandreæ* represent them principally in the tropical parts of Asia. As yet only two species of this tribe have been found in America, viz. *Klugia azurea*, Schlect., in Mexico, and *Napeanthus Brasitiensis*, Gardn., in the Organ Mountains of Brazil. One species, *Rhabdothamnus Scabrosus*, Steud., exists in New Zealand. *Fieldia* Australis, Cunn., is from New Holland; and *Ramondia pyrenaica*, a European species, is referred here by De Candolle. One species of *Streptopus* is from South Africa, and the other five from Madagascar; while several species of *Cyrtandra* are from the Sandwich Islands.

By far the greater part of described species, however, are from the more Eastern parts of India, such as Nepal, Ava, Malacca,* Sumatra, and Java. Few exist on the Western side of the Continent of India, Dr. Wight, I believe, having only met with three or four species. In Ceylon, the Flora of which partakes much of the character both of that of the Peninsula of India and of the Eastern Islands, there exist, so far as is yet known, fourteen species, of which I find not less than twelve to be hitherto undescribed. One of the described species—*Didymocarpus zeylanica*, R. Br., I have not yet met with; and *Klugia zeylanica*, DC. (*Glassanthus zeylanica*, R. Br.) is now described for the first time, Mr. Brown having only named it in the work above referred to. Only one species, *Klugia notaniana*, DC., is common to the Peninsula and Ceylon.

ÆSCHYNANTHUS CEYLANICA, *Gardn.*

Æ. foliis lanceolatis, basi acutis, apice obtuse acuminatis, nervis lateralibus paucis, obliquis; umbellis 2-3 floris, pedicellis calyce subæqualibus, glabris; calyce 5-partito glabro, lobis linearibus; corollæ extus glanduloso-pubescentis, calyce quadruplo majoris, lobis rotundatis, ciliatis, maculatis, staminibus exsertis, filamentis puberalis, seminibus utrinque pilo unico.

Hab.—On trees in forests on the mountains of the Central Province: not uncommon. Fl. in September and October.

Descr.—A scandent, radicant, branched *shrub*. *Branches* round, compressed a little at the nodes, glabrous. *Leaves* opposite, petiolate, lanceolate, acute at the base, obtusely acuminate, somewhat fleshy, glabrous, 2½-3 inches long, by about 8 lines broad: *Petioles*

* Judging from the collections sent by the late lamented Mr. Griffith to Dr. Wight, and which I lately had an opportunity of looking over in his Herbarium, an immense number of Malacca *Cyrtandreæ* still remain to be described. These I hope soon to see taken up by Dr. Wight.

about 3 lines long. *Umbels* terminal, sessile, 2-3 flowered. *Pedicels* slender, glabrous, about 4 lines long. *Calyx* free, deeply 5-parted, lobes linear, obtuse, about 3 lines long. *Corolla* hypogynous, gamopetalous, infundibuliform, curved, 12-15 lines long, covered externally with short glandular hairs, of a scarlet colour. *Limb* somewhat spreading, irregularly 5-cleft, lobes rounded ciliated with short gland-bearing hairs, the two upper ones smaller than the others, all of a greenish colour with irregular atrasanguineous stripes. *Stamens* 5, four only of which bear anthers. *Filaments* complanate, glandularly pubescent, the fertile ones exserted, the barren one included. *Anthers* oblong, 2-celled, cohering in pairs. *Ovary* free, surrounded at the base by a cyathiform crenulated disk, siliquose, attenuated at the base, 1-celled, with two slightly protruded parietal placentæ, each consisting of two subrevolute ovuliferous laminæ. *Ovules* numerous. *Style* filiform, exserted, about as long as the stamens, glabrous. *Stigma* entire, dilated, concave. *Capsule* siliquose, cylindrical, straight, about eight inches long, 1-celled, 2-valved, with a loculicidal dehiscence. *Seeds* numerous, attached to the broad lamellæ which form the placentæ on the middle of each valve, pendulous, oblong, with a single long white hair at each extremity. *Testa* brown, rugose.

Obs.—The species to which this one is most closely related, is *Æ. Perrattetii*, Alph. DC., from the Neilgherries, where I collected it in fruit, in February 1845, along with Dr. Wight. From a comparison of specimens, I find them to differ in the following particulars : The Ceylon species has the leaves broader and more acute at the base ; the umbels are rarely more than 2-flowered, while in the Neilgherry one they vary from 3-5; the corolla of the Neilgherry plant is glabrous, while the Ceylon one is glandularly pubescent; the capsule of the Neilgherry species is only three inches long, while in the other it is eight.

DIDYMOCARPUS LONGIPETIOLATA, *Gardn.*

D. tomentosa, caule prostrato radicante, foliis alternis, longipetiolatis, orbiculato-ovatis, basi cordatis obtusis crenatis, pedunculis axillaribus folio vix æquantibus 2-3-trichotomis paucifloris pilosis, calycis 5-partiti lobis linearibus obtusis deciduis.

Hab.—Adam's Peak, found by *Mrs. General Walker.*

Descr.—*Herbaceous. Stem* prostrate, rooting, tomentose. *Leaves* alternate, on long petioles, or bicularly ovate, cordate at the base, obtuse, crenate, obliquely pennivenous, veins about 7 on each side, tomentose on both sides, paler on the under surface, about 3 inches long, by as many broad. *Petioles* tomentose, 3-3½ inches long. *Peduncles* axillary, solitary, nearly as long as the leaves, pilose, two or three times trichotomously divided, the divisions bearing several small linear pilose bracts at their base. *Pedicels* pilose, about 3 lines long. *Calyx* free, persistent, deeply 5-parted, lobes linear-subulate, obtuse, pilose, about 2 lines long. *Corolla* hypogynous, gamo-petalous, whitish, about 9 lines long, infundibuliform, a little constricted at the throat, pilose externally. *Limb* 5-cleft, bilabiate, upper lip 2-lobed, lobes short, rounded, reflexed, lower lip 3-lobed, the lateral lobes broadly obovate, divaricate, the intermediate one rounded, and much smaller. *Stamens* 4, the anterior pair only fertile. *Filaments* glabrous. *Anthers* reniform, glabrous, cohering, 1-celled. *Ovary* free, seated in a very small dentate annular disk, siliquose, pubescent, 1-celled, with two protruded parietal placentæ, each bearing two subrevolute ovuliferous margins. *Style* 1, filiform, glabrous, persistent. *Stigma* obliquely orbicular from the abortion of the upper lip. *Capsule* siliquose, glabrous, terite, crowned with the persistent style, about 1½ inches long, 1-celled, 2-valved, with a loculicidal dehiscence, the valves bearing the placentæ along their middle. *Seeds* numerous, oblong, pendulous. *Testa* brown, reticulated.

Obser.—This plant I was at first inclined to consider the *Didymocarpus zeylanicus* of Mr. Brown in the "Plantæ Javanicæ Rariores," p. 119, but judging from the very short character which he has there given, his plant differs from this in two or three particulars. Thus, in it the leaves are said to be dentate and longer than the petiole, while in this they are crenate and shorter than the petiole; in his the calyx is said to be persistent with the lobes acute, while in this it is deciduous with the lobes obtuse. They must, nevertheless, be very nearly allied to each other.

DIDYMOCARPUS HUMBOLDTIANA, *Gardn.*

D. tomentosa, acaulis, foliis radicalibus petiolatis ovato-ellipticis, basi obtusis vel subcordatis, apice obtusissimis, crenatis supra piloso-tomentosis, subtus lanuginoso-tomentosis, scapis folio longioribus trichotomis, bracteis oblongis, obtusis, tomentosis, lobis calycinis villosis, linearibus, obtusis, persistentibus, caps. pollicaribus siliquosis apice attenuatis.

Hab.—On moist shady rocks above Rambodde; at an elevation of from 4000-5000 feet above the sea. Fl. nearly all the year.

Descr.—*Herbaceous,* stemless, tomentose. *Leaves* with long petioles, ovate elliptical, obtuse or slightly cordate at the base, with a very obtuse apex, crenate, pennivenous, veins about 5 on each side, pilose-tomentose above, densely lamiginosely tomentose beneath, particularly on the veins, exclusive of the petiole from 3-3½ inches long, by from 2-2½ broad. *Petioles* flattened, a little winged above from the decurrent base of the lamina, tomentose, from 2-3 inches long. *Scapes* numerous, pilose-tomentose, longer than the leaves, about three times trichotomously divided, the lower divisions subtended by two oblong obtuse tomentose bracts about 3 lines long, those of the upper ones smaller. *Pedicels* slender, pubescent, from 6-8 lines long. *Calyx* free, persistent, villous, deeply 5-parted, lobes linear, obtuse, of a dark brown colour, about 3 lines long. *Corolla* about an inch long, and nearly as much broad, of a white colour with a slight tinge of purple, hypogynous, gamo-petalous, tubular at the base, ventricosely campanulate above. *Limb* 5-cleft, bilabiate, upper lip 2-lobed, lobes ovate, obtuse, reflexed, lower lip 3-lobed, lobes broadly ovate, obtuse, about equal spreading. *Stamens* 4, the posterior pair abortive, the anterior pair fertile, the *filaments* of which are very much thicker than the others, and sigmoidly curved. *Anthers* subreniform, 1-celled, cohering, glabrous. *Ovary* free, seated in a small annular disk, elongated, somewhat conical, pubescent, 1-celled, with two parietal slightly protruded placentæ, each with two broad divaricate laminæ which bear the ovules. *Style* filiform, glabrous, persistent. *Stigma* bilamellate, lamellæ small, obtuse. *Capsule* siliquose, pubescent, terite, crowned with the persistent style, about an inch long, gradually tapering from below upwards, 1-celled, 2-valved, with a loculicidal dehiscence, the valves bearing the placentæ along their middle. *Seeds* numerous, oblong, pendulous. *Testa* brown, pitted.

Obser.—This very pretty little plant I dedicate to the Prince of Scientific travellers—Baron Humboldt.

DIDYMOCARPUS PRIMULÆFOLIA, *Gardn.*

D. piloso-tomentosa, acaulis, foliis radicalibus petiolatis, petiolis alatis, ovato-ellipticis vel suborbicularibus, basi acutis, apice obtusissimis, crenatis, utrinque piloso-tomentosis, scapis racemosis vel subdichotomis, paucifloris, folio longioribus; bracteis parvis, pedicellis glanduloso-pilosis, lobis calycinis pilosis, linearibus, obtusis, deciduis, caps. 9-linearibus siliquosis apice attenuatis.

Hab.—On shady rocks in forests on the Hantane range, near Kandy. Fl. during the rains.

Descr.—*Herbaceous,* stemless, pilose-tomentose. *Leaves* with long petioles, from ovate-elliptical to suborbicular, acute and decurrent at the base, forming a wing along the whole length of the petiole on each side, very obtuse at the apex, regularly crenate, rugose, alike villously tomentose on both sides, pennivenous, veins about 5 on each side, exclusive of the petiole from 2-3 inches long, by from $1\frac{1}{2}$-2 inches broad. *Petioles* winged, from $1\frac{1}{2}$-2 inches long. *Scapes* few, pilose, longer than the leaves, racemose or rarely subdichotomously divided. *Pedicels* slender, glandular-pilose, about 6 lines long, with small linear obtuse bracts at their base. *Calyx* free, pilose, deciduous, deeply 5-parted, lobes linear, obtuse, about $1\frac{1}{2}$ lines long. *Corolla* hypogynous gamo-petalous, about 6 lines long, pubescent externally white, with a slight tinge of purple, infundibuliform, ventricose above. *Limb* 5-cleft, bilabiate, upper lip 2-lobed, lobes orbicular, obtuse reflexed, lower lip 3-lobed, lobes about equal, larger than the upper ones, but of the same shape. *Stamens* 2, with very small rudiments of a posterior pair. *Filaments* short, pubescent, curved. *Anthers* subreniform, 1-celled, adhering face to face, glabrous. *Ovary* free, seated in a very shallow annular disk, siliquose, glandular-pubescent, 1-celled, with two parietal placentæ. *Style* filiform, glabrous, persistent. *Stigma* obliquely subcapitate, depressed. *Capsule* siliquose, slender, pubescent, terite, crowned by the persistent style, about 9 lines long, 1-celled, 2-valved, with a loculicidal dehiscence, the valves bearing the placentæ along their middle. *Seeds* numerous, elliptical, pendulous. *Testa* brown, pitted.

Obser.—This species, although nearly related to the former, is readily distinguished by its smaller size in all its parts, the leaves being destitute of woolly tomentum, the more simple inflorescence, and the much smaller size of the abortive filaments.

CHIRITA MOONII, *Gardn.*

C. caule suffruticoso, ramoso, ramis teretibus villoso-tomentosis, foliis quaternis, petiolatis, oblongo-lanceolatis, basi acutis, apice acutis vel subacuminatis, minute, glanduloso-dentatis, supra villoso-tomentosis infra adpressè sericèo-villo-tomentosis, pedicellis axillaribus solitariis, petiolo duplo-longioribus, lobis calycinis lineari-lanceolatis, longe acuminatis, carinatis, corollâ magnâ extus pubescente.

Martynia *lanceolata, Moon. Cat. Ceylon Plants, p.* 45.

Hab.—Four Korles, *Moon.* On rocks near the summit of the Hantane range, near Kandy. Fl. during the rains.

Descr.—*Suffruticose,* 2-3 feet high, branched. *Branches* round, villously tomentose. *Leaves* verticillate, quaternate, petiolate, oblong-lanceolate, acute at the base, acute or subacuminate at the apex, minutely glandular-dentate, pennivenous, veins about 10 on each side, and together with the midrib prominent below, villous-tomentose above, covered with adpressed serecious hairs beneath, from $4\frac{1}{2}$-6 inches long, by $1\frac{1}{2}$-2 broad. *Petioles* 8-10 lines long. *Pedicels* axillary, solitary, about twice the length of the petiole, villous-tomentose, thickened towards the apex, with two small bracts a little above the middle. *Calyx* free, deciduous, 5-parted nearly to the base, lobes linear-lanceolate, very much acuminated, carinate, pubescent externally, about an inch long. *Corolla* hypogynous, gamopetalous, tubular at the base, ventricosely campanulate above, about 3 inches long, pubescent externally. *Tube* with two plicatures on its posterior inner face which close round the style, of a pale purple colour, with a broad yellow stripe internally extending from the bottom of the tube to the base of the middle lobe of the lower lip. *Limb* 5-cleft, bilabiate, lobes of the upper lip 2, suborbicular, reflexed, lower lip 3-lobed, lateral lobes broadly obovate, the middle one much narrower, all of a rich purple colour. *Stamens* 5, the posterior very rudimentary, the two lateral larger, villous, with their apices incurved, barren, the two anterior fertile, reaching about half way up the tube of the corolla. *Filaments* glabrous, very much thickened, and geniculate a little above the middle. *Anthers* elliptical, 1-celled, cohering, very villous on their anterior margins. *Ovary* free, glabrous, seated in a five-lobed annular disk, siliquose, 1-celled, placentæ 2, parietal, formed by the introflexed margins of the carpels, prominent, with the lamellæ very much curved. *Style* filiform, persistent, pubescent upwards. *Stigma* bilabiate, the upper lip obtuse, abbreviated, the lower cuneate, truncate. *Capsule,* siliquose about 5 inches long, 1-celled, 2-valved, with a loculicidal dehiscence. *Seeds* numerous, oblong, acute at both ends, pendulous, small. *Testa* brown, reticulated.

CHIRITA WALKERI, *Gardn.*

C. caule suffruticoso, ramoso, ramis teretibus, villoso-tomentosis, foliis ternatim verticillatis, petiolatis, oblongo-lanceolatis, basi acutis, apice acuminatis, minutè glanduloso-dentatis, utrinque tomentosis, pedunculis axillaribus, solitariis, gracilis, folio brevioribus, 3-4-floris, lobis calycinis lineari-lanceolatis, acuminatis, tomentosis, corollâ extus puberulâ.

Hab.—Ceylon, *Mrs. General Walker.**

Descr.—*Suffruticose* erect, branched, every where covered with white tomentum. *Branches* round, leafy. *Leaves* verticilate, ternate, petiolate, oblong-lanceolate, acute at the base, acuminate, minutely glandular-dentate, pennivenous, veins about 12 on each side, 5-7 inches long, by from 20-27 lines broad. *Petioles* about 6 lines long. *Peduncles* axillary, solitary, slender, about 3 inches long, about 4 flowered, bearing 2 subulate bracts at the base of the pedicels. *Pedicels* umbellate, 6-10 lines long, bibracteate a little above the middle. *Calyx* free, deciduous, deeply 5-parted, lobes linear-lanceolate, acuminate, 8-10 lines long, valvate. *Corolla* hypogynous, gamo-petalous puberulous externally, about 1½ inches long, purple, tubular at the base, ventricosely campanulate above. *Limb* bilabiate, 5-lobed, lobes rounded, obtuse, entire. *Stamens* 5, the posterior one very rudimentary, the two lateral ones sterile, nearly as long as the fertile ones, villous, the two anterior ones fertile. *Filaments* about 5 lines long, thickened and geniculate about the middle, glabrous. *Anthers* subreniform, 1-celled, cohering, glabrous. *Ovary* free, glabrous, seated in an hypogynous cup-like annular yellow disk, siliquose, 1-celled, with two parietal placentæ formed by the introflexed margins of the carpels. *Style* filiform, glandularly puberulous, persistent. *Stigma* bilabiate, upper lip abbreviated, rounded, the lower cuneate, truncate. *Capsule* siliquose, straight, about 3 inches long, 1-celled, 2-valved, with a loculicidal dehiscence. *Seeds* numerous, pendulous, oblong, acute at both ends. *Testa* brown.

CHIRITA COMMUNIS, *Gardn.*

C. Caule suffruticoso ramoso, ramis teretibus adpressè pelosis, foliis oppositis, petiolatis ovatis, basi rotundatis vel subcordatis, apice acutis vel sub-acuminatis, integris supra adpressè pilosis, pedunculis axillaribus solitariis folio sub-æqua-

* About ten years ago, the late General Walker and his lady made very large botanical collections in Ceylon, the great mass of which were sent to England to Sir William Hooker, who previous to my leaving for Ceylon, kindly allowed me to select a set of them to take out with me.

libus, trichotomis, lobis calycinis oblongo lanceolatis, acuminatis, glaberrimis, corollâ glaberrimâ.

Hab.—Common in moist shady places in forests on the mountains of the Central Province. Fl. during the rains.

Descr.—*Suffruticose*, 1-1½ feet high, densely covered with white adpressed hairs, branched. *Branches* round. *Leaves* opposite, petiolate, ovate, rounded or subcordate, and often a little unequal at the base, acute or subacuminate, green above and adpressly pilose, pale and sparingly pilose beneath, pennivenous, veins about 10 on each side, exclusive of the petiole from 3½-4 inches long, and from 2-2½ broad. *Petioles* 8-15 lines long. *Peduncles* axillary, solitary, about as long as the leaves, pilose-pubescent below, glabrous upwards, two to three times trichotomously divided, each division with two lanceolate, acute bracts, about 3 lines long at its base. *Pedicels* about 6 lines long, glabrous. *Calyx* free, deciduous, somewhat inflated, 5-parted, divided nearly to the base, lobes oblong-lanceolate, acuminate, glabrous, obscurely 3-nerved, about 6 lines long and 2½ broad, of a brownish purple colour. *Corolla* hypogynous, gamo-petalous, glabrous, 1½ inches long, tubular at the base, ventre-cosely campanulate above, with two plicatures on its posterior inner face, which close nearly round the style, of a pale purple colour, with a broad yellow stripe internally, extending from the bottom of the tube to the base of the middle lobe of the lower lip. *Limb* 5-lobed, bilabiate, lobes rounded, obtuse, entire, the middle one of the lower lip smaller than the others, all of a purple colour. *Stamens* 5, the posterior one very rudimentary, the two lateral ones about half the length of the fertile, villous, the two anterior ones fertile. *Filaments* about 4 lines long, thickened and geniculate about the middle, upper half with a few long villi internally. *Anthers* elliptical, 1-celled, cohering, very villous on their anterior margins. *Ovary* free, glabrous, seated in an annular fleshy disk, siliquose, 1-celled, with two parietal placentæ formed by the introflexed margins of the carpels. *Style* filiform, persistent, pubescent towards the apex. *Stigma* suborbicularly peltate. *Capsule* siliquose, curved, 3-4 inches long, 1-celled, 2-valved, with a loculicidal dehiscence. *Seeds* numerous, oblong, pendulous, small. *Testa* brown, pitted.

ISANTHERA, Nees ab Esenb. in Trans. Linn. Soc. 17. p. 82; Endl. Gen. Plant. N. 3871; DC. Prod. 9. p. 279.

Char. Gen.—*Calyx* 5-partitus, lobis lineari-lanceolatis subæqualibus. *Corolla* hypogyna, rotato-subcampanulata: *tubo* brevissimo: *limbi* 5-fidi, lobis ovato-ellipticis, vix æqualibus, calyce sublongioribus. *Stamina* 4, cumquinto postici, sterili: *filamenta* corollæ tubo inserta, ejusdem lobis alterna, brevia, subulata, libera, demum recurvata: *Antheræ*, subglobosæ, uniloculares, liberæ, rimâ transversa dehiscentes. *Ovarium* annulo glanduloso basi cinctum, ovoideo-conicum, uniloculare. *Stylus* brevis. *Stigma* obtusum. *Capsula* ovato-oblonga calyce persistente vix longior, approximatione placentarum falso bilocularis. *Lamina* lamellis placentaribus quatuor inserta, parva, elliptica, compressa.——Suffrutices *Indicæ*: Caule *erecto, vix ramoso, rufo-tomentoso, medulla ampla farcto*, foliis *alternis, penniveniis, supra viridibus et lanugine sparsæ, subtus lanugioso-albicantibus*, floribus *axillaribus, fasciculato-glameratis vel cymosis*, calycibus *extus lanatis. Corollis glabris, albis.*

1. Isanthera *floribunda, Gardn.* Suffruticosa vix ramosa rufo-tomentosa, foliis alternis, petiolatis, ovali-oblongis, basi cuneatis, acuminatis, serratis, supra demum glabriusculis, pedunculis axillaribus, cymosis multifloris.

Hab.—Adam's Peak, *Moon. Mrs. General Walker.* Hantane range, near Kandy. Fl. in April, May and June.

Descr.—*Suffruticose,* 1-2 feet high. *Stem* rarely branched, with large pith, leafy. *Leaves* alternate, petiolate, 6-10 inches long, and 2-3 broad, oval-oblong, cuneate at the base, acuminate, serrate, pennivenous, veins about 12 on each side, prominent, green and a little woolly above, at length becoming nearly glabrous, white and tomentose beneath. *Petioles* 15 lines to 2 inches long, concave above, convex below, dilated at the base. *Cymes* axillary, much shorter than the leaves, solitary, many flowered, tomentose. *Calyx* free, persistent, covered with shining woolly tomentum, deeply 5-parted, lobes linear-lanceolate, about equal. *Corolla* hypogynous, gamopetalous, rotate-subcampanulate, white. *Tube* very short: *limb* deeply 5-parted, lobes obovate-elliptical, obtuse, a little longer than the calycine segments. *Stamens* 4, with the rudiment of a fifth, alternate with the divisions of the corolla, included: *filaments* short free, at length recurved: *anthers* subglobose, 1-celled, free, dehiscing by a transverse slit. *Hypogynous disk* annular. *Ovary* free, pubescent, ovoid-conical, 1-celled, but apparently 2-celled from the approximation of the prominent placentæ: *placentæ* 2, parietal, each with two divaricate laminæ which are ovuliferous only at their extremities. *Style* short, persistent. *Stigma* obtuse. *Capsule* ovate-oblong, scarcely longer than the persistent. *Calyx* 1-celled, 2-valved, with a loculicidal dehiscence, the valves bearing the placentæ along their middle. *Seeds* numerous, small, elliptical, pendulous, compressed. *Testa* brown, reticulated.

Obser.—The genus *Isanthera* was first established by Nees von Esenbeck in the 17th Vol. of the 'Linnæan Transactions,' and so far as I can learn—not having the volume beside me to consult—he considered it related to *Verbascum.* Endlicher in his 'Genera Plantarum,' places it doubtfully at the end of *Solanaceæ*, with the observation that it "perhaps belongs to *Cyrtandraceæ*," in which latter order it is placed doubtfully by De Candolle. The plant which I have here described I have no doubt belongs to the genus *Isanthera*, notwithstanding that it wants the polygamous character ascribed to it by Nees. Of the present plant I have examined numerous specimens from different parts of the Island, both in the recent and dried state, without having been able to detect a single flower that was not hermaphrodite. This fact leads me to suspect, that the specimens of the species on which Nees founded the genus, were not in a good state for examination. The corolla is very fugaceous in my plant, and is no doubt the same in his, and this may have led him to suspect that his plant bore female flowers destitute of corolla, as well as hermaphrodite ones. As the stamens are inserted on the corolla, what he has taken for rudiments of stamens in his female flowers must have been the hypogynous disk. The genus unquestionably belongs to *Cyrtandreæ*, and will range in the sub-tribe *Loxonieæ*, along with the following new genus. The generic character of *Isanthera* which I have drawn up, is taken entirely from the Ceylon species. In one or two instances I have met with the sterile stamen bearing a small anther, which will account for Nees' describing his plant as pentandrous; but that it is not always so is evident from the fact that De Candolle, on the authority of Bentham, makes it tetrandrous.

CHAMPIONIA. *Genus Novum.*

CHAR. GEN.—*Calyx* 5-partitus, lobis lineari-subulatis, æqualibus. *Corolla* hypogyna, rotata: *tubo* brevissimo: *limbo* profunde 4-partito, lobis oblongo-lanceolatis, æqualibus, calyce longioribus. *Stamina* 4, æqualia; filamenta erecta, complanata. *Antheræ* ovato-oblongæ, adnatæ, liberæ, 2-loculares, longitudinaliter dehiscentes. *Glandula* hypogyna nulla. *Ovarium* oblongo-conicum, 1-loculare, placentis 2, parietalibus. *Stylus* filiformis. *Stigma* capitatum. *Capsula* oblonga, calyce persistente longior, 1 locularis, valvis 2, medio placentiferis. *Semina* plurima, parva, nuda, ovata, compressa, pendula. *Testa* reticulata. ——— Suffrutex *Ceylanicus;* caulibus *simplicibus, superne villoso-tomentosis,* foliis *oppositis, vix disparibus, petiolatis, oblongis, basi cuneatis, penniveniis, reticulatis, integerrimis, supra pilosis, demum glabriusculis, infra pallidis, pubescente-tomentosis,* pedunculis *axillaribus, folio-brevioribus, trichotomis,* calycibus *pilosis lobis-triatis,* corollis *glabris, albis.*

1.—Championia *reticulata, Gardn.*

HAB.—Saffragam, *Moon.* Adam's Peak. *Mrs. General Walker.* Fl. May and August.

Descr.—*Suffruticose*, unbranched, from 6-12 inches high. *Stem* round, glabrous below, villous tomentose above. *Leaves* opposite, one a little smaller than the other, petiolate, oblong, cuneate at the base, obtuse or acute, entire pennivenous, veins about 10 on each side, intervenium highly reticulated, shining above, and pilose, at length becoming nearly glabrous, beneath whitish, and minutely pubescently tomentose, margin slightly ciliated, from 6-7 inches long, and from 15-22 lines broad. *Petioles* 8-12 lines long, tomentose. *Peduncles* axillary, solitary or in pairs, shorter than the leaves, pilose, two or three times trichotomously divided. *Pedicels* slender, 4-10 lines long, glabrous, or villous particularly under the flower. *Calyx* free, deeply 5-parted, lobes linear-subulate, striated, about $2\frac{1}{2}$ lines long, bearing externally a few long, pellucid, articulated hairs, persistent. *Corolla* hypogynous, gamo-petalous, rotate, regular. *Tube* very short. *Limb* deeply 4-parted, lobes oblong-lanceolate, obtuse, striated, longer than the lobes of the calyx. *Stamens* 4, equal, inserted on the tube of the corolla alternately with its lobes, included. *Anthers* ovate-oblong, obtuse, adnate, free, 2-celled, dehiscing longitudinally. *Connective* broad. Hypogynous *disk* none. *Ovary* free, oblong-conical, pubescent, 1-celled, with two slightly protruded parietal placentæ. *Ovules* numerous. *Style* filiform, deciduous. *Stigma* capitate. *Capsule* oblong, about 4 lines long, 1-celled, 2-valved, the valves bearing the placentæ on their middle. *Seeds* many, naked, ovate, compressed, pendulous. *Testa* brown, reticulated.

Obser.—This very remarkable plant I dedicate to my excellent friend, Capt. J. G. Champion of the 95th Regiment, who, during several years that he has been in Ceylon, has devoted much attention to the indigenous vegetation of the Island. There can be no doubt of its being a legitimate denizen of *Cyrtandreæ*, but it will not associate with the members of any hitherto described genus. Its technical characters bring it into De Candolle's 6th sub-tribe, *Loxonieæ;* and its nearest affinity is with *Isanthera*, from which it is distinguished by its opposite leaves, and the structure of its corolla. In habit it agrees with *Napeanthus*, as also with *Loxonia* itself, except in the less disparity of the leaves. One of its most remarkable features is the constant disagreement between the number of the divisions of the calyx and corolla, the former being five, the latter four, parted; and I have found this to be constant in a number of specimens from two different parts of the island. No flowers which I have ever examined, are so well adapted for the procuring of spiral vessels as those of this plant, the calycine segments being made up of one entire mass of them. They are also abundant in the corolla, but less so than in the calyx, and in the filaments they do not exist at all.

KLUGIA NOTONIANA, *Alp. DC.*

K. caulibus, racemes, pedicelisque lineâ laterali villosâ notatis; calyce 5-angulato, angulo superiore basi altè alato—cristato, cætris leviter et æqualiter alatis.

Glossanthus malabaricus, *Klein in Wall. Cat. n.* 6394; *Benth. Scroph. Ind. p.* 57.

Glossanthus notoniana, *R. Br. in Hors. Pl. Jav. Rar. p.* 121.

Klugia notoniana, *Alph. DC. Prodr.* 9. *p.* 276.

Hab.—In moist shady places above Rambodde? at an elevation of about 5000 feet, associated with *Impatiens subcordata*, Arn. Fl. July and September.

Descr.—*Annual*, erect, 1-1½ feet high. *Stems* round, fleshy, branched, villously pubescent on one side, particularly towards the top, branched. *Leaves* alternate, petiolate, exstipulate, membranaceous, entire or somewhat sinuate, minutely glandular-dentate, ovate oblong, cordate and very unequal at the base, acuminate at the apex, upper surface green, with small scattered adpressed hairs, the under pale, glabrous, or with a few hairs on the veins, pennivenous, veins close, and about 20 in the large side, 5-8 inches long, by from 2-2½ inches broad. *Petioles* 1-2 inches long, villous on the upper surface. *Racemes* opposite the leaves, simple elongated, floriferous at the apex, with a broad villous line on one side. *Flowers* secund, 20-25, blue. *Pedicels* villous on one side, about 2 lines long, each with a small subulate bract at its base. *Calyx* free, persistent, green, about 3 lines long. *Tube* 5-angled, the upper angle with a deep rounded wing-like crest on its lower half, the others very slightly and equally winged, glabrous except the angles which are pilose. *Limb* 5-cleft, lobes equal, erect, ovate, acute, with a glandular tip, margins ciliated. *Corolla* hypogynous, gamopetalous : *tube* cylindrical, white, about 5 lines long, with the throat closed, glabrous. *Limb* bilabiate, upper lip ovate, dentately truncate, reflexed, about 3 lines long, deep blue, lower lip large, broadly elliptical, obtuse, entire, about 15 lines long, by 11 lines broad, with two oblong concavities at the base, of a deep blue colour, but with a yellow blotch at the base. *Stamens* 4, didynamous : *filaments* filiform, reaching to the base of the upper lip of the corolla. *Anthers* all perfect, 2-celled, glabrous, cohering in a mass. Hypogynous *gland* entire, cup-shaped, about 1 line deep, and of a whitish colour. *Ovary* free, ovate, glabrous, 1-celled, with two parietal placentæ, each with 2 divaricate straight ovuliferous laminæ. *Style* filiform, glabrous, persistent. *Stigma* capitately cup-shaped. *Capsule* enclosed within the calyx, somewhat obovate, 1-celled, 2-valved, with a loculicidal dehiscence, the valves bearing the placentæ along their middle. *Seeds* numerous, oblong, pendulous : *testa* brown, reticulated.

Obser. I.—As no detailed description of this species has hitherto been published, I have thought it proper to give one here, in order that it may be contrasted with the other two Ceylon species, from both of which it may readily be distinguished by the broad villous line which runs along the upper part of the stem, the racemes, and the pedicels. My Ceylon specimens agree in every respect with those which I collected on the Neilgherries, along with Dr. Wight, in February 1845. The character which M. Alphonse De Candolle gives of the calyx is a most erroneous one, viz. " Calyce basi superne grossè et obtusè calcarato." What he has taken for a spur is the winged expansion of the lower part of the upper angle. He further states, that the corolla in his specimen is only 6 lines long. It must be observed, however, that unless very carefully dried the corolla in all the species shrinks very much.

Obser. II.—This species was first noticed in Wallich's catalogue, in the year 1828,* at n. 6394, under the name of *Glossanthus malabaricus*, Klein MSS., but no character of it was published till Mr. Bentham did so, in 1835, at p. 57, of his "Scrophularineæ Indicæ." Since then Mr. Brown has ascertained, that a Mexican plant which M. Schlechtendal published in the "Linnæa" for 1833, under the generic name of *Klugia*, is a congener of the present species; but in place of following the excellent law of adopting the name under which a genus has been first described, he adheres to that of Wallich's catalogue in his article on *Cyrtandreæ* in Horsfield's "Plantæ Javanicæ Rariores." M. Alphonse De Candolle in his father's posthumous article on the same tribe, in the 9th Vol. of the "Prodromus," has, on the contrary, adopted Schlechtendal's name; and I here follow him, as I believe that the law of priority of description ought to be rigidly adhered to. Had earlier attention been paid to this golden rule, much of the confusion which has crept into the synonymy of natural science, through the adoption of mere manuscript and catalogue names, would have been avoided.

Obser. III.—Mr. Brown doubts whether his genus *Loxotis* (*Rhynchoglossum*, Blume) ought to be generically distinguished from this. Besides the difference which he has pointed out in the nature of the stamens, *Loxotis* differs from the Indian species of *Klugia*, at least, in having the racemes springing from the axills of the leaves. They are perhaps, however, too nearly related to be kept asunder.

KLUGIA GLABRA, *Gardn.*

K. glaberrima, calyce 5-angulato, angulo superiore basi altè alato-cristato, cætris exalatis.

* This is the date of the preface to the catalogue.

Hab.—In moist shady places near Rambodde, associated with *Klugia Ceylanica*, Alph. DC. Fl. in September.

Descr.—*Annual* erect, glabrous. *Leaves* alternate, petiolate, ovate-oblong, sub-dimidiate, unequal at the base, acuminate, entire, green above, pale beneath, pennivenous, veins about 20 on the large side, 5-7 inches long, and from 2½-3 broad. *Racemes* opposite the leaves, glabrous, floriferous at the apex. *Flowers* secund, about 20, blue. *Pedicels* about 2 lines long, each with a single subulate bract at its base. *Calyx* free, persistent, glabrous, loosely tubular, 5-angled, the upper angle with a deep wing-like crest on its lower half, the others wingless. *Limb* about equally 5-cleft, the lobes erect, acute, with a glandular tip. *Corolla* hypogynous, gamopetalous. *Tube* cylindrical, white, about 4 lines long, with the throat closed. *Limb* bilabiate, the upper lip truncate, reflexed about 1½ lines long, lower lip broadly elliptical, 10-12 lines long, by about 9 broad, with two elliptical concavities at the base, of a deep blue colour, but with a blotch of yellow immediately above the concavities. *Stamens* 4, didynamous: *filaments* filiform, reaching to the base of the upper lip of the corolla. *Anthers* all perfect, 2-celled, glabrous, cohering in a mass. Hypogynous *gland* entire, of a cup-shape, scarcely a line deep. *Ovary* free, ovate, glabrous, 1-celled, with 2 parietal placentæ, each of two divaricate, ovuliferous laminæ. *Style* filiform, glabrous, persistent. *Stigma* dimidiately orbicular. *Capsule* included within the calyx, ovate, 1-celled, 2-valved, with a loculicidal dehiscence, the valves bearing the placentæ along their middle. *Seeds* numerous, oblong, pendulous: *testa* brown, reticulated.

Obser.—This species, which is nearly related to the last, is easily distinguished by being glabrous, in having more membranous leaves, by only the upper angle of the calyx being winged, by the acute, not acuminate, calycine segments, and by the smaller flowers. One of the capsules which I examined was 3-valved, all of which were placentiferous.

KLUGIA CEYLANICA, *Alph. DC.*

K. stellato-piloso-pubescens, calyce 5-angulato, angulis æqualiter alatis.

Glossanthus zeylanica, *R. Br. in Hors. Pl. Jav. Rar. p.* 121.

Klugia zeylanica, *Alph. DC. Prodr.* 9. *p.* 276.

Hab.—Common in moist shady places about Kandy. Fl. during the rains.

Descr.—*Annual*, erect, 1-1½ feet high, pilose-pubescent, pubescence forked or stellate. *Stem* round, fleshy, branched. *Leaves* alternate, petiolate, ovate-oblong, cordate and very unequal at the base, acute or shortly acuminated, entire, dark green above, pale beneath, pennivenous, veins about 12 on the large side, 4-5 inches long, and about 2½ broad: *Petioles* 12-15 lines long. *Racemes* opposite the leaves, floriferous at the apex. *Flowers* secund, from 20-25, deep blue. *Pedicels* about 3 lines long, each with a subulate bract about half its length at its base. *Calyx* free, persistent, tubular, 5 angled, angles all equally winged, glabrous except the margins of the wings which are pilose: *Limb* deeply 5-cleft, the lobes lanceolate, acuminate, with a glandular tip, glabrous. *Corolla* hypogynous, gamo-petalous: *Tube* cylindrical, about 6 lines long, with the throat closed, white: *Limb* bilabiate, upper lip broadly ovate, truncate, about 1½ lines long, reflexed, white, lower lip large, entire, orbicular, about 4 lines long, deep blue, with a yellow ring round a broad concavity which exists at the base. *Stamens* 4, with the rudiment of a fifth, didynamous: *filaments* filiform, glabrous, reaching to the base of the upper lip of the corolla: *anthers* 2-celled, glabrous, cohering in a mass. Hypogynous *gland* cyathiform, crenate, yellow. *Ovary* free, ovate, glabrous, 1-celled, with 2 parietal placentæ, the divergent laminæ of which bear the ovules. *Style* filiform, glabrous, persistent. *Stigma* orbicular, concave. *Capsule* enclosed within the calyx, 1-celled, 2-valved, with a loculicidal dehiscence, the valves bearing the placentæ along their middle. *Seeds* numerous, elliptical, pendulous; *testa* brown, reticulated.

Obser. I.—This is one of the most easily characterised of the Indian species of the genus, the rounded incurved base of the large side of the leaf, the forked or stellate pubescence, the equally winged angles of the calyx, and the long narrow much acuminated calycine lobes, readily distinguishing it from the others.

Obser. II.—At page 121 of the "Plantæ Javanicæ Rariores," Brown has named, but not described, a species of this genus which he calls *Glossanthus Zeylanicus ;* but it is quite impossible for me to determine whether it was this or the former species he had in view. The reason why I have adopted his name to this one is, that it is by far the most common species, is very abundant about Kandy, and hence was the most likely one for him to be in possession of.

EPITHEMA CEYLANICA, *Gardn.*

E. tota piloso-hispida, foliis infer. oppositis vel abortu solitariis, petiolatis, latè ovatis, cordatis, duplicato-serrato-dentatis, super. oppositis, sessilibus, pedunculis terminalibus 1-3 elongatis, apice spicatis, spicis densis, secundis, circinalis basi bracteatis, bracteis cordatis, cuculatis, obtusis, dentatis.

Hab.—In clefts of moist rocks in forests in the central Province. Fl. during the rains.

Descr.—*Annual,* erect, hispidately pilose, about 1 foot high. *Stem* round, fleshy, sparingly branched. *Leaves* opposite, one of those of the lower pair often abortive, the lower ones petiolate, the upper ones sessile, ovate, cordate acutish or obtuse, doubly dentate-serrate, pennivenous, veins about 10 on each side ; lower ones exclusive of the petiole 5-6 inches long, and from $3\frac{1}{2}$-5 broad : *Petioles* about 3 inches long ; the upper ones about 2 inches long, and about 20 lines broad. *Peduncles* terminal, 1-3, from 3-5 inches long, spicate at the apex, spike dense, secund, circinate, with a large sessile, cordate, orbicular, concave, denticulate bract at its base, into which the upper end is curved. *Calyx* free, persistent, tubular, about 2 lines long, deeply 5 cleft, lobes lanceolate, acute valvate. *Corolla* hypogynous, gamo-petalous, infundibuliform, about 4 lines long : *tube* white : *limb* 5-cleft, bilabiate, upper lip smaller than the lower one, 2-lobed, lobes ovate, obtuse, lower lip 3-lobed, lobes suborbicular, obtuse, blue. *Stamens* 4, the two posterior fertile, the two anterior sterile :

filaments filiform, the sterile and fertile united in pairs at the base by a thin membrane : *Anthers* subreniform, 1-celled, cohering, glabrous. Hypogynous *disk* formed of five distinct, emarginate, yellow glands. *Ovary* free, ovate, oblong, obtuse, pubescent, 1-celled, with two parietal placentæ reaching half way up the walls, but free and ovuliferous at their apices. *Style* filiform, glabrous, persistent. *Stigma* capitate. *Capsule* ovate, 1-celled, with an irregular circumcissal dehiscence. *Seeds* numerous, oblong, attached to the free apices of the placentæ by the long slender umbilical cords ; *testa* brown, beautifully spirally striated.

Obser. I.—Although the lower leaf of this species is generally solitary, I have met with several specimens in which it was opposed by another smaller one. In one flower which came under my examination, one of the barren filaments was changed into a petaloid organ of the same colour as the limb of the corolla. The walls of the capsule are very thin and membranous, and the dehiscence takes place a little above the middle. The placentæ are truly pedicellate, but the pedicels adhere to the parieties to about their middle, the upper part only being free and seminiferous, the seeds being attached to it by long slender umbilical cords, some of which are erect, others pendulous. The seeds are beautiful objects under the microscope, resembling very much the *nucules* of the genus *Chara*, being elegantly spirally striated. This species is distinguished from *F. Brunonis*, Decaisn., which it resembles in habit, by its larger size, sessile upper leaves, and much smaller flowers.

Obser. II.—Altogether *Epithema* is a very anomalous genus of the tribe to which it belongs, having several remarkable peculiarities of structure ; such as the circumsissal dehiscence of the capsule, and the posterior, not the anterior stamens being the fertile ones. This latter circumstance forms a link by which to connect *Cyrtandreæ* to *Gesneriaceæ*.

Notes on Indian Botany. By R. Wight, M.D., F.L.S., *Imp. Acad. Nat. Curios. Bonn.*

(Continued from page 363.)

On the Genus Lasianthus, *Jack.*

The genus *Lasianthus* was defined and published by Mr. Jack in 1825, adopted by Blume in 1826, and by Sprengel in his genera in 1830. In the same year, De Candolle published the genus in the 4th volume of his Prodromus, under the name of *Mephitidia,* assigning as his reason for suppressing Jack's name "*non* Lin. *nec* DC.," from which it would appear that both Linnæus and he had each published a genus under that name, and that at least one of them was then extant in Botany. Being curious, while writing on the subject, to know something of the genus in whose favour Jack's very appropriate name had been set aside, I turned up the name in Steudel's Nomenclator Botanicus, and was surprised to find no such name emanating from DC., and that *Lasianthus,* Lin. had been, by himself, appropriated to a species of *Gordonia,* an older generic name for his plant. From Steudel I went to other lists of genera given by Sprengel, Bartling, and Lindley, but could find no "*Lasianthus,* DC.," neither could I find it in any of the volumes of the Prodromus, and as a last, and rarely failing, resource, I had recourse to Endlicher's genera, and there found the missing name, not however as a generic one, but as a subgenus or section of *Gordonia.* And in that capacity it seemed so little thought of by the author, (DC.) that he had not deemed it worthy of a place in his Index to the volume, thereby affording no clue to its existence as a Botanical name: and, until resuscitated for the purpose of superseding Jack's, was almost unknown in Botany. Under Compositæ the name again occurs, and is again set aside with the remark "*non* DC. *nec* Jack."

Having thus traced the history of the name as a Botanical generic designation, the question, a grave one too, then arose: Is DC., or any other Naturalist, authorized by the rules of Nomenclature to set aside a well defined and already admitted generic name, on account of its already existing as a sectional or sub-generic name, but not, as such, admitted into the list of genera forming the Index appended to the volume in which it occurs?

This question was, of course, almost without hesitation, answered in the negative. Further reflection, however, based on the fact that De Candolle's decision had already passed unquestioned by all subsequent writers with whose works I am acquainted, including G. Don, Lindley, Endlicher, and Meisner, made me pause before finally acting on my own opinion, and restoring Jack's name to the science. A reference however to the history of *Wallichia,* as given by Mr. Griffith in a recent number, coupled with the generally admitted propensity of mankind to follow a leader until our own powers of reflection are called into play, by having a question submitted in a tangible shape for our decision, in the end determined me to do that, after the fullest consideration, which my judgment from the first told me was right. I therefore restore Jack's name, in the firm conviction that others, on similar consideration, will admit the propriety of my doing so, and acknowledge its justice by doing as I have done. This I expect on the simple and obvious principle, that a sub-generic name can never be admitted to rank higher than a second specific one, and may be employed in the sub-division of 20 or more genera of the same order without causing the slightest confusion or ambiguity. *Gordonia (Lasianthus,) Wallichii,* DC. would never be confounded with *Cleyera (Lasianthus) Japonica,* or *Terinstromia (Lasianthus,) brevipes,* were such sub-divisions necessary towards the elucidation of the species of these genera, and still less is *Gordonia (Lasianthus,) Wallichii,* likely to be confounded with *Lasianthus cyanocarpus,* Jack. In a word, I consider the reason given for the suppression of Jack's name quite inadmissible, and therefore restore it to the science.

Few are the honors Science has to confer on her votaries; the principal, indeed the only one being the perpetuation in her annals of their names in connexion with the subjects of their investigations, and *that*, when well merited should not be lightly set aside. In the present instance, I conceive it has been set aside on most insufficient grounds, and therefore with the greatest respect and deference for the truly great and illustrious man who first, I believe, in an unguarded moment committed the error, (and whose memory I revere as being one of the most eminent benefactors of the science of Botany) as well as for the other celebrated Botanists who, by unthinkingly following his footsteps, have confirmed, in place of correcting his oversight—I take the liberty of thus pointedly directing attention to the erroneous division, in the hope of preventing its becoming a precedent that might lead to the perpetration of unintentional injustice to deserving individuals, similar to that which has been unreflectingly inflicted on the meritorious Mr. Jack.

The generic character given by Jack is too brief for this variable genus, but it was taken from two species only. Blume's, derived from the study of 16 species, is more comprehensive, and indeed leaves but little room for improvement, except that he has not noticed the ovary or its contents, nor the structure of the seed and direction of the embryo, which are imperfections of some moment. His character has, under the name of *Mephitidia*, been adopted by De Candolle, with a few unimportant verbal alterations.

In 1834, Mr. Arnot gave under *Lantia* a fuller, and upon the whole, more perfect character than either of the preceding, and except that it was necessarily limited to a single species, (*Lantia venulosa, Lasianthus venulosus,*) the only one then known to us, would in all essential points have left nothing further to be desired.

From the date of De Candolle's Prodromus, no one seems to have made any direct additions to the genus. Under the ordinal character of our Prodromus two species are indicated, which I have here taken up, and our *Lantia venulosa,* is a genuine member of the genus. But beyond these I have not met with a single notice of any species referable to the genus. This I look upon as the more remarkable, considering how numerous the species are, and the wide geographical range they occupy. Java, Sumatra, Malacca, Tenasserim, Chittagong, Silhet, the Indian Peninsula and Ceylon, all furnish species to my present list, and I feel pretty certain that my Herbarium still contains several undescribed species, which are concealed among an extensive unarranged collection from Assam and Mergui.

Among the species here described, I have only been able to identify two of Blume's, and even of these I still entertain doubts, though both are from the Eastward. Whether I am indebted for so many new species to their being all really undescribed, or to the brevity and consequent insufficiency of his characters, remains to be ascertained by comparison of specimens. Acting under this uncertainty, I have endeavoured to avoid Blume's error by giving greater compass to the definitions, at once to ensure precision in my characters, and to lighten the labours of those who come after me, by rendering as easy as possible the identification of my species, when the plant under examination is one of them. This however it must be acknowledged is not always an easy affair, so great is the tendency in this genus to variation, especially in the number of parts of the flower, the organ from which in other genera the most stable characters are derived, which, unavoidably, leads to the construction of loose definitions. The corolla moreover in several of my specimens is wanting, and as it generally furnishes good distinctive marks, mine are in these cases necessarily imperfect to that extent.

In drawing up the following generic character, I have departed from the usual plan—that of introducing a number of unessential particulars into the essential character, and winding up with a very brief and imperfect natural one —and reduced my essential character within the briefest possible limits by excluding every non-essential particular: and have brought into the concluding natural one, every particular which can in any way contribute to the correct understanding of this curious genus. In this way, as a whole, it has been extended to an unusual length, but the necessity for detailed descriptions has thereby been diminished. I was further induced to adopt this plan, on the supposition that it is as yet a genus imperfectly known to Botanists, otherwise I should have supposed that, at least, some species would have been added to it in the course of the last fifteen years, the time that has elapsed since the publication of the 4th volume of De Candolle's Prodromus.

Lasianthus.

Jack Linn. Trans. 14. *Blume Bijdr. p.* 995, *Spreng. Genera, p.* 94. *Ruh. Mem. Soc. H. N. Par. p.* 210, *non Lin. nec Zuccar.* Mephitidia *Reinward. in Blume. D.C. Prod.* 4, 452, *G. Don Gen. Syst. Gard.* 3, 548. *Meisner Gen.* 166, *Endlicher Gen. p.* 540.

Calyx, limb 4-7 cleft. *Corolla* 4-7 cleft: *throat* and *limb* usually hairy. *Stamens* 4-7 inserted near the throat: *filaments* short: *anthers* oblong, scarcely exserted. *Ovary* crowned with a fleshy disk, 2-7-celled, with a single erect ovule in each: *style* about the length of the corolla: *stigma* usually capitate, 2-7-lobed. *Drupe* globose, containing 2-7 nuts. *Nuts* usually rugose, or furrowed on the back. *Seed* erect: *albumen* fleshy, enclosing a cylindrical erect embryo.

Shrubs or small trees. Young branches, petiols and costa of the under surface of the leaves usually clothed with long matted, or rigid appressed hairs. *Stipules* caducous, bearing a ring of hairs or filiform bristle-like scales. *Leaves* short, petioled, usually elliptic, oblong, more or less acuminated at the apex, and tapering at the base; often hirsute on both sides, but generally on the costa and veins. *Veins* prominent, pinnate, running in curved lines towards the margin, the last pair forming, with the costa, a 3-nerved termination of the leaf; veinlets conspicuous, passing in nearly straight lines between the costa and veins, giving a peculiar and unique character to the venation. *Bracteas* often large and numerous, copiously clothed with long matted hair, forming a thick involucrum round the axillary sessile fascicles of flowers. Flowers always small in all the genuine species I have seen. *Calyx* limb sometimes much produced, and parted to the base into subulate or lanceolate teeth; sometimes short and obtusely lobed, rarely truncated, and furnished with short almost inconspicuous teeth. *Corolla* small, tubular, lobes of the limb spreading, and, with the throat, generally hairy. *Drupe* usually succulent, generally blue when ripe.

The hairs on all parts of the plant especially where long and shaggy are jointed, in some species almost approaching to moniliform. The leaves are said by Blume to exhale a disagreeable odour. I have only observed this in one species, *L. fœtens,* which however seems scarcely to belong to the genus, but which I have added at the end on the strength of that character, and its having blue fruit.

Analytical distribution of the Species.

§ I. Leaves penninerved: veinlets connecting the primary veins, passing transversely in nearly straight lines between them. True Lasianthi.

1. Calyx limb more or less deeply parted; lacineæ elongated, subulate or lanceolate, as long as the tube of the corolla.

   A. Flowers cymosely aggregated, subsessile, furnished with an involucrum of bracteas equalling or exceeding the flowers. Bracteose.

a. Exterior bracteas large, foliacious: interior, when present narrow, lanceolate or subulate: the former much longer than the flowers.

1. L. bracteatus.
2. L. Jackianus.
3. L. Roxburghii.
4. L. Wallichii.
5. L. Moonianus.
6. L. attenuatus.

b. Bracteas, all of nearly equal length, subulate or lanceolate, about the length of the flowers.

7. L. Griffithii.
8. L. retosus.
9. L. pilosus.
10. L. ellipticus.

B. Flowers axillary, subsessile, or loosely cymose; bracteas minute or inconspicuous. NUDIFLORÆ.

a. Flowers axillary, sessile.

11. L. Blumeanus.

b. Flowers cymose: cyms compact, few flowered, or loosely dichotomous.

12. L. venulosus.
13. L. dichotomus.

2. Calyx limb cleft, divisions ovate, lanceolate, subfoliacious, usually short.

A. Flowers sessile, aggregated.

14. L. ciliatus.
15. L. rostratus.
16. L. pterospermus.

B. Flowers pedicelled, subcapitate, few.

17. L. capitulatus.

3. Calyx limb shortly cleft, divisions short, obtuse, or triangularly dentate.

A. Leaves coriacious, venation (in dry specimens) prominent on both sides, veinlets slender, or to the naked eye sometimes almost inconspicuous, except *L. venosus.*

18. L. acuminatus.
19. L. parvifolius.
20. L. strigosus.
21. L. Walkerianus.
22. L. venosus.

B. Leaves membranaceous, veins slightly prominent, veinlets remote, very slender.

23. L. longifolius.
24. L. constrictus.
25. L. pauciflorus.
26. L. ? dubius.

§ II. Leaves even, smooth, (lævis) veins slender, veinlets reticulated, not passing in straight lines between the primaries, ovaries 2-celled with 1 erect ovule in each, corolla funnel-shaped, spurious. Lasithi.

27. L. ? fœtens.

Note.—Some of these subdivisions may not be found very obvious or even clearly useful in the examination of solitary specimens, but I found them very useful when a number of species were to be determined.

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1. Lasianthus bractiatus, (R. W.) every where except the upper surface of the leaves, hairy: leaves linear, lanceolate, acuminated, glabrous above, except the costa, which with the whole under surface is clothed with brownish

yellow hairs : bracts numerous, exterior pair foliaceous, ovate cordate acuminate, those within smaller ; the innermost linear subulate ; all very hairy : flowers axillary, sessile, free : calyx about 5-parted, lacineæ slender subulate : corolla—: ovary 5-celled.

HAB.—Malacca, Griffith.

OBS.—Leaves about 8 inches long, under two inches broad, ending in a slender tapering acumen. The most characteristic feature of this species is the bracteæ, which are large and numerous, completely concealing the few flowers, 3 or 4 of which nestle in the centre.

2. LASIANTHUS JACKIANUS, (R. W.) shrubby : every where clothed with long yellowish hairs, springing from enlarged (glandular ?) bases: branches terete; internodes short: stipules triangular, short, broad at the base, glabrous within : leaves subsessile ovate lanceolate, shortly and abruptly acuminate : flowers axillary subsessile, aggregated, few, (3 or 4) supported by two foliaceous lanceolate bracteas : calyx deeply 4-cleft, divisions ovate lanceolate, hairy on both sides ; corolla about the length of the calyx, glabrous within, lobes ciliate : ovary 3-4-celled : drupes small.

HAB.—Neilgheries, flowering February and March.

OBS.—Leaves from 4 to 5 inches long by about 1½ broad : hairs long yellowish coarse jointed. The bracteas vary from ½ to 1½ inch in length, exactly lanceolate, and by their size and form at once distinguish this from all the described species. Being quite sessile and axillary, they at first sight convey the idea of 3-foliate leaves with small pinnæ. It approaches *L. cyanocarpus*, Jack, but is distinguished by the form of the bracts, lanceolate in this, cordate in the latter species.

3. LASIANTHUS ROXBURGHII, (*Mephitidia*, W. & A. Prod. page 390, under the order) " shrubby hersute : leaves short

petioled, lanceolar, entire, acuminate : flowers axillary, sessile, much shorter than their numerous lanceolar bracteas: berries 5 seeded." *Triostium hersutum.* Roxb. D.C.

Hab.—Chittagong, flowering during the hot season.

Obs.—My specimen of this plant is very old, and somewhat deteriorated, so that I can scarcely add to Roxburgh's brief character.

It is every where hairy, that on the upper surface short and very rough, springing from elevated glandular ? points; below it is much longer and somewhat matted, especially on the costa and veins : the leaves are nearly sessile, about 7 inches long, by about 2 or 2½ broad acuminated: stipules lanceolate obtuse: bracteæ numerous; exterior one foliacious lanceolate, interior bract subulate or approaching to filiform, covered with long coarse hair, in which the flowers seem to be concealed. The flowers I have not attempted to examine, believing it useless.

4. Lasianthus Wallichii. (*Mephitidia Wallichii,* W. & A. Prod. p. 390, under the order) shrubby leaves subsessile, oblong, acuminate, unequal at the base, coriaceous, hairy when young, afterwards nearly glabrous: stipules linear lanceolate, hispid: bracteas numerous, linear lanceolate, 3-nerved, hispid, ciliate, about the length of the corolla : flowers numerous axillary sessile: calyx 5-cleft, lacineæ lanceolate acuminate persistent: corolla funnel-shaped, hispid; tube about an inch long; limb 5-cleft, divisions linear, bluntish, hairy, shorter than the tube: ovary 5-celled, ovules erect: stigma 5-lobed : fruit (unripe) baccate ? (abridged from Wallich's description.)

Novatilea ? hispida, Wall. in Roxb. Flor. Ind. Carey's Edition, 2, p. 187.

Hab.—Silhet, flowering hot season.

Obs.—Leaves narrow, acute, finely acuminated, from 4 to 6 inches long, smooth above, roughish beneath : flowers white, hispid, stamina included.

5. Lasianthus Moonii, (R. W.) shrubby : ramulis lightly compressed, hairy : leaves short petioled oval cuspidate or shortly acuminate, coriacious, glabrous, shining above, coarsely reticulated and hairy beneath : stipules short, obtuse, and with the petioles and bracts thickly clothed with long coarse hairs : bracteas numerous short ; exterior ones orbicular cuspidate, shortly acuminate ; interior bracts slender subulate : flowers axillary numerous, umbellate on short stout peduncles : calyx campanulate, limb 4-5-cleft hairy. Corolla — ? : ovary 4-5-celled. Ceylon.

Apparently from the specimen, a stout shrub, internodes of ramuli slightly ancepitous, flattened at the joints : leaves about 6 inches long by about 3 broad, nearly a perfect oval ; the thick and hairy forming a coarse network beneath.

It seems nearly allied to *L. Cyanocarpa,* but is readily distinguished by its numerous flowers, and somewhat umbellate inflorescence. The suborbicular pointed bracts of this species are very peculiar.

6. Lasianthus attenuatus? (Jack) shrubby : hairy : leaves ovate, or suborbate, somewhat unequal at the base, alternated to a fine point, glabrous above, except the costa, thinly pubescent beneath, especially on the veins : flowers few 1-3, sessile, axillary, enclosed in an envolucrum of about 6 linear lanceolate bracts : Calyx 4-cleft, with a wide sinus between the laminæ : Corolla — : fruit — :

Hab.—Malacca, Griffith.

Obs.—I have added a doubt to the specific name, as a close comparison of my specimen with Jack's description shows some discrepancies. His plant is described as suffrutescent, mine seems from the specimen quite a shrub : the branches in his are said to be villous; in mine they are densely hairy: the leaves of both nearly correspond: his are said to be softly villous beneath, from 3 to 4 inches long by about one broad: the largest leaves on my specimen, which is evidently a young one, are 3½ inches long by one broad, and the difference between softly villous and thinly pubescent, can of itself be no importance as a specific distinction, as that may be attributable, in cases like the present, to a difference of soil or season, or even to a difference of the idea attached by the writers to the same words. The most material discrepancy between his description and my plant, lies in the bracteas, in his "two opposite lanceolate acute villous," in my specimen there are about six in each axil: the flowers so far as my specimen enables me to compare them, correspond. As the correspondence between the more essential points of structure is considerable, I refer my specimen to Jack's species with considerable confidence, but not without doubt. When examined under a magnifier the hairs of this species seem almost moniliform. In nearly all the species the hairs are more or less articulated, in this they are peculiarly so.

7. Lasianthus Griffithii, (R. W.) shrubby: branches, especially at the joints, compressed, hairy when young, afterwards glabrous: leaves large, lanceolate, acuminate, widest part above the middle, glabrous above, pubescent, and on the veins hairy, beneath: stipules broad, triangular, pointed: flowers sessile, crowned, enclosed in an involucrum of numerous subulate very hairy bracteas; calyx limb about seven cleft; divisions acute, thickly clothed with long hairs; corolla 7-cleft, throat and laminæ very hairy, stamens 7, sessile: style filiform: stigma capitate, 7-lobed, ovary 7-celled.

Hab.—Malacca, Griffith.

Obs.—A large species; leaves upwards of 12 inches long by from 3½ to 4 broad at the broadest part: about ⅔ above the base, whence they suddenly contract and terminate in a narrow pointed acumen. The compressed ramuli, large leaves and stipules, and very numerous, narrow, linear pointed coarsely hairy bracts, which form the involucrum to the flowers, render this an easily recognized species.

8. Lasianthus retosus, (R. W.) Shrubby: ramuli terete very hairy: leaves ovate lanceolate, acuminate, short petioled coriacious, glabrous, except the costa above; hairy below, strongly marked with a network of veins, the reticulations depressed above, prominent beneath: stipules small triangular: bracteas subulate hairy, about the length of the calyx, thickly clothed with long coarse hairs: flowers numerous, sessile: calyx 5-parted, segments subulate hairy: corolla 7-cleft: stamens 7-ovary, 7-celled.

Hab.—Mount Ophir, Malacca, Griffith.

Obs.—The want of symmetry between the calyx and the rest of the flower, if constant, will always render this an easily recognized species: the distinctness of the reticulations increases with the age of the leaves, owing to the interspaces increasing faster than the veins, and becoming bullate.

9. Lasianthus pilosus, (R. W.) Shrubby: branches clothed with long black shaggy hair: stipules long, subulate pointed: sessile semicordate or somewhat unequal sided at the base, acuminated, sprinkled with short hairs on both sides, more abundantly below: hairs of the bracts and calyx black or dark brown: bracts few, narrow lanceolate: calyx six cleft enlarging in fruit, divisions slender subulate persistent: corolla — ?: ovary 6-8-celled: fruit hairy, crowned with the long shaggy limb of the calyx.

Hab.—Malacca, Griffith.

Obs.—Approaches *L. inequalis*, Blume, in its unequal sided leaves, but the character "bracteis lanceolatis involucratis," is opposed to their union ; the bracts here being unusually few, the leaves from 4 to 7 inches long by from 1 to 2 broad, semi-cordate, acuminated. In this the cells of the ovary are more numerous that the divisions of the calyx. The corolla I have not seen. The copious black shaggy hair of the branches, and inflorescence, combined with the short very pale yellowish hairs of the leaves, seem to supply good specific characters.

10. Lasianthus ellipticus, (R. W.) shrubby : branches hairy : leaves short petioled elliptic, pointed at both ends, membranaceous, polished above, glabrous except the veins, and a little tuft of hair on the point beneath : flowers few, axillary sessile : stipules somewhat scariose, longer than the petioles, hairy ; ending in a subulate point : bracteas hairy, linear subulate, longer than the calyx : calyx limb 5-parted, segments lanceolate, hairy : corolla hairy, 5-cleft : stamens 5 : ovary, 5-celled.

Hab.—Malacca, Griffith.

Obs.—The membranous but firm, and when dry, the delicately translucent leaves of this species at once distinguish it from all the species I have seen. In form they are elliptic, pointed at both ends, 6 inches long by 2½ broad : above they are quite glabrous, equally so below, except the veins, which are hairy and finely reticulated ; each leaf ends in a fine point, tipped with a small tuft of soft hairs.

11. Lasianthus Blumianus, (R. W.) shrubby : glabrous ramuli terete: leaves short petioled, elliptic lanceolate, acuminate, glabrous : stipules short, triangular pointed : flowers aggregated, few : bracteas short, subulate hairy : calyx limb deeply 4-cleft, divisions lanceolate acute, presistent glabrous, corolla 4-cleft, hairy within : stamens 4-sub-sessile in the throat of the corolla : ovary 4-celled : style equalling the corolla, stigma hairy, drupe globose.

Hab.—Courtallum.

Obs.—This species is most readily distinguished by its large calyx, as compared with the rest of the flower, the laminæ of the limb are much longer than the tube, lanceolate entire, and glabrous; the whole flower however scarcely exceeding the very short petiole.

12. Lasianthus venulosus, (*santia venulosa*, (W. A.) Prod.) shrubby: glabrous, leaves coriacious, short petioled, elliptic oblong, cuspidate or acuminate, glabrous above: veins prominent on both sides, beneath sprinkled with hairs: cymes axillary, short peduncled, few flowered: bracteas small, hairy: calyx 4-5-parted, divisions subulate, as long as the tube of the corolla: corolla 4-5-cleft, throat and lobes hairy: stamens 4-5; style as long, or often longer than the corolla: stigma 3-5-lobed; cells of the ovary equalling the lobes of the stigma: a single erect ovule in each.

Santia venulosa W. and A. Prod. p. 422. *Mephitidia venulosa*, R. W. Icones, No. 1032.

Hab.—Common in woods about Ootacamund, on the Neilgheries.

Obs.—A very ramous shrub: leaves from 2 to 4 inches long by about half the breadth, of a light yellowish green colour, sometimes acuminated, oftener cuspidate: flowers pale yellow: drupes about the size of a pea, blue. The inflorescence is essentially cymose, but often one-flowered, peduncles seem to spring direct from the branch. In the following nearly allied species the cymose structure is fully developed.

13. Lasianthus dichotomus, (R. & W.) shrubby: branches glabrous terete except at the joints, which are compressed: leaves short petioled, elliptic, ovate, or slightly cordate at the base, cuspidate, glabrous, except the short petiole, and a few scattered hairs on the veins: stipules lanceolate, about the length of the petiole, pointed: cymes axillary, solitary, longish peduncled, once or twice dichotomous; divisions

racemose, flowers secund: bracteas subulate, sprinkled with bristly hairs: calyx deeply 4-cleft, divisions lanceolate acute, frequently tipped with a tuft of bristly hairs, about the length of the tube of the corolla, corolla funnel-shaped, 4-cleft, throat and lacineæ hairy: stamens 4 included: style exserted, stigma 4-lobed, ovary 4-celled.

HAB.—Shevagherry hills, near Courtallum. These hills attain an elevation of about 3000 feet, and botanically considered, afford about the richest station, in proportion to the extent explored, I ever visited.

OBS.—This species is nearly allied to the preceding, but I think quite distinct. Its loose dichotomous inflorescence, half the length of the leaves is, so far as I have seen, confined to this species. Leaves from 3 to 3½ inches long, and from 1 to 1½ broad.

14. LASIANTHUS CILIATUS, (R. W.) shrubby: branches terete tomentose: leaves coriacious, ovate lanceolate, acute, glabrous above, petioles and under surface, especially the veins, hairy, margin ciliate: stipules short, triangular, hairy on both sides: flowers aggregated, axillary, sessile: bracteas minute hairy: calyx 3-4-parted, divisions ovate, hairy on both sides, as long as the tube of the corolla: corolla small, 3-5-cleft very hairy: anthers sessile oblong: style short: stigma 3-4-lobes: ovary 3-4-celled: fruit about the size of a large pea, nuts bullately corrugated on the back.

HAB.—Western slopes of the Neilgheries below Sisparah, flowering February and March.

OBS.—The leaves are 6 to 8 inches long, and generally under two broad, very coriacious, the under surface reticulated with prominent veins, the margin bound with a dense line of short stiff ciliæ. The bullate nuts seem almost peculiar to this species, but there is an approach to the same structure in

L. venulosus, which appears a nearly allied, but quite distinct, species. This also approaches *L. capitulatus,* but is quite distinct.

15. Lasianthus rostratus, (R. W.) Shrubby: ramuli terete, slightly compressed at the joints, very hairy: leaves short, petioled, from elliptic oblong to linear lanceolate, rounded or sometimes acute at the base, contracted into a beak at the apex, glabrous above, pubescent beneath, especially the veins and petiols which are strigous: stipules small, pointed, hairy: flowers axillary, sessile, few, (1 to 3): bracteas minute, inconspicuous: calyx very hairy, 4-cleft with a wide sinus between the divisions, margins ciliated with long hairs: corolla 4-cleft, covered with coarse articulated hairs, pubescent within: anthers sub-sessile, incumbent: style much longer than the tube: stigma 4-lobed: ovary 4-celled.

Hab.—Courtallum and Shevagherry hills, flowering August and September.

Obs.—A large shrub: leaves 4-6 inches long by about 1½ broad, rigid, coriacious, strongly veined, usually rounded, but occasionally acute at the base. The flowers are very minute. In my specimens the expanded corollas have all fallen off, but the young buds show a nearly glabrous interior. The berries seem to be about the size of small peas.

16. Lasianthus pterospermus, (R. W.) Shrubby: ramuli much compressed, strigously hairy: stipules triangular pointed, shorter than the petioles: leaves lanceolate, abruptly acuminated, glabrous, except on the veins: flowers axillary, sessile, aggregated (3-5): bracts minute: calyx sparingly hairy, deeply 5-cleft: segments short, obtuse: ovary 5-celled: fruit globose, when dry, furrowed with intermediate sharp angles, 4-5 pyrenous: nuts bisulcate, with 3 prominent wing-like projections on the back.

Hab.—Malacca, Griffith.

Obs—The leaves are from 6 to 8 inches long, nearly 2 broad coriacious, prominently veined, but only slightly reticulated beneath. The stipules are small, subulate pointed, fruit, judging from the dry and shrivelled specimens, about the size of a small cherry; the sharp wing-like ridges of the nuts present the most characteristic feature of this species.

17. Lasianthus capitulatus, (R. W.) Shrubby: strigosely pubescent: leaves short petioled, coriacious, from ovate elliptic acuminate, to ovate oblong lanceolate, attenuated towards the apex, glabrous: stipules very small, triangular: peduncles axillary, about the length of the petioles, few (3-4) flowered: flowers sessile, on the apex capitulate: bracteas small, subulate: calyx 4-5-cleft, divisions broad, ovate, obtuse, seen by transmitted light 3-nerved: corolla, before expansion, hairy ovary, 4-5-celled.

Hab.—Lisparah, Neilgheries.

Obs.—This species is evidently nearly allied to *L. venulosus;* but is, I think, quite distinct. In the narrow-leaved form, the leaves are six inches long by 1½ broad; in the broad elliptic leaved variety, they are about 5 inches long by 2¼ broad. The mature fruit I have not seen, but when far advanced the lobes of the calyx are still persistent.

18. Lasianthus acuminatus, (R. W.) Shrubby: ramuli terete, pubescent: leaves coriacious shining, glabrous, except the slightly pubescent nerves, lanceolate, acuminate at both ends, mucronately cuspidate at the apex: stipules short subulate pubescent: flowers axillary, sub-sessile, two or three together: bracts, if present, inconspicuous: calyx hairy, 4-cleft; segments triangular blunt: corolla tubular 4-cleft, glabrous, hairy within: style equalling the tube, scarcely exserted: stigma 3-4-cleft, ovary 3-4-celled.

Hab.—Pulney, September 1836.

Obs.—The venation is the same in this as in *L. parvifolius*, but in other respects it is amply distinct. In some points it approaches *L. lucisus*, but the long attenuation of the leaves at both ends, and their nearly entire freedom from pubescence, forbids my uniting them while unacquainted with that species, except by the brief character given by Blume, especially, taking into consideration the geographical position of the two plants. The leaves in this are glabrous on the margin, about 3½ inches long, by from 1 to 1½ broad, ending in a slender mucronate acumen above, and tapering into the petiole at the base: flowers about the length of the petiole.

19. Lasianthus parvifolius, (R. W.) Shrubby: glabrous: leaves obovate lanceolate, obtuse, attenuated at the base, glabrous on both sides, the very slender approximated transverse reticulations between the larger veins, running in parallel, nearly quite straight lines: flowers axillary, sessile, two or three together: bracts minute or wanting: calyx 4-lobed, glabrous: corolla tubular 4-cleft, throat and lobes of the limb hairy: stamens 4 on the throat of the corolla: anthers exserted: ovary 3-4-celled: fruit, apparently, about the size of a pea.

Hab.—Courtallum, flowering August and September.

Obs.—Leaves about 2 inches long, by about ¾ broad, somewhat spatula-shaped, except for a short abrupt often cuspidate acumination: corolla about 4 lines long, the anthers exserted beyond the hairs of the throat, a very characteristic species as regards the outline, size and venation of their leaves.

20. Lasianthus strigosus, (R. W.) Shrubby: branches terete, strigous: leaves petioled elliptic, sharp-pointed coriacious, glabrous and shining above, strigous on the costa and

veins beneath: stipules short, triangular, acute: flowers axillary, sessile, aggregated: bracteas wanting, or inconspicuous: calyx, strigous campanulate, limb shortly 5-lobed; lobes triangular ciliate: corolla tubular, limb 4-5-lobed, hairy: anthers included: stigma capitate, exserted: ovary 4-5-celled.

Hab.—Ceylon.

Obs.—In its general appearance and characters this species approaches *L. rostratus;* but is, I think, most certainly distinct. The leaves are about 5 inches long by 2 broad, oblong, elliptic, coriacious, glabrous and shining above, dull with strigous veins below, ending in a sharp subulate point. The flowers are slender, tubular, about ½ an inch long; the throat hairy: the berries apparently globose, about the size of peas, 4 or 5-celled.

21. Lasianthus Walkerianus, (R. W.) Shrubby: branches sparingly strigosely hairy or glabrous, compressed: leaves coriacious, petioled, lanceolate, acuminate, mucronately cuspidate; glabrous above, the veins and margins beneath sparingly pubescent; when dry, somewhat revolute on the edges: veins prominent on both sides, stipules triangular, short, pointed: flowers axillary, sessile, aggregated, ebractiolate: calyx campanulate; limb truncate, slightly crenately 4-toothed: corolla tubular 4-cleft; limb and throat hairy; stamens 4: stigma sub-exserted, capitate, 4-lobed; ovary 3-4-celled.

Hab.—Ceylon. In 1836, in company with Colonel Walker, I gathered the specimens now described.

Obs.—The leaves, which are very coriacious with a tendency to become yellow in drying, from 3 to 4 inches long by from 1 to 1½ broad: the veinlets in this species show a greater tendency to curvature, and net-like reticulation than is usual in this genus. The flowers which are collected into dense fascicles, are about ¼ of an inch long, with a slender tube and 4-lobed hairy limb. In its foliage it very nearly approaches *L. venulosa*, but is far removed by its inflorescence and flowers: in these again it approaches *L. strigosus*, but is abundantly distinct in its foliage. It also approaches, in general appearance *L. parvifolius*, but differs in having numerous flowers, while that species has only one or two.

22. Lasianthus venosus, (Blume.) Shrubby: branches terete, coarsely strigose: leaves short petioled, ovate oblong, acuminated, slightly unequal at the base, very venous; the veins prominent, and more or less strigose on both sides: stipules triangular, hairy within: flowers axillary, subsessile, solitary or few: calyx limb 5-toothed or cleft, divisions spreading, hairy: corolla —.?

Hab.—Malacca, Griffith.

Obs.—My specimen is imperfect as regards flowers, but I think there can scarcely be a doubt of its being identical with Blume's plant, the specific character of which is taken entirely from the leaves: "leaves short petioled, oblong acuminate, obliquely attenuated at the base, very venous (venosissimus,)" a most characteristic word as applied to my specimen. The leaves vary from ovate with a rounded or subcordate base, to elliptic with an attenuated one, are from 3½ to 4½ inches long, and from 1½ to nearly two broad; the veins on both sides clothed with short, rigid, adpressed hairs.

23. Lasianthus longifolius, (R. W.) Fruticose glabrous, branches terete: leaves large, short petioled, lanceolate acuminated glabrous: stipules as long as the petiols, pointed, hairy within at the base: flowers few, axillary, sessile: calyx truncated, minutely toothed: ovary about 7-celled; nuts thin, compressed, convex on the back.

Hab.—Malacca, Griffith.

Obs.—The leaves of this species exceed a foot in length, by about 3 inches broad, glabrous on both sides, ending in a fine pointed acumen. The limb of the calyx seems cylindrical, truncated, but those on my specimen are not in a good state for examination, being all past maturity. It may therefore belong to the cleft or dentate section.

24. Lasianthus constrictus, (R.W.) Fruticose ramulis terete, thicker at the joints, glabrous or with a sprinkling of hair near the joints : leaves slightly coriacious, lanceolate, tapering at both ends, sometimes a little unequal sided, slightly crisped on the margin ; glabrous on both sides, except a sprinkling of hairs on the veins : veins slightly prominent, especially the costa, which in the dry plant forms quite a ridge : stipules minute, pointed : flowers axillary, sessile, fascicled : bracts minute, hairy : calyx limb dilated, 4-lobed, constricted at the throat : ovary 4-celled.

Hab.—Mergui, Griffith.

Obs.—The constricted neck, and dilated limb of the calyx of this species at once distinguishes it from all the others, in other respects it is a well marked species ; the thickening of the nodes at the origin of the leaves, the elongated form of the leaves, which are fully 6 inches long by about 1½ broad, almost sessile, tapering to a point at both ends ; all mark this as a peculiar species. I have not seen either corolla or fruit. The unique constriction of the neck of the calyx at first made me doubt its being a *Lasianthus*, but the venation of the leaves, which is peculiar and characteristic in this genus, leaves no doubt on that head.

25. Lasianthus pauciflorus, (R. W.) Ramuli terete, tomentose near the extremities, below frequently covered with a pulverulent crust : leaves subsessile, elliptic oblong,

attenuated at the base, slenderly acuminate at the apex, glabrous, above hairy, especially on the nerves beneath, stipules longer than the petiols, subulate pointed, caducous, leaving a ring of bristle-like scales : flowers solitary, axillary, sessile, calyx glabrous, 4-toothed; teeth triangular obtuse.

Hab.—Mergui, Griffith.

Obs.—My specimens of this plant are most imperfect as regards flowers, only one being left on the specimen; but as its whole habit proclaims it a *Lasianthus*, I have thought best to include it, and render the list, to that extent, nearer complete. The leaves are elliptic, about 4 inches long by 1½ broad, ending in an abrupt narrow acumen.

26. Lasianthus? dubius, (R. W.) Shrubby, ramuli compressed hairy, older branches glabrous : leaves petioled, obovate lanceolate, attenuated towards the base, acuminate at the apex; glabrous above, pubescent beneath, and densely hairy on the costa and veins: stipules scariose on the margin, blunt: inflorescence cymose, common peduncle elongated, trichotomous, each branch abruptly ending in a capitate fascicle of 3-7 sessile, bractiolate flowers: calyx densely hairy; limb tubular truncated, obscurely 5-toothed, glabrous within : corolla short, limb 5-lobed, throat and lobes hairy: anthers large, subsessile, exserted : ovary crowned with a fleshy disk larger than itself, 2-celled with a solitary, erect, compressed, orbicular ovule in each: style equal in length to the corolla: stigma 2-lobed: fruit ——. ?

Hab.—Ceylon. Specimens communicated by Colonel Thacker, and also collected by myself in April 1836.

Obs.—This appears a *Lasianthus* in every thing, except the 2-celled ovary and 2-lobed stigma to which, perhaps, may be added, the curious inflorescence; in the venation of the leaves, the hairiness of the ramuli, petiols, costæ, veins, peduncles, and calyx; in the ring of hair left by the caducous stipules; in the throat and limb of the corolla, and finally in the jointed character of the hairs; while in the very material points of ovary, stigma, and inflorescence, it approaches *Psychotria,* from which again it is separated by its compressed orbicular ovules. Altogether, it appears a very peculiar plant, the proper genus of which cannot be correctly determined without fruit; but, I believe, I am quite safe in placing it here. The larger leaves are from 6 to 7 inches long by about 2 broad.

27. LASIANTHUS? FŒTENS, (R.W.) Shrubby or subarboreous glabrous: leaves petioled, glabrous, even from ovate to elliptic lanceolate, acute or sub-acuminate, attenuated at the base, short petioled, exhaling when growing a very fetid odour: stipules minute cuspidate; peduncles axillary, solitary, jointed bi-bracteate at the joint, one flowered with two minute bracteoles at the base of the calyx tube; corolla infundibuliform, 4-cleft, tube and limb glabrous: stamens inserted within the tube; filaments short; anthers large oblong not exserted: style length of the corolla: stigma subclavate, 2-lobed, blunt: ovary 2-celled; ovules, 2 erect: fruit succulent, baccate, obovate, 2-seeded.

HAB.—Neilgherries, frequent in the Avalanche woods, generally past flower, and the fruit about half grown in February. Shevagherry, August in flower.

OBS.—It is with considerable reluctance I place this plant in this genus, wanting as it does, the characteristic venation of the leaves, and having a 2-celled ovary. In most other points, (except perhaps the baccate not drupaceous fruit, such as the cymose tendency of the inflorescence, as indicated by the double series of bracteas, the infundibuliform corolla, erect ovlues and fœtor of the plant) it accords with *Serissa,* a spermacoceous genus, and to which this is probably even more nearly related than to *Lasianthus.* When Mr. Gardner and I first found it, we agreed, after a pretty attentive examination, in placing it here, and I retain it, though further acquaintance with the genus makes me doubt the propriety of doing so.

The Botany of the Antarctic Voyage of H. M's. Ships 'Erebus' and 'Terror,' in the years 1839—1843. *By* Joseph Dalton Hooker, M. D., R. N., F.L.S., *Parts* 1—5, *London,* Reeve Brothers, 1844. *Communicated by Mr.* Gardner.

The expedition to which the author of the above work was attached as Botanist, left England in the beginning of the year 1839, for the purpose, as it is well known, of investigating the phenomena of terrestrial magnetism, and of pursuing maritime geographical discovery in high southern latitudes. Besides these leading objects, it was enjoined to the officers that they should use every exertion to collect the different objects of Natural History to be met with in the various countries they were about to visit. After three distinct cruises to the South Polar regions, from their more northern winter quarters, the expedition reached England in the autumn of 1843, with rich collections both in Zoology and Botany. To assist in the publication of these, the Lords Commissioners of the Treasury granted the liberal sum of £1000 to each department.

The number of specimens which Dr. Hooker brought back with him is very great, and all in a beautiful state of preservation—as we had an opportunity of witnessing shortly after his return to England—notwithstanding the very limited accommodation and means which necessarily existed under the circumstances in which he was placed, for preparing and preserving them. The alacrity which he has displayed in placing his discoveries before the public, is quite without parallel in the annals of British voyages of discovery, not one year having elapsed after the return of the expedition before he had all his materials put into order, and several numbers of the work published. Indeed, we believe, that with the exception of our first Botanist, Mr. Brown, Dr. Hooker is the only Botanist attached to Government voyages of discovery, who has undertaken to publish the result of his own labours while abroad. Nor is the " Flora Antartica"—which is to consist of twenty monthly parts, each part containing eight plates—to be the only work he purposes publishing in connection with the voyage; as he announces, besides, a " Floræ Novæ Zelandiæ," to be illustrated with one hundred and forty plates, and a " Flora Tasmanica," which will contain two hundred plates.

Besides the collections which the author himself accumulated, these works will contain the " still unpublished Herbaria formed by Sir Joseph Banks, Forster, Solander, and Menzies, all deposited in the British Museum, and placed at the author's disposal by Mr. Brown, as are also the plants of Capt. Fitzroy's voyage, by Mr. Darwin and Professor Henslow." In addition to these, the rich materials contained in the Herbarium of the author's father, Sir William Hooker —one of the largest, if not the largest, private one in Europe—will enable him to make most important additions to the extra tropical Flora of the Southern Hemisphere.

The manner in which the " Flora Antartica," is got up, is highly creditable to all parties connected with it. It is of royal quarto size, and beautifully printed by Reeve Brothers, the well known Conchologists, and Natural History Lithographers. The drawings are by Fitch, an artist who has been many years in the employ of Sir William Hooker, the illustration of whose works has given him a reputation, second to none in the department which he has followed. Owing to the public being allowed the full benefit of the Admiralty grant, the work is sold remarkably cheap—certainly a third or fourth cheaper than it could otherwise have been offered. Although the Botany of the Antarctic regions has but little direct bearing on that of India, yet, by the manner in which the author has treated his subject, there is much in the present work that will render it not only interesting, but useful to the Botanists of any country, but particularly to those who study the science with reference to the Geographical distribution of plants. In a very interesting summary of the voyage, which serves as an introduction to the work, we find the following account of the climate of the remote regions which the expedition visited :

" Respecting the climate of the various regions visited by the expedition, and especially that which prevails within the Antarctic circle, little need here be said, except that the vast proportion which water bears to land, tends to render the temperature uniform throughout the year, and the further south is the position, the more equable does the climate seem to be. No analogy can prove more incorrect than that which compares the similar degrees of latitude in the North with those of the South. The most casual inspection of the map, suffices to show the immense proportion of sea to land in the Southern Hemisphere, the mass of the continents terminating to the north of latitude 40° S., America alone dwindling away to the fifty-sixth degree. The scattered islands discovered to the south of this, are therefore removed from the influence of any tracts which enjoy a better or continental climate. The power of the sun is seldom felt, and unless in the immediate neighbourhood of land, and accompanied by a comparatively dry land wind, that luminary only draws up such mists and fogs as intercept its rays. After entering the pack-ice between 55° and 65°, the thermometer seldom, during any part of the summer day, rises 32° or falls below 20°; and while the southerly winds bring snow, the northerly ones transport an atmosphere laden with moisture, which becoming at once condensed, covers the face of the ocean with white fogs of the densest description.

"All Islands and lands to the southward of 45°, partake more or less of this inhospitable climate, which, though eminently unfavourable to a varied growth of plants, still from its equable nature, causes a degree of luxuriance to pervade all the vegetable kingdom, such as is never seen in climates where the vegetable functions are suspended for a large portion of the year. The remoteness of these islands from any continent, together with their inaccessibility, preclude the idea of their being tenanted, even in a single instance, by plants that have migrated from other countries, and still more distinctly do they forbid the possibility of man having been an active agent in the dissemination of them. On the contrary, the remarkable fact that some of the most peculiar productions are confined to the narrowest limits, is a strong argument in favour of a general distribution of vegetable life over separate spots on the globe. Hence it will appear, that islands so situated furnish the best materials for a rigid comparison of the effects of geographical position, and the various meteorological phenomena on vegetation, and for acquiring a knowledge of the great laws according to which plants are distributed over the face of the globe."

The parts which as yet have reached us, are devoted to the Botany of Lord Auckland's group and Campbell's Island, which lie to the south of New Zealand. From the general view of the nature of these islands, we make the following extracts :—

"The Flora of these islands is closely related to that of New Zealand, and does not partake in any of those features which characterise Australian vegetation. Most of the plants may indeed be presumed to exist on the unexplored mountains, especially those of the middle and southern Islands of New Zealand; but others are doubtless peculiar to those higher southern latitudes which they inhabit, thus being analogous to those few novel forms that appear only in the most arctic parts of America. Even between the Floras of Lord Auckland's and Campbell's Islands a marked difference exists, several species growing most abundantly in the latter which are not found at all in the former, where also the proportion of species common to other antarctic countries is less, and the affinity is greater with the productions of New Zealand.

" *Lord Auckland's Group.* A view of this small and very limited group, of about twenty miles long and eleven in its greatest breadth, as it appears on approaching from the sea, presents an almost equal distribution of woods, shrubs, and pasture-land. The mountains are low and undulating, nowhere exceeding 1400 or 1500 feet, clothed for their greater part, but scarcely to their very summits, with long grass, and frequently covered during November and December, though not generally with snow. The climate is rainy and very stormy, so that on the windward sides the plants are stunted and checked, and resemble those of a higher southern latitude, or of an elevation several hundred feet above that which the same species inhabit on the sheltered parts. The whole group of islands appears formed of volcanic rocks, mostly of black trap, whose decomposition, especially among the ranker vegetation of the lower grounds, produces a deep rich soil. A myrtaceous tree (*Metrosideros umbellata*) forms the larger proportion of the wood near the sea, and intermixed with it, grow an arborescent species of *Darcophyllum*, several *Coprosmas*, *veronicas* (frutescent), and a *Panax*. Under these, and particularly close to the sea-beach, many ferns abound; conspicuous among them is a species with caulescent or subarborescent stems half a foot and upwards in diameter, crowned with handsome spreading tufts of fronds. Beyond the wooded region, some of the same plants, in a dwarf state, mingled with others, compose a shrubby broad belt, which ascends the hill to an elevation of 800 or 900 feet, gradually opening out into grassy slopes, and succeeded by the alpine vegetation. It is especially towards the summits of these hills that the most striking plants are found, vying in brightness of colour with the Arctic Flora, and unrivalled in beauty by those of any other Antarctic country. Such are the species of *Gentian* and a *veronica* with flowers of the intensest blue, several magnificent *Composit*, a *Ranunculus*, a *Phyllachne*, and a *Liliaceous* plant, whose dense spikes of golden flowers, are often so abundant as to attract the eye from a considerable distance. Here too the vegetable types of other antarctic lands may be seen in the greatest number, and even such as are analogous to the arctic productions, none of which can be more decided than a species of *Hierochlœ*, *Potentilla*, *Cardamine*, *Juncas*, *Drosera*, *Kautago*, *Epilobium*, several *Grasses*, and Mosses belonging to the genera *Andrœa*, *Conostomum*, and *Bartramia*. Many of the plants in the lower grounds are no less striking and beautiful, as an arborescent *veronica* bearing a profusion of white blossoms, a maritime *Gentian*, a handsome large flowered *Myosotis*, the magnificent *Aralia Polaris* (Homb and Jacq.), two fine kinds of *Anistome*, and several beautiful ferns.

"Campbell's Island, two degrees to the southward of Lord Auckland's group, is smaller, far more steep and rocky, with narrow sheltered vallies, and the broader faces of the hills much exposed, and hence bare of any but a grassy vegetation. Except in the bays, the coast is as iron-bound as that of St. Helena, the rocks assuming even a wilder and more fantastic form. Ever lashed by heavy swells, and exposed to a succession of westerly gales, this land affords no holding-place for such trees as skirt the beaches of Lord Auckland's Islands. In the narrow, sinuous bays, however, the scene is quite changed, for they are often margined by a slender belt of brushwood, with an abundant under-growth of *Ferns* stretching up the steep and confined gallies.

" The geological features of the two Islands are alike, and the only difference in climate consists in that of Campbell's Island being still more forbidding and dreary. Fogs, snow, squalls, and mists are the prevailing meteorological phenomena of these regions; and though such a state of atmosphere has a tendency to check the general mass of vegetation, still the constant moisture and equable temperature thus afforded support a luxuriant herbage in the very sheltered vallies. In Campbell's Island, the mountains, which rise very abruptly to about 1300 feet, are almost bare of vegetation, their rocky sides presenting a larger proportion of *Grasses, Mosses* and *Lichens*, than in Lord Auckland's Group. Though all the handsomer plants are also found in the larger of the latter islands, yet, by growing here at a much lower elevation and in far greater abundance, they form a more striking feature in the landscape, the golden-flowered *Liliaceous* plant being conspicuous, from its profusion, at the distance of a mile from the shore."

The following observations occur under the head of *Gentiana cerina*, Hook. fil.; and will give an idea of the high character of the general remarks scattered through the work :

" Although Gentians are seldom white flowered as species, this and the former are decidedly so, with red or red purple at the base of the segments, and the veins of the same colour; the pure blue of the European species is unknown amongst those of these regions, or of the higher latitudes of South America. Indeed, I think that few genera display so full a series of colours in the flowers as this does; red, blue, yellow and white, are all exhibited in it, with many of the intermediate compound tints. Yellow and white are rare in the regions of the Gentians, but almost invariably present; the red species are nearly confined to the Andes of South America and New Zealand. Amongst Dr. Jamieson's 'Botanical notes on the Flora of the Andes of Peru and Colombia,' I find the following interesting remark :— 'Of sixteen species of Gentian with which I am acquainted, one-half are red, four purple, one yellow, and one white.' (Bot. Journal, vol. 2, p. 649.) Their inferior limit under the line we find from the same source to be 7852 feet, and they ascend from thence nearly to the limits of perpetual snow on Cotopaxi; they do not in South America descend to the level of the sea in a lower latitude than 54° or thereabouts, where, however, there are no Alpine species, though the snowline does not descend below 4000-3500 feet. On the Himalaya, where the species are all blue flowered, one species has been gathered by my friend, Mr. Edgeworth, near Ratha Kona, on the Mána Pass, at an elevation of 16,000 feet, near the limit of perpetual snow, and another reaches in latitude 31° W. the altitude of 12,689 feet, according to Dr. Royle. In Ceylon a species has been gathered at between 6000 and 8000 feet of elevation. One species *G. prostrata*, H. B. K., has a most extraordinary range, both in longitude and latitude. In Southern Europe it inhabits the Corinthian Alps, between 6000 and 9000 feet high. In Asia it has been found on the Altai mountains about latitude 52° W. where they attain an elevation of 15,000-16,000 feet; and on the east side of the Andes of South America in 35° South: it descends to the level of the sea at Cape Negro; in the Straits of Magalhaens in latitude 53° S.; and at Cape Good Hope in Behring's Straits, latitude 68½° N.

"The fact of the occurrence, and the great number, of species of *Gentiana* inhabiting only the more elevated regions of the temperate and tropical zones, and there reaching the snow limit, renders it very remarkable that they should be so proportionally scarce in the higher latitudes both of the northern and southern hemispheres. Generally speaking, the inhabitants of these elevated and cold regions are species of such natural orders and genera as compose the mass of the Polar vegetation. It is so to a great extent with certain groups of *Ranunculaceæ*, of *Graminiæ*, *Caryopylleæ*, *Cruciferæ*, *Grieleæ*, *&c. &c.*, but not with *Gentianeæ;* the proportion which the species of the transition temperate zones bear to the other plants of those regions on the one hand, and to the tropical species of the same genus on the other, is in both cases remarkably small. They are entirely unknown to the Floras of the Polar American Islands; very few inhabit Greenland, Iceland, or the Arctic sea-shores in the north, or Tasmania, New Zealand, Fuegia, or the Antarctic Islands in the south; and again in other parts of N. Europe and America, or of Chili and Patagonia, they are infinitely less numerous than in the Alps of Middle and South Europe, or the Andes of the equator."

Most sincerely do we wish the Author health and leisure to complete the important works he has undertaken in the same style in which they have been begun. What has already appeared stamps him as a Botanist of very high rank, and places him at once, and that too at an early age, among the leading ones of the day.

Sketch of the modern views regarding Physiological and Pathological Chemistry.

[The following popular account of the application of chemistry to Physiology and Pathology is mainly a condensed translation of a paper by Dr. Kloss of Frankfort, with a few alterations and additions.—J. M. P.]

1. *Physiological chemistry* has of late years made more rapid progress than any other science, and has exercised an important influence on practical medicine, although many of its supposed results require confirmation.

(a.) Principles of Chemistry in the vegetable kingdom. (According to Liebig,) the immediate constituent of all vege-

tables is carbon; the great mass of vegetable matter is formed of compounds, which contain carbon and the elements of water: the latter either in the same condition in which they exist in water, (woody fibre, starch, sugar and gum:) or in that of carbon with the elements of water and a certain quantity of oxygen, (most vegetable acids:) or in that of carbon and hydrogen with little or no oxygen (volatile and fatty oils, wax and resins.) The vegetable acids are constituents of all the fluids of plants, and are generally united to inorganic bases, metallic oxides: these last are never wanting, and after incineration are found in the ashes. Nitrogen which is not entirely absent in any plant, (being present in at least some of the fluids,) but which forms the smallest portion of its constituents, is especially the constituent of vegetable albumen, gum, &c. It also at times occurs in the form of acids, of indifferent substances, and of peculiar combinations possessing the properties of metallic oxides (organic bases.) The development of a plant is therefore dependent on the presence of a combination of carbon, which presents to it carbon in an assimilable state, and one of nitrogen, which supplies nitrogen in a like condition: it further requires water and its elements, and also a soil which supplies inorganic materials. The assimilation of carbon takes place by a decomposition of the carbonic acid of the air, of the decaying humus, or of water, by means of which carbon enters into the constitution of the plant, and oxygen is exhaled. This process, which probably goes on in all parts of the vegetable, takes place only under the influence of light, especially the light of the sun, and is independent of a high degree of temperature. Hydrogen is taken up, when the water is decomposed, by its oxygen being set free. Nitrogen, without which no plant reaches its full development, much less flowers and fructifies, is supplied to it only in the form of ammonia, (in rain water and in manures.) The inorganic substances, of which it used to be believed that the organism could produce them by a sort of in-dwelling power, are taken up only from the soil. These inorganic substances serve for the production of the vegetable acid salts, which appear to be necessary for certain ends indispensable to the existence of the plant. According to Liebig's researches, they can take each other's places, and a plant, when it cannot find such a base at all, or only in too small a quantity in an assimilable state, either remains backward in its development, or produces an organic base (such as solanine, chinine, morphine, &c.) to take the place of the inorganic bases which are wanting.

(b.) Principles of Chemistry in the animal kingdom. (According to Mulder, Liebig, Lehmann, &c.) the chief constituent of the animal body is proteine (consisting according to Mulder of carbon 4, hydrogen 31, nitrogen 5, oxygen 12,) which in combination with phosphorus or sulphur, or with both at once, forms the radical of albumen, of fibrine and of caseine. It is therefore the element of the most important phænomena of life, in the course of which it undergoes endless transformations, and is at last converted into a substance, which is excreted as being of no further use to the body. ———Albumen (which consists of 10 atoms of proteine, 2 atoms of sulphur, and 1 phosphorus) is in the animal body the commencing point of all nutrition, as well as the primitive form of the other combinations and metamorphoses of proteine. It is for the present assumed, that in the process of digestion all the other nutritious substances which contain proteine (fibrine, gum, caseine) both of animal and of vegetable origin, are first converted into the most soluble combination of proteine, before they can pass into the blood, and take a share in the process of nutrition: and that after this, the other combinations of proteine are formed from the blood. ——— Fibrine (consisting of 10 atoms proteine, 1 atom phosphorus and 1 sulphur) existing in a fluid state in the blood, and in a coagulated one in the muscles, maintains its com-

position only as long as it remains under the influence of vital action, and decomposes, whenever it is removed from the organism. Its decomposition may be delayed and almost prevented by alkalies. According to Denis decomposed fibrine may even be dissolved by them, and converted back into a kind of fluid albumen. The formation of fibrine must be regarded as dependent on albumen, as it is not found in the lymphatics. This is confirmed by the observation of Nasse, that the quantities of the albumen and of the fibrine of the blood are in inverse proportions to each other. The chemical cause of the transformation of the albumen of the blood into fibrine is commonly supposed to depend on oxygen being taken up by respiration. On this account arterial and male blood are richest in fibrine, as also the blood of those who take much exercise, which causes an increased quantity of oxygen to be taken up, and makes the organs that are richest in fibrine, namely the muscles, increase in size in a marked degree. The formation of fibrine may perhaps take place thus, by 1 atom of the sulphur of the albumen uniting with oxygen, forming sulphuric acid and combining with the alkali of the serum, while the remainder of the sulphur has become fibrine with the proteine and phosphorus, (Lehmann). Hoffman believed, that by the addition of a little sulphuric acid to blood, whose fibrine had been removed by beating, that he had obtained from the albumen of the serum fibrine in the form of a fine white membrane. In the vegetable kingdom gum is quite analogous to animal fibrine, and occurs mixed with colouring matter in the green parts of plants as a green deposit, and in the seeds of the cerealia.————Caseine (consisting of 10 atoms proteine and 1 atom sulphur) which is not decomposed by boiling, but which is precipitated by acetic and lactic acids from aqueous solutions, is especially contained in milk. For the present we must believe that by digestion it is converted into albumen, before it reaches the blood, for it has not yet been found in the absorbents. Vegetable caseine, (Legumine) occurs principally in the seeds of the leguminosæ.———These three compounds of proteine, albumen, fibrine and caseine, both vegetable and animal, are by no means formed from their elements within the animal body, but reach it ready made. Vegetables alone are in a condition to produce elementarily proteine from their inorganic articles of nourishment.———Globuline, which was at times declared to be identical with caseine, at times with albumen, and was afterwards recognised by Mulder as a compound of proteine, free from phosphorus (proteine 15 and sulphur 1,) occurs in the substance of the lens and in union with hæmatine, and constitutes in the coats of the blood globules, the greatest part of the firm portion of the blood. The origin of globuline can only be from the albumen of the blood, but of the mode in which it is produced we know nothing.———Besides the compounds of proteine, animals also enjoy nourishment from substances free from nitrogen, as fat, sugar, amyline, gum, pectine, &c., which consist of carbon and the elements of water, and are probably employed in the formation of fat, (and the formation of lactic acid according to Lehmann) in as much as they possess all the constituents of fat in addition to a certain quantity of oxygen, which disappears during its formation. ——In grown-up people the weight of the body remains on the whole pretty uniform when the diet is regular, although not nearly the quantity of carbon that has been taken in, can be found in the excretions. This carbon is exhaled as carbonic acid through the lungs and by the skin. The formation of that acid develops animal heat. Liebig shews by calculation, that the quantity of carbon consumed with the articles of food, is about 37 per cent. more than what is wanted for the production of animal heat. With active and continued exercise, and thus increased assumption of oxygen, more carbon is given out in the form of carbonic acid, and the formation of fat limited, or the fat already deposited is again brought into use for the purpose of combustion. The formation of fat is thus dependent on a deficiency of oxygen, which is absolutely essential to the disengagement of carbon.—In closest connection with the process of respiration and the production of fat, stands (according to Liebig) the secretion of bile. The bile which is loaded with carbon, is removed only in very small quantities along with the excrement, and its greater portion returns into the circulation, becomes carbonic acid by combustion, develops heat, and is in fine removed from the body by the process of respiration. It may be borne in mind, that Mulder and Liebig disagree as to the manner in which oxygen is taken up by the blood, also that some chemists (as Kemp) deny *in toto* that either bile or fat is employed in respiration.——In accordance with the foregoing views, articles of food are (by Liebig) divided into those which contain, and those which are free from, nitrogen. To the first, or plastic ones as they are called, belong all those which contain the proteine, in the form of albumen, fibrine or caseine, and not in an already metamorphosed state, from which it is no longer reducible. Liebig names these substances which are free from nitrogen, respiratory-nourishing, because they supply to carbon the materials for breathing and the production of heat. All these substances are converted in the stomach, with the aid of the gastric juice, (consisting of pepsine and weak mineral acids) of water, and the oxygen of the air swallowed, into a condition in which they are fitted for passing into the blood. Pepsine, is a body found in a peculiar state of transformation, and causes (like yeast in fermentation) by contact with the portions of food which are insoluble in water, a new grouping of their elements, (perhaps to be named albuminous fermentation). A certain quantity of pepsine can probably only dissolve a certain quantity of food, just as so much yeast converts into alcohol and carbonic acid only so much sugar. The mineral acids of the gastric juice, without which the pepsine does not act, obviously owe their origin to the culinary salt used at meals, the soda of which plays an important part in the reduction of food, containing fibrine and caseine along with albumen, and in the formation of bile, which is a sort of soap-like compound. This free acid plays a similar part to sulphuric acid, which in a mixture of diastase and amyline hastens their metamorphosis into sugar. In truth we know nothing more regarding digestion, except the outward essentials to its taking place; the particular histories of the substances broken down by the transformation are, for the greater part, unknown. Liebig has, by a comparison of the final chemical results of the transformation with the commencement of the process, (that is, of the substances taken in and those evacuated) made a first step towards dispelling this darkness. Urine contains the products of the transformed structures which are richest in nitrogen, bile of those which are richest in carbon; and as all structures have originally been produced by the blood, so must the elementary constituents of the bile and urine taken together, resemble the composition of the blood, in their relative proportions. But in the transformation of structures, no other bodies except the oxygen of the air and water have taken part: we must therefore find again all the constituents of blood in the constituents of urine and bile, with the addition of a certain quantity of oxygen and of water; and we find that choleic acid represents the bile, uric acid and ammonia the elements of urine. If then we abstract from the composition of blood the constituents of urine, we must after making allowance for the quantity of oxygen and of water which has been added, arrive at the composition of bile. Or vice versâ, after abstracting the constituents of bile with oxygen and water, from the constituents of the blood, we must arrive at urate of ammonia, or urea and carbonic acid. As the last products of these transformations we obtain, (because the choleic acid is reduced into carbonic acid and the uric into carbonic acid, and ammonia) carbonic acid, ammonia and water, the elements of the nourishment of plants.——The inorganic constituents of the animal body are, according to the views of most authors, introduced into the system in the articles of food, and all authorities agree on this point, that the animal body cannot form these constituents from the elements, or change them into others, when introduced.

II. *Pathological chemistry*, in as much as life manifests itself solely by an unceasing change of substance, regards disease (*i. e.* a group of vital phænomena, which deviate in any degree from the normal) as a peculiar condition of the exchange of substance, and endeavours under this idea to fathom its causes; while nosology represents disease as a compound of symptoms, and assumes for each one a *vis a tergo*, which cannot be any further explained, such as an acid matter, a parasite, &c.

Poison, Contagion, Miasma. Liebig expresses himself thus on these subjects. *Nutritious* substances are those which lose their properties under the influence of the vital powers, without exerting a chemical action on the organ that operates upon them. Other substances alter the direction, the force, or the intensity of the resistance of the vital powers, in consequence of which the function of their organs is altered. They cause a disturbance by their mere presence, or because they are themselves undergoing transmutations,—these are *medicines*. If their tendency to unite themselves with the constituents of the organs be stronger than the resistance of the vital powers, they work as *poisons*.——A very peculiar class of substances, which may be produced by decomposition of a particular sort, work as deadly poisons, not from their power of forming new combinations, or because they contain a positive poison, but from the condition in which they are, and which they impart to the organism, (*contagions*): Liebig compares the operations of these bodies to fermentation, and in this rests on the position laid down by Laplace and Berthollet. "An atom set in motion by any power can communicate its motion to another atom, which is in contact with it." The blood has no power in itself to produce metamorphoses; its chief characteristic is its being ready to undergo them. Decaying and diseased substances work in it, as yeast in a fermenting mixture. Thus, poisonous sausages impart their state of decomposition to the living organism, and the patient dries up to the condition of a mummy. Poisons of this sort are produced in the living body also, as in measles, the plague, syphilis, &c. These contagions may retain their power for a long time without being destroyed, if their peculiar state of decomposition be preserved, (as by dry weather). Some have attributed to contagion a peculiar (parasitic) life, as if it were the germ of a seed; some have sought for its causes in the presence of microscopic forms, but Liebig explains its operation by its peculiar state of decomposition.——A *miasma* works by its chemical character, in as much as it forms combinations, or causes decompositions: it excites disease, without reproducing itself: it does not by its peculiar nature cause a gradual decomposition like contagion, but works directly as a poison.

Oxides of proteine. All the constituents of compounds containing nitrogen, are formed from proteine: the most important are the phosphorus and sulphur compounds of proteine (albumen, fibrine, caseine). Every atom of proteine, which has once served in the production of a vital phænomenon, is to be considered as dead, and the most easily eliminated form, in which in men and in the carnivora the dead proteine is excreted from the body, is that of urea. Its formation is therefore unceasing, and its excretion from the body constant and uninterrupted. Only oxygen and water take part in its formation, and thus urea is an oxide or oxyhydrate of proteine.——If now we carry with us the idea, that the oxygen (and water) unites with the compounds of proteine only in definite proportions to form new combinations, and that there are no indefinite intermediate compounds, we can conceive that a certain quantity of oxygen, instead of gradually penetrating a quantity of proteine by its normal stages of vital manifestations and decomposition, may seize at once on a larger quantity of it, and so raise it to the extreme of vital activity. This excess of oxidation the chemists attribute only to fever and to inflammation. In diseased processes of such a nature, a greater quantity of oxygen is consumed, than the body has to yield for the purposes of life. This misproportion of matter to be excreted, which is only got rid of in the form of urine, (in which it is most easily eliminated,) constitutes the *materia peccans* of disease.——— In inflammation an increase in the fibrine of the blood has been observed, and its origin has been ascribed to the albumen of the blood, 1 atom of whose sulphur is supposed to be converted into sulphuric acid: the inflammatory crust too is considered to be formed of fibrine. Mulder describes it as a hydrate of two stages of the oxidation of proteine, its binoxide and tritoxide; (epidermose and albuminose of Bouchardat). Thus the albumen, when it meets with the oxygen, does not form a binoxide, but a tritoxide at once: fibrine, on the other hand, easily assumes oxygen from the air even at the common temperature, and can undergo either of the stages of oxidation. The oxidation of proteine becomes only by its excess a pathological phænomenon, for it occurs in healthy blood also. The oxidation takes place in the lungs by means of the oxygen which is inspired. An abnormal increase of the oxidation of proteine can therefore only happen, when by rapid cooling of the inspired air, a greater quantity of oxygen than usual is introduced into the circulation, or when through any cause the number of inspirations exceeds the normal one, or the circulation of the blood is accelerated. As we may consider the gelatine-yielding substances to be more advanced stages of the oxidation of proteine, and the false membranes partly yield gelatine, and partly have the composition of inflammatory exudations, the formation of the plastic products of inflammations becomes in some degree intelligible. In inflammation the oxidation of proteine is increased on its surface, but not in its depth, and therefore the compounds of proteine which are consumed, quit the body in an imperfectly excrementitious form, and are recognisable especially in the urine (as great quantities of uric or hippuric acid, oxalic or lactic acid, when the urea diminishes in quantity) and in the perspiration.——In disease a compound of proteine quits the body either unaltered, or in an imperfectly excrementitious state, in larger quantity than usual, or is at least kept beyond the influence of the ordinary vital actions. Thus, compounds of proteine are found in excretions, in which they do not occur under usual circumstances (as albumen in colliquative diseases in the urine, the perspiration, and the excrement,) or they become deposited in a place, where they are uncomfortable or dangerous to the organism, and are more or less removed from the influence of the natural processes of transformation, (as pus, tubercle, scrofula, carcinoma, hypertrophy, &c.). The physiologists indeed agree pretty generally with the chemists on this head, that the abnormal chemical products, excretions, and deposits, as well as the primary elements of diseased swellings, exudations, and false membranes, differ from normal ones, only in their abnormal situation; and when in a state of complete chemical and organic development, some such deposits can at times be removed by the application of substances which hasten the transformation of matter (as culinary salt in scrofula) and which subject the deposits afresh to the influence of transmutation. Others obstinately resist every attempt of this kind, and fall (like carcinoma and tubercle) into a state of chemical destruction, that involves the harmony of the whole organism.——Bence Jones, a disciple of Liebig, refers the *materia peccans* of the diseases just named, to the abnormal quantity of imperfect excrementitious forms of proteine and its compounds, and assumes a threefold division of diatheses into the uric acid, the oxalic acid, and the phosphoric acid. ———By the uric acid diathesis he understands that condition of the organism which in urine is followed (in consequence of less proteine being oxidised than is wanted for the formation of urea) by a continued and excessive deposit of uric acid, free, or united to a base. The cause of excessive formation of uric acid is either an absolute diminution of the quantity of oxygen assumed by the body, or the proteine must share the inhaled oxygen with the articles of food which are free from nitrogen (as fat, starch, sugar, alcohol and spirituous drinks,) which are converted into carbonic acid, and carried off by the respiration. The devouring of much animal food containing proteine, and of rich dishes, and the use of spirituous drinks along with an easy mode of life with diminished exercise, and diminished assumption of oxygen, are assigned as the predisposing causes of the uric acid diathesis. Its remedies are thus obvious. These views are however by no means generally received.———Out of the uric acid diathesis, a secondary one, the oxalic acid, develops itself at times. In this case, the oxidation of the substances to be excreted goes a stage further, but still falls short of the normal one. Dr. Bird considers the oxalic acid diathesis, which he believes to be more common than is usually supposed, a variety of azoturia, in which the kidney converts part of the urea or of its elements into oxalic acid. In calculi we often find concentric layers of urate of ammonia, and of oxalate of lime alternating, which have been formed according as the patient has varied his mode of life.———As to the phosphoric acid diathesis, Jones divides it into the true and the false: in the first, in consequence of the general condition of the body the urine is alkaline, and the phosphates are deposited: the false one again depends on disease of the urinary organs themselves, which causes decompositions of the urea and precipitation of the earthy phosphates. In the treatment of the phosphoric acid diathesis, vegetable acids are indicated, and the avoidance of vegetable substances containing many phosphates, as bread and potatoes.

Bile is, according to Liebig, not intended for direct excretion from the body, and only a very small trace of bile and cholesterin is to be found in the fæces; its soda is used again in digestion, and its chief constituent, the choleic acid, is used in the formation of the carbonic acid which is expired. The increased or diminished formation of bile has a great many phænomena of disease associated with it. Soda, and therefore especially the consumption of common salt, is absolutely essential to its formation. When it is in excess, the formation of bile is increased and accelerated, and when that material is not supplied in sufficient quantity in the food, (especially consisting of the Amylaceæ) the fat deposited in the body must be applied in its stead. On this account, men and animals that consume much salt, do not grow fat: for the same reason saline waters are ordered in obstructions of the liver; on this account in tropical countries the eating of melons very rich in alkalies produces bilious fever,(?) in which the transformation of matter goes the length of dissolving the fluids of the body. Hoffmann ascribes bilious pneumonias to the bile that has been formed not being consumed, and the efficacy of tartar emetic, to its evacuating the bile from the body, after which the oxygen is able to produce the ordinary transmutation of the proteine compounds.——— In diminished formation of bile, the portion of oxygen which formerly made carbonic acid from the bile, unites with other matters, and more varieties of oxy-proteine are produced, than can be made use of, (Tuberculosis, &c. are the result). ———As regards scurvy and scrofula, Dr. Kloss believes, that after a comparison of the discordant accounts on the subject, he has obtained this general result, that in scrofula, salt is not present in sufficient quantity for the production of the necessary supply of bile, while in scurvy, salt is present in excess, and the amount of articles of diet free from nitrogen is diminished, which again are the most powerful causes of scrofula. Both conditions are attended by an increased action of oxygen on proteine. In scrofula and tuberculosis deposits of unconsumed proteine take place—in scurvy, owing to the sea-air being rich in oxygen, there is a complete consumption, and a loss of proteine.

As regards *lactic acid,* to which Lehmann assigns so important a physiological action in the body, and which he considers to be a universal solvent and agent of transportation, as well as a material element of the organism, although it can nowhere be found, according to Liebig, it may be assumed from the more recent observations, that its formation is unnecessary to the production of the ordinary vital phenomena, and that it is an imperfectly excrementitious matter (formed in the place of carbonic acid). Produced in small quantity from vegetables in the stomach, it is consumed by the respiratory process, and converted into carbonic acid. Large quantities of it are abnormal, and occur in the various excretions: they produce a lactic acid diathesis, which affords the *materia peccans* to scrofula, rickets, chronic eruptions, &c. We may add, that increased formation of lactic acid, and diminished secretion of bile accompany each other. Liebig denies the existence of this acid in the animal fluids. Berzelius still believes in it, and Pelouze seems to attribute to it important functions in the animal economy.

As in plants the presence of a certain quantity of inorganic matters is necessary (according to Liebig), so also is it in animals. The blood especially, as the centre of nutrition, manifests a tendency to preserve its inorganic constituents in a medium or normal state, in as much as on the one hand, it gets rid of all salts, &c., whenever they enter it in more than due proportion: and as on the other hand, discomfort or actual illness ensues, whenever the normal quantity is not supplied. Examples of this are offered by the varying quantities of iron contained in the blood (for instance its deficiency in chlorosis), and by the different quantities and qualities of the earths of the bones, in diseases of the osseous system.

Remarks on Dr. Boase's *Primary Geology. By Captain* Campbell, 21*st Regiment, Madras Army.*

"A Treatise on Primary Geology, being an examination both practical and theoretical of the older formations. By Henry S. Boase, M.D., Secretary of the Royal Geological Society of Cornwall, &c. &c. 8vo. pp. 399. London: Longman and Co. 1834."

I have frequently had occasion to allude to Dr. Boase's work, in communicating such geological information as I have had opportunities of picking up, and as the book is, I believe, but little known in India, these remarks are intended to afford fellow-labourers in science an idea of the information it contains, and as a just tribute for the advantages I have derived from referring to it.

The author, after a long period of twenty years passed in the pursuit of geological information in Cornwall, informs us that, having remarked, "Many facts which appeared to be incompatible with the prevailing theory, he was induced to publish them in the *Cornish Transactions*, and to attempt their solution by another explanation."

To consider the validity of his objections, it was agreed that they should be discussed at a general meeting of the British Association for the Advancement of Science, and this work was undertaken for the purpose of making the members in the first place fully acquainted with his views: for, as the author remarks, "Truth, not victory, is the object contemplated: and if my conclusions have been legitimately deduced from the facts brought forward, their value cannot be diminished by an exposure to the fullest scrutiny."

As might have been expected, the correctness of the author's views has been disputed by those who tell us that "the theories of primary geology have been settled long ago." By those who having examined imperfectly a confined and partially exposed tract of primary rocks, call their science "a knowledge of the earth," and by all those who cannot believe descriptions to be correct, which may be at variance with their preconceived ideas of natural phenomena. He has been told,

"That the granitic formation of Cornwall may not be analogous to that of other countries: that he has greatly erred in supposing the circumstances of this narrow peninsula to be applicable to all granitic districts; and that a more extended knowledge would lead him to confess, with the peasant Tityrus,

"Urbem, quam dicunt Romam, Melibœe, putavi
Stultus ego huic nostræ similem."

In his 3rd and 5th Chapter, the author in copious extracts from published descriptions, endeavours to show how far his description of facts in Cornwall agrees with observation in other parts of the world, and comparison can be made also with my imperfect description of the similar formation of the Bharramahal in South India.

In consequence of the hasty manner in which the work has been drawn up, a want of classification of observation and remark is apparent throughout, by which the perusal is rendered fatiguing and laborious, although it is written in a plain and pleasing style; but it is to be hoped that in a second edition this objection will be removed.

Upon the neglect of the study of the primary rocks, and the very few published minute descriptive details regarding them, the author remarks:

"The granitic formations have not been carefully studied by all the cultivators of Geology during the last twenty years: and even now they attract little attention, as is clearly demonstrated by the brief and unsatisfactory manner in which they are sketched in the recent and otherwise excellent works of De la Beche and Lyell. Dr. Macculloch, during the earlier part of the period specified, continued to enrich this branch of the science with a vast body of facts, to which I am indebted for numerous and most important illustrations: but with this exception no Geologist of note, in this country, has published any minute and descriptive details concerning the primary rocks; all have been absorbed in the pursuit of the wonderful and fascinating knowledge unfolded by the fossiliferous strata."

Also:

"In most of the lately published geological accounts of countries we look in vain for details concerning primary rocks: we sometimes indeed learn, that such and such a district consists of granite; but cannot collect any information concerning its composition, or the manner in which its varieties are associated together."

Also:

"This deficiency is attributable to two causes: first, to the indisposition of Geologists to enter into mineralogical minutiæ, which they have hitherto considered in this country to be comparatively unimportant; and secondly, to the want of such favourable opportunities for investigation as occur in the cliffs of Cornwall."

In remarking on the advantages of the study of the primary rocks, the author quotes De la Beche:

"The inferior stratified rocks may not at first be so attractive as the contemplation of the varied forms of organic life, and the probable conditions under which it may have existed; but it will nevertheless be found equally, if not more, delightful, as the enquirer obtains more certain results, from the investigation being conducted through the medium of the exact sciences."

Upon the effect produced by a constant reference to theoretic system, it is remarked, that, "It prevents the student from taking practical lessons in the book of nature, until he has completed the course of theoretical instructions; and then it too frequently happens, that he can only make his observations according to the prescribed rules, and under a particular bias, prejudicial to impartial observations."

By theoretical Geologists, it is contended that the mineral character of a rock is a subject of little importance, because it does not afford the means of estimating the supposed *age* or the time of its formation; but without entering at any length upon the discussion of such views, it will be seen at once that in a *descriptive* science, it is by the mineral character alone that a rock can be identified.* In advocating the advantages of a nomenclature depending upon geological relations, Humboldt is made to remark in the English translation of his work on the 'superposition of rocks,' page 8:

"Under the equator, as in the north of Europe, the beds of a real transition syenite lose their hornblende without becoming another rock."

Now as a rock is a crystalline aggregation of several minerals, and as its identity depends on the number, the proportion, and the mode of aggregation of the component minerals; it is difficult to understand how it can be asserted, that a rock is the *same*, when it is avowedly *different*. Dr. Macculloch has, with his usual acumen, detailed and considered the advantages and disadvantages of both the geological and mineralogical methods, but the correctness of the following remarks of our author will probably not be denied:

* In descriptive science we ought not to exclude any characters, and it is in this spirit we believe that geological enquiries are now conducted. It is true that in primary rocks we have hardly any other than mineral characters to guide us. We may remark, however, that some of the so-called primary rocks, even some of those we believe described by Dr. Boase in the West of England, have by the more recent enquiries of Sedgewick and De la Beche been found not to be so. We allude particularly to certain slates of Devonshire, in which distinct and peculiar fossil remains are now found, although they were previously regarded, we believe, as primary.—Ed.

"If a rock be designated according to its geological relations, its name must be liable to change, because the principles of the science are not as yet permanently established; besides, on this plan, in the examination of countries previously unexplored, too much depends on the correct judgment of the observer: but when a rock acquires a name from the nature of its composition, whether purely mineralogical, or blended with organic remains, then this part of the science becomes perfectly descriptive, like the other branches of Natural History; and much curious and accurate information may then be expected from travellers who are not accomplished Geologists, and Dr. Macculloch, although he has so strongly advocated the geological method of description, admits in his directions for conducting geological observations, ('System of Geology,' Vol. II. page 473,) that a correct description of its mineral character is necessary, as the varieties of this rock are highly interesting, especially under its passages into trap."

If then it is generally admitted, that a particular mineralogical character caused by one mineral, *i. e.* the superabundance of hornblende, is interesting and worthy of notice, why should not the same be allowed, and attended to, with regard to other minerals; Dr. Boase having shewn in Cornwall (and the same also occur in India) that the changes in the primary rocks are highly interesting, and afford an opportunity for the most intricate researches.

Dr. Boase thus unfolds the plan and object of his work:

"In conducting the proposed enquiry, there are two objects which demand attention: first, the description of the primary rocks both of Cornwall and of other countries, in order to ascertain in what respects they are analogous to each other; and in the next place, an examination whether the phenomena exhibited by these rocks are in accordance with the principles of the prevailing theory. On this plan the following pages will be nearly equally divided between a narration of facts and hypothetical speculations; and the former part will lead to such lengthened preliminary details, as to constitute an essay on primary geology: which so far from detracting from the interest of the work, may perhaps impart to it a more permanent value than it would otherwise possess. Indeed, without such an introduction, the succeeding theoretical discussion would not be generally understood.

"It has always been kept in view as an important object, to preserve these details as free as possible from all hypotheses: but the language of the science is, in many instances, so engrafted and founded on theoretical speculations, that it could not be always accomplished; for in some cases, the published descriptions would not admit of translation into less exceptionable language without the risk of perverting the author's meaning, or of incurring the imputation of misrepresenting facts.

"In the arrangement of these details the following order has been adopted:

"*1st.* A description of the various kinds of granitic rocks, and the modes in which they are associated together.

"*2nd.* Of the primary schistose rocks, under the same relations.

"*3rd.* Of the structure of the primary rocks.

"*4th.* Of the nature of the primary rocks, both granitic and schistose, at their junction with each other.

"*5th.* Of the modes in which these rocks are intermixed and connected together.

"*6th.* Of the mineral and metalliferous veins by which these rocks are traversed."

In his 2nd Chapter, the author enters upon a minute description of the granitic rocks of Cornwall, which being in a great measure technical, it would be difficult to make a summary interesting to the general reader.

The following definition is given of the application of the name:

"Granite, in the common and original acceptation of the term, denotes a rock composed of felspar, quartz, and mica. It oftentimes contains in addition to these, some other minerals; but those just enumerated are considered, in the following pages, as *essential* to true granite; and if either of them is wanting, the compound may then receive a distinct denomination. These component minerals of granite, both essential and accidental, are united together by a confused crystallisation, not only mutually penetrating and interfering with each other, but sometimes the small crystals of one are completely enveloped in the large crystals of a different kind of mineral. And it is a very common occurrence for one or even more, of these minerals to be developed in large crystals in a granular basis of the whole, so as to constitute a porphyritic granite. This character is generally imparted by the felspar, and rarely by the quartz or mica."

In his advocacy of such a hypothetical term as "True Granite," it may be doubted if Dr. Boase may not himself have fallen into the error which he blames in others. For the term is totally uninteresting, and even unintelligible, unless with reference to theoretical assumptions. On this point Dr. Macculloch's remarks (System of Geology, Vol. II. page 81) are peculiarly apposite:

"The term granite has by some been limited to a compound of quartz, felspar, and mica, and the word syenite, adopted for those containing hornblende, laying the foundation of a large progeny of errors. The distinction is as unfounded as it is pernicious. To the first compound there is sometimes superadded hornblende, or else it becomes a substitute for the mica, producing a granite even more abundant than the first; while the ternary compounds also loose one or other of their ingredients, and become binary: all these varieties further occurring on the same mass, and often within a very small space. In nature, therefore, granite ranges within four essential minerals, quartz, felspar, mica and hornblende, in different combinations of two, three or four. If this were merely a question of mineralogy, the distinction, thus condemned, might be conceded without inconvenience; but as the nomenclature of rocks is a nomenclature for the purposes of geology, it is easy to see what fallacies may intrude from an improper use of terms: as has happened from that of syenite, thus making a distinct geological rock of any granite which happens to contain hornblende. Thus have the latest been confounded with the older unstratified rocks; not only producing inextricable confusion, but permitting trifling observers to impose on their readers by false or flimsy statements founded on mere terms."

To return to Dr. Boase's description. He remarks:

"In Cornwall the granitic rocks occur at the surface, in the form of eight insulated masses, four of which are of much greater extent than the others; each of these masses presents some peculiarities, but all of them contain several varieties of true granite. The most general feature of the Cornish granite is the abundance of its felspar, shorl however is the characteristic mineral of this district; indeed it is seldom altogether absent from these granitic rocks for any extent, though it is often in such minute particles as to require a magnifying glass for its detection.

"Thus we learn that the granitic masses of Cornwall are not, as some have supposed them to be, composed of one kind of rock, uniform in its constitution, and uninteresting in its varieties, but as complex in their composition as the stratified rocks; and in their mineral transition into each other, afford us curious and instructive subjects for investigation: on this account, the utility of mineralogical distinctions is obvious; and it will be still more apparent when we consider these granitic rocks hereafter, not only in their relations toward each other, but also towards the crystalline schists with which they are associated."

In his 3rd Chapter, Dr. Boase proceeds to compare the granitic rocks of other countries with those of Cornwall, wherever he is able to find minute mineralogical descriptions given in sufficient details for his purpose, and remarks:

"Notwithstanding the paucity of such description, yet sufficient data may be gleaned for our purpose, which is to show, that the granitic rocks of other countries exhibit similar variations in their mineral composition, and similar associations as those of Cornwall."

And at the close of the chapter,

"In concluding these brief details concerning the granitic rocks, we will only observe, in addition to the remarks which have been incidentally made, that a comparison of the granitic formation of Cornwall with that of other countries shows that some compounds that are of rare and limited occurrence in the former, are developed elsewhere in extensive masses: as the instances of the binary compounds of quartz and mica, and quartz and talc: and vice versâ, the porphyritic granites, and porcelaineous protogine, sparingly scattered in other countries, are abundant in Cornwall, as are likewise, in a still greater degree, the shorlaceous varieties of granite, and the binary combinations of quartz and shorl; facts which point out to us that all well marked compounds of distinct minerals ought to be distinguished by appropriate names, although they may be only known to exist in small quantities. The above specific binary compounds are as much entitled to distinct names, as shorl-rock: if they be not required in the one case, neither is it necessary in the other; so that the terms shorl-rock, hornblende-rock, and others, should be expunged from the geological nomenclature, if this view be persisted in. If the knowledge of the primary rocks be a study worth pursuing, a mineralogical classification must be ultimately adopted: for, accurate details concerning their transitions into each other, and their modes of association, cannot be given on the present system. This topic will be reverted to; but in passing we cannot help seizing every opportunity to urge the necessity of this reformation, being firmly convinced that no measure will tend more to promote the progress of this department of the science."

I think the correctness of the above remark will be readily assented to by Indian Geologists, but the question whether such minute descriptive details cannot be made interesting, as well as useful, I must leave for the Zoologist, the Ornithologist, &c. &c. to determine. For in the pursuit of these sciences, it appears to me, that a great portion of the interest lies in that minute, and accurate description of details by which species and varieties are distinguished with certainty, although they have never before been seen.

In the 4th Chapter the primary schistose rocks of Cornwall are described, and the author commences with the following preliminary remarks:—

"The primary rocks have been divided into stratified and unstratified, the latter comprising the various granitic rocks, which generally occur in large insulated clusters, and have a compact and massive structure; the former denoting those non-fossiliferous rocks which surround, and are intimately connected with the granite, and are commonly distinguished by a slaty or schistose structure.

"It will be found, however, that this division is perfectly arbitrary: for both stratified and unstratified rocks are so intermixed in their associations, that it is sometimes impossible to decide to which of these classes a rock, under examination, belongs: in order therefore in some measure to avoid this confusion the primary rocks will, in the following pages, be supposed to consist of granitic and schistose groups; only understanding, by this division, that in the one granites, and in the other slates predominate; and it must not be forgotten that this is an artificial, not a natural arrangement, merely to facilitate description.

"The rocks which immediately surround the insulated masses and ranges of granite, are very numerous; and although they are generally schistose, they are sometimes massive, and in their structure very similar to the granitic. These circumstances, however, will come under consideration hereafter; at present our object is to obtain a knowledge of the composition and internal appearance of the individuals of the schistose group.

"In describing the various schistose groups, that of Cornwall will in the first place demand our attention. It may be divided into two series, the porphyritic and the calcareous; the former including those rocks which occur next the granite, and contain porphyries and other granitic rocks in the form of regular beds or *elvan-courses*, and which abound in veins of tin and copper ores; the latter, comprising those rocks which are more or less remote from the granite, contain no *elvans*, but abound much more in greenstone, especially its obscurer varieties, and in dark-coloured limestones, sparingly metalliferous, containing no tin, but productive of lead and antimony; and lastly, possessing occasionally organic remains.

"Most of the rocks of the calcareous series appear to be referrible to the older portion of that class which is intermediate between the primary and the secondary, commonly known by the name of *tran-*

sition; a class of Werner's system which for many years had fallen into disuse, but has been lately revived on account of its convenience.

"The individuals of this calcareous series will not be treated of in this place, with the exception of the magnesian rocks, serpentine, euphotide, and talc-schist, which immediately follow the porphyritic series.

"The rock in contact with granite in Cornwall has been usually called argillaceous schist, or clay-slate. Dr. Berger, and after him many other Geologists, have termed it greywacké; but as Professor Mohs has very justly observed, it has no resemblance to this rock: some have adopted the word *killas*, from the miners, to denote this kind of slate, but have used it more vaguely than even it is done provincially; for even the miners acknowledge that some important varieties of this rock are not true *killas*, but a *kind of elvany killas.* The remarks of the late Rev. J. J. Conybeare are very appropriate:—'The common *killas*,' he observes, 'after much question as to its being a variety of greywacké, which, if that term has any definite meaning, it unquestionably is not, has been at last admitted on all hands to be a genuine clay-slate; but this appellation, perhaps, after all, does not convey a much clearer notion of the real nature and constitution of the rocks included under it, than the repudiated greywacké.' In fact, no term has been more misapplied than that of clay-slate; and its application has been general to all fine slaty rocks, no matter to what member of the primary slates they belong, or, indeed, whether they occur in the transition or secondary classes. In Cornwall, for instance, there are at least a dozen kinds of rocks that are very fissile, all of which have been indiscriminately called clay-slate, notwithstanding they sensibly differ from each other in their external and physical character, and are respectively associated with distinct *suites* of rocks."

In the 5th Chapter, Dr. Boase has collected a detailed description of the primary schistose rocks of other parts of the world, for comparison with those of Cornwall, and remarks:

"In attempting to shew that the primary or crystalline schists of different countries are the equivalents of those of Cornwall, it is not intended to assert that they are all of the same nature, and referrible to precisely the same geological epoch: on the contrary, it is wished for the present to avoid all conjectures concerning the nature of their origin, and only to express that these slates do, as in Cornwall, bear a certain relation to the granite with which they are associated: and consequently all slates, both foreign and Cornish, which have the same relative connection and position with the granite, may be regarded as parallel or equivalent rocks."

The 6th Chapter contains an investigation of the varieties of structure, both external and internal, which is found in the various primary rocks, both granitic and schistose.

In the 7th Chapter,

"The relative position, and the nature of the granitic and schistose rocks at their junction,"

is considered, and after shewing that an unconformable position of the schists incumbent upon granite is common, and they are known in many cases to abut against the granite with the seams of the lamination: it is proved that at the junction not only is the structure of the schists and their mineral composition much modified, but that the granite also is changed in a similar manner; and the author remarks,

"In short, the granite and slate of Cornwall, at their junction, are frequently so similar, both in composition and concretionary structure, that the detached blocks, as they lie side by side, cannot at a little distance be distinguished from each other; the darker colour of the slate, and its tendency, often slight, to break into laminæ, are sometimes the only differences to be detected on a closer inspection."

And the same remarks are shewn to be applicable to the granitic and schistose rocks of other countries also.

Of the 8th Chapter, the purpose is thus stated:

"Having detailed in the preceding chapter the nature and position of the schistose rocks at their point of contact with granite, it is now proposed to consider how these stratified and unstratified rocks comport themselves, when more intimately intermixed in the form of beds, dykes, veins and detached portions of various irregular shapes and dimensions."

After noticing the occurrence of elongated portions of granite imbedded in the schists as "Elvan-courses," the author remarks :

" Besides these somewhat regular beds or courses of granitic rocks, irregular masses or bunches of various dimensions also occur in the primary slates. These are particularly abundant near the junction, as is well illustrated on the sea-shore near the village of Mousehole, in Cornwall; where they are seen to be connected with the slate on all sides, sending out veins, passing into the slate by mineral gradations, forming, with portions of the slate, the same concretions, and also containing insulated pieces of slate of different sizes and shapes. It might be contended that these bunches of granite are merely protuberances of the subjacent granite : in some cases, even at Mousehole, they probably are; but that they are not always so, is demonstrated by the workings of Dolcoath mine, where several of these outlying masses of granite have been found to be perfectly insulated.

" The granitic rocks are thus disseminated throughout the crystalline schists, under various circumstances, and in different forms; so likewise the latter rocks occur in detached portions in the granite not only at the junction, but in the main mass, some distance therefrom."

The author then gives minute descriptive details of the phenomena of granite veins, and thus concludes :

" In short, wherever granite-veins have been observed at the junction of the granitic and schistose rocks, they exhibit similar phenomena to those of Cornwall. With very little alteration, therefore, we may, with Mr. Carne*, sum up the evidence on this subject in the following manner :—

* Geol. Trans. of Cornwall, vol. ii. p. 69.

"1. The composition of the granite-veins is generally different from that of the main body of granite, and it is very frequently of a much smaller grain. It will, however, be found to resemble the veins, courses, or beds which form an integrant part of the central mass.

"2. The slate which is contiguous to the granite-veins, is frequently much harder, more crystalline, and its texture is, in general, less schistose than that which is more distant: and it often exhibits mica, hornblende, or other minerals in a distinct form, the nature of the mineral depending on the composition of the containing rocks.

"3. Some granite-veins are closely connected with the slate, both being intimately united and inseparable; and indeed, sometimes, as in the case of Rannoch, one of the component minerals of the veins is crystallised, and its crystals penetrate and are contained in the slate as well as in the vein: it often happens, however, that the veins can be easily detached from the slate, and have distinct walls; that is, an open seam or joint divides them from the latter.

"4. Detached portions of the slate, having the appearance of fragments, are frequently insulated in the granitic veins, and sometimes indeed also occur in the main body of granite; and, *vice versâ*, similar portions of granite are often completely enveloped in the slate.

"5. These veins are sometimes so abundantly and intricately blended with the slate, either one or the other predominating in the mass, that the whole is involved in apparent confusion; whilst in other cases the slate reposes on the granite without any appearance of dislocation or disturbance, and is traversed by well-defined granite-veins.

"6. These veins have, in some cases, been traced to the main mass of granite, with which they appear to be in complete union, and to form one body, losing entirely their character as veins; whilst in other instances these veins have been found to continue their course through the granite as well as the slate.

"7. The granite-veins have no general direction or position; they run towards every point of the compass, and dip at every angle from the horizon to the perpendicular.

"8. These veins are sometimes straight, and pretty regular in their thickness; but in general they are more or less tortuous, and gradually become smaller as they recede from the granite.

"9. It occasionally happens that where these granite-veins occur, the slate is intersected by numerous small quartz-veins: some of these are traversed by the former; others, on the contrary, traverse and heave both the granite-veins and the other quartz-veins."

The 9th Chapter is devoted to a minute description of the mineral and metalliferous veins in primary rocks, and the author thus commences it:

"Before concluding this sketch of the primary rocks, it is requisite, in order to complete their description, to make a few observations on the mineral and metalliferous veins by which these rocks are traversed. The details on this subject will be almost entirely drawn from Cornwall, where the phenomena of veins have been more extensively and more minutely investigated than in any other country; and, indeed, as far as works on this subject in our language are concerned, Cornwall has been the principal source of information. The metalliferous veins contained in the secondary rocks are not unimportant, either in an economical or scientific point of view; but to enter on their examination, at present, would be departing from the plan of this work, and would, if they were fully treated of, require an entire volume. Besides, it is desirable that the subject of veins should be carefully described under distinct heads, according as the rocks with which they are associated vary in their nature: and when a large body of facts has, by these means, been collected, then our generalisations may be placed on a more permanent basis; but, at present, the facts which we possess concerning veins are fully equalled, if not exceeded in number, by speculations on their nature and origin.

The vast importance of an accurate knowledge of veins to our commercial welfare and prosperity, is generally admitted; and Geologists, also, have always regarded veins, not only as a curious and interesting feature in the structure of the earth, but also as affording valuable evidence concerning the internal movements and convulsions which our planet has periodically experienced. Notwithstanding, however, the high estimation in which this subject is generally held, it is astonishing how little progress has been hitherto made in this department of geology: every other branch of the science abounds with copious and good descriptions, which are daily increasing in number and in importance; whilst that of veins scarcely possesses any plain and honest details unencumbered with hypothesis. Indeed, the low state of our knowledge of these curious phenomena is plainly denoted by the neglect with which they have been treated in the most recent and most esteemed geological publications. Thus the student looks in vain for any practical information on this subject in the voluminous work of Lyell on the Principles of Geology: and in the Manual of De la Beche, he must rest contented with some short details; indeed, the author has apologised for the brevity with which he has treated this branch of the science, and adds, that his notice of it 'is solely intended to call the attention of the student to a few interesting circumstances.' We rather suspect that the confusion of facts and theory in the descriptions of veins, rendered the subject unfit for the pages of his practical work. In Macculloch's System of Geology, also, although the account of veins occupies a few more pages, yet it does not convey an accurate notion of a vein; and is, as in every other work, so blended with hypothesis, that the student cannot distinguish fact from conjecture.

"This fault, both in our elementary and systematic works, is certainly to be regretted: it is not, however, attributable to these eminent Geologists, but to the mode in which this part of the science has been treated; and their names are only here adduced as authorities to show the truth of our observation, that the knowledge of veins is very defective."

And the Chapter thus concludes:

"In concluding this brief sketch of the Cornish veins, which has been divested as much as possible from all theoretical considerations, we would ask whether enough has not been advanced to show that the general idea of these veins is incorrect: and when we hereafter discuss the nature of their origin, it will be seen that our knowledge on this subject is as unsatisfactory as the descriptive details. From the leading facts which have been now brought together, we learn that veins, whether large or small, possess precisely the same characters: they are intimately connected with the containing rock by mineral transitions, and vary in composition as the nature of the rock changes; they are not straight, but are curved both in their course and dip; their sides or walls are only distinct from the rock when the seams or joints are developed by decomposition, and are always partially confounded with the rock by a perfect intermixture or transition; they intersect each other both in length and depth, and in the larger veins those series which run in the same direction are generally affected by the others in a similar manner; but this is not invariably the case: their intersections are very frequently attended by alterations in the course of the disconnected veins, but the amounts of these apparent movements, in an extensive series, are very various, even in the case of a single intervening vein."

In the 10th Chapter, the author sums up the inferences he draws from the results of his investigation of the phenomena of the primary formations of Cornwall, and its comparison with the description of that of other countries: these remarks may be abridged as follows:

1*st*. That there is always a similarity of mineral composition between the granitic rocks and the adjacent primary schists, with which they are associated.

2*nd*. That the same brecciated structure or apparent origin from the conglomeration of fragments occurs both in the schistose and granitic primary rocks, and if allowed to be an evidence of derivative origin in the one case, so must it also be allowed in the other.

3*rd*. That the granitic and mineral veins of Cornwall, gradually pass into the rocks they traverse, and both present the same appearance of heaves, slides, and similar phenomena, commonly referred to motion, when veins of the same or of a different class interfere with each other.

4*th*. That the origin of both the schistose and granitic rocks is the same.

5*th*. That parts of the schistose formation present by insensible graduation a perfect granitic structure.

6*th*. That the primary schists are not stratified, or that the granitic formations are as much stratified as the schistose.

7th. That the granitic and primary schistose formations are only positions of the same continuous formation with a variety of structure.

8th. That as masses of granite are found to occur insulated and imbedded in the schistose formations, and connected with the schists by the most intimate gradations of structure, and mineral composition; it is possible that all the granitic formations, however extensive, may be merely imbedded varieties in the schistose.

9th. That the granitic rocks in the same continuous formation are found to present every variety of mineral composition, and although a particular mineral is found to prevail in particular localities, that mineral composition cannot be allowed to be a guide to the age or mode of formation of the granitic rocks.

I have shewn that Dr. Boase's 7th Inference derives support from an examination of the association of the granitic and schistose rocks of Mysore, and the idea expressed in the 8th Inference has often occurred to me as a subject of speculation. It is supported by the insulated appearance of the granitic mountain masses in the Bharramahal and in most parts of South India; also from the globular concretions of granite of which many granitic hills are formed, but the evidence has appeared to me to be strongest in support of the probability of the granitic formation of Southern India being continuous in all its vast extent.

In his 11th Chapter, the author gives a synopsis of the prevailing theories regarding the nature and oirgin of the primary rocks, which he thus concludes:

"Having now given a general view of the prevailing theory concerning the primary rocks, and having endeavoured to elucidate the same by copious extracts from Lyell's 'Principles of Geology,' we proceed to point out those parts of the theory which appear to be objectionable; and to state the order in which it is proposed to conduct the discussion on which we are now about to enter.

"It is laid down, as a fundamental principle of this theory, that the primary rocks consist of two distinct classes; not distinguished from each other for the sake of facilitating scientific descriptions, but severed by well-marked characters, and by natures diametrically opposite: the one having been formed from materials deposited and arranged by water; the other, by the action of an internal fire, at considerable depths below the surface. These conclusions are said to be founded on physical evidence,—on facts recorded by numerous observers in various parts of the world: and it may therefore appear to be an idle waste of time, an attempt of no little presumption, to make even a show of assaulting a position so strongly fortified. There is no intention of disputing the correctness of the facts, when such have been sufficiently investigated and faithfully described; but the evidence which these afford, may be sometimes disputed: for what is this physical evidence of which we so often hear, and to which theorists so frequently appeal? It is only a testimony recorded in hieroglyphics of an unknown character, and which may therefore admit of divers interpretations. In our attempts to decipher these characters, no solution can be admissible, unless it be applicable to all without exception. Now, the prevailing theory satisfactorily explains a great body of these facts, but it will be the object of the following pages to show that there are some phenomena which it does not appear to interpret in a clear and convincing manner. For instance, we are taught that gneiss, and other primary strata, which so nearly resemble the granitic rocks, especially at their junction with each other, are merely sedimentary deposits altered by the contact of granite in a state of fusion; and, that the condition of secondary strata next to trap-rocks, clearly indicates that such changes do take place under similar circumstances: but, after making every allowance for the comparison of small things with great, we shall strive to show that the cases compared are not analogous; that the evidence brought forward bears witness to changes produced by heat, but not to such changes as the primary strata are supposed to have undergone; viz., an assimilation of the aqueous to the igneous rocks, by the introduction of *additional elements* into the composition of the former.

"Lastly, the prevailing theory embraces igneous convulsions, as one of its leading principles; by which the stratified rocks are said to have been forced up from their original horizontal position, and inclined at various angles, by which they have been curved and contorted; and by which they have also been rent and fissured in various directions: thus affording space for the intrusion of igneous rocks, in the forms of veins or dykes, and for the formation of mineral and metallic veins; and also occasioning those faults and dislocations so common both in the stratified and unstratified rocks. To this doctrine, also, we cannot give our assent *in toto*. No one can deny, that volcanic fires have in former times occasioned, and still continue to produce, great mechanical alterations in the structure of the solid crust of our planet; but it does not appear to be satisfactorily demonstrated, that the inclination of the primary strata is attributable to this cause; nor, that the phenomena of granitic veins and dykes, and of metalliferous veins, are infallible indications of igneous convulsions.

"These are grave and weighty points of dissent, as regards the stability of the Plutonic theory; and, if we can only succeed in the first instance, in giving plausible reasons for this difference of opinion, the objections ought surely to receive a candid and patient examination: they may be satisfactorily answered, or they may, perchance, prove knotty and stubborn opponents. In either case, it may be requisite to make appeals to nature by additional investigations: so that there is some satisfaction in thinking, that, in whichever way this discussion may terminate, by thus digging about and examining the ground of the radical doctrines of the science, the field of geology, like that of the departed husbandman in Bacon's fable, may be rendered more fertile and productive.

"In conducting the proposed enquiry, it is intended to arrange it under the following heads:—

"1. Are the primary schistose rocks stratified?

"2. Have the primary schistose rocks been elevated into their present inclined positions by Plutonic agency?

"3. Are the primary schistose rocks sedimentary deposits, altered by the contact of igneous rocks?

"4. Do the primary rocks afford physical evidence that they have experienced fissures, dislocations, and other mechanical movements?

"5. May not all the phenomena of the primary rocks, both stratified and unstratified, be satisfactorily explained on the supposition that these rocks are of contemporaneous origin?"

In the 12th Chapter, the subject of "An enquiry into the nature of stratification" is entered upon, in which the various phenomena observed in the primary rocks in various parts of the world, are compared, and the author thus concludes it:

"We shall, therefore, conclude the chapter, with remarking, that this view not only reconciles many of the incongruous opinions which have been advanced on this subject by the most eminent Geologists; but it offers us an explanation of those parallel lines which often intersect formations, undoubtedly produced at different times; an occurrence that has caused no little perplexity. And lastly, it points out, how a difference of opinion has frequently existed on a subject so apparently simple, as whether a given rock is or is not stratified; for the term stratum has reference not only to the arrangement of rocks in parallel layers by deposition, but also to the tabular forms produced by joints or seams: and since this is only a variety of structure, common in a greater or less degree to all rocks, it clearly shows that it cannot be made a ground of distinction, much less the fundamental basis for a classification of rocks. The terms stratified and unstratified are, in many respects, synonymous with the two kinds of internal structure,—the massive or compact, and the schistose or fissile: the former predominating in granitic, trappean, and other rocks of this nature, commonly called igneous; the latter being more characteristic of the primary slates, and of the secondary and tertiary deposits, which are of aqueous origin. We have seen, that though each kind of internal structure respectively prevails in certain series of rocks, yet that neither is exclusively confined thereto: and thus it has happened, that some granitic or unstratified rocks have been pronounced to be stratified; and some members of the stratified have been called unstratified intrusive masses, though intimately blended with, and perfectly enveloped in, the former. We contend, therefore, that the various kinds of granitic and primary slates have been unnecessarily separated from each other; that these slates are not stratified, in the usual acceptation of the word, only differing from granite in the mode in which their component particles are aggregated together: and, finally, that although the primary slates in structure often resemble rocks of the fossiliferous groups, yet they are not detrital and sedimentary rocks, as we shall attempt to show in a succeeding chapter."

In the 13th Chapter, the subject considered is,

"Have the primary schistose rocks been elevated into their present inclined position by Plutonic agency?"

The description of apparently elevated strata in various parts of the world is reviewed, also igneous operations now in progress—elevation-craters—changes of level of sea and land—the apparent protrusion of granite in a solid and fluid state—and various other points upon which it is quite impossible to give an abstract of the various important and conflicting evidence collected, but of the nature of which an idea may be formed from the author's concluding inferences.

"On the grounds detailed in this chapter, we therefore conclude that the inclined position of strata is not an infallible criterion of mechanical elevation; that this appearance in the primary slates may be more justly attributed to their original structure, and in many of the secondary strata to the same cause conjointly with their deposition on inclined surfaces; and, that the notion of granite having been protruded through and tilting up the strata, either in a fluid or solid state, does not appear to be countenanced by reference to the known effects of igneous agency; and, lastly, that the situation of strata adjacent to trap-rocks, the supposed connecting link between the granitic rocks, and existing volcanic products, is of too intricate and conflicting a nature to be received as positive evidence of such an occurrence."

(To be continued.)

Notes on the Geology and Mineralogy of Affghanistan. By Captain THOMAS HUTTON, F.G.S.

The route from Ferozepore to Candahar, proceeding viâ Bhawulpore and Sukkur, affords little to attract the attention of a geologist until he arrives at the latter station; the tract of country travelled over consisting principally of loose shifting sands, heaped up by the wind around the stunted bushes of mimosa, with occasional clearings for cultivation in the jungles, which usually border the river Garah. After passing Bhawulpore however, the country improves vastly in cultivation which is both of more frequent occurrence and much richer than in the more Northern portion of the district, but the soil throughout appears to be composed of nearly the same river deposits of *silt* intermingled with vegetable and calcareous matter, while in some places beds of *Kunkur* underlie the silts in the same manner as in the Gangetic Provinces. The country is mainly, if not altogether, dependent upon the river for the supply of water necessary for irrigation, and is every where intersected by deep canals communicating with the Garah, which during the rainy season fills them by the rising of its waters; but at other seasons, when the river has again shrunk within its bed, the Persian wheel is used to raise the water for the crops along the banks, while farther inland, it is either not at all procurable, or is scantily supplied by wells.

During the monsoon many parts of this district are inundated, more especially in the low-lying tracts below Bhawulpore, where I was informed it was not uncommon at that season to see the inhabitants paddling over the submerged fields in small boats. Innumerable land and river shells*

* These consisted of *Pupa indica,* with two varieties, *P. cænopicta ; P. bicolar ; Helix granulata* (of Benson); *Achatina gracilis; Paludina Bengalensis; P. præmorsa; Planobis indicus, P. compressus; P. nanus; Melania Pyramis;* and a species of *Cyrena.* At Roree I found a dead specimen of *Pupa pulchella,* which occurs living in the Hills around Subathoo.

were strewed over the sandy plains, even several miles from the river, a fact which, added to the circumstance of the huts in some parts being built on supports or stilts, bears ample testimony to the extensive floodings which annually occur.

The whole tract of country from Ferozepore to Roree, is strictly *alluvial,* iron sand being in some places plentifully intermixed in the sands along the river's edge; but at Roree a low ridge of *nummulitic limestone* crosses the Indus. On the left bank, the town of Roree stands upon this formation; the fort of Bukkur, in the middle of the stream, is likewise built upon it, and it then extends some distance across the country on the Sukkur side, or right bank.

The rock is chiefly of a pale sandy hue, often approaching to white, and sometimes exhibiting a few scattered *nummulites,* though at Sukkur it appeared to be without them.

The strata are thin and numerous, sometimes much indurated, always compact, and alternating with layers of *flint,* nodules of which are likewise frequently imbedded. I had no opportunity of examining these strata at Roree, but I possess some specimens of *Conus, Clypeus* and other shells, which were found there imbedded in chalky strata; from Bukkur also I possess a flint bearing on it the cast of a *Patella,* which was kindly presented to me by Colonel Stacy.

The dip of the strata in that portion which I had an opportunity of inspecting is slight, and towards the north-east.

Farther research in that locality by those who may now be occasionally stationed at Sukkur, would no doubt bring to light many interesting fossils from this formation, which is a member of the cretaceous system, well known in Europe to abound in marine organic remains; but at the time when I visited Sukkur in 1841, I had no opportunity, from want of time and from sickness, of doing more than noting the few facts here recorded.

From Sukkur to Shikarpore the formation is again entirely *alluvial*, and so indeedi t continues to be up to the very base of the range of mountains which skirts the plains of Cutchee or Cutch Gundava. Proceeding from Shikarpore towards Dadur, the three first marches are through thick jungles of Mimosa and Tamarisk, with occasional clearings for cultivation. Beyond this the desert of Cutchee commences, spreading in a wide and arid plain without a shrub or a blade of grass. The soil of this desert tract is a hard arenaceous clay, containing scales of *mica*, and some calcareous particles. This alluvial tract of country is bounded on two sides by mountains forming offshoots from the great Solimaun range. They appear, generally speaking, to be composed of secondary rocks, some of which furnish abundance of nummulites and other marine shells, while about forty miles distant from the town of Bagh, is a *sulphur* mine which has long been worked, and contains several large chambers, from which, in by-gone days, the mineral was extracted. This mine is still resorted to, and was farmed out in 1839 to twenty men, who paid a sum of rupees 700 to the Governor of Bhag, then a brother of Mehrab Khan, the ruler of Kilat.

The produce of the mine is *native sulphur*, of excellent quality, both massive and crystallised, in octohedral prisms of a clear amber colour. Within one of the chambers is a spring of *petroleum*, which falls in drops from the roof, and is received into a well excavated in the floor. The *adits* of this mine lead into very extensive and spacious chambers, which have evidently been excavated by man in more prosperous days, although the wonder-loving Beloochis swore they were all natural caves, of unknown extent. The chambers are lighted by native lamps or chirags,* and the adits are in some places so narrow, that the miners are obliged to creep in on their bellies; and from this circumstance it

* Little earthen saucers of oil with a cotton wick.

becomes necessary to be extremely careful that the flame is not communicated to the walls, so as to ignite the sulphur. There is likewise a small well of brackish water within the mine, which however is turned to no account. The petroleum is rendered useful by mixing it with the dust and small fragments of sulphur, from which, by boiling, a coarse dark-coloured brimstone, of inferior quality, is extracted. The pure native sulphur is broken into pieces and boiled in oil, from which the common yellow brimstone of commerce is produced. Candahar is partly supplied with sulphur from these mines and partly from Gurmsael and Bulkh ; that from Gurmsael is reckoned inferior to the others, and sells at a lower price. When the markets are well stocked, the best sulphur sells at from 2½ to 3 annas per seer,* and that from Gurmsael at about one anna less. But in the winter season, and at other times, when it is scarce, it sells at from 7 to 8 annas per seer.† The brimstone is usually made at the mines, and afterwards pays a duty at Candahar of 1-40th. It constitutes an article of the Affghan Materia Medica, and is also used for curing itch or feverish eruptions in camels, a disease which regularly attacks them at the commencement of the hot weather, when the old coat of hair falls off. A small quantity is used by the chemists in the preparation of sulphuric acid, but by far the greater portion is employed in the manufacture of coarse gunpowder. Another sulphur mine is said to exist in the direction of Seevee, among the Murrhyes, but of it, I could gain no particulars.

Proceeding onwards from the town of Bhag towards Dadur, the soil is still alluvial, until some miles beyond Mahasur the road winds through hills of crumbling sands and clays, plentifully studded with water-worn pebbles of *trap*, *nummulite limestones*, *sandstones*, *&c.* These hills have a

* Taking the rupee at two shillings, the price is from 3¾*d.* to 4½*d.* per seer, or about 2 *lbs*.. Or 1¾*d.* to 2¼*d.* per lb.

† That is, from 5¼*d.* to 6*d.* per lb.

wasting appearance, and are in many places fading away rapidly under the influence of atmospheric agents, and some indeed have been entirely swept off, leaving nothing but a broad base of pebbles confusedly mingled together, and affording specimens of nearly every rock to be met with in the neighbouring mountains. In some parts again they appear to be imperfectly consolidated or semi-indurated, exhibiting indications of stratification, but usually they are composed of stiff reddish clays alternating with loose textured sandstones, the clays being often horizontally divided by their layers and detached masses of *foliated gypsum*, of a pure and glossy transparency.

From the situation of these crumbling hills, opposite to the openings of the mountain glens, many would perhaps be led to attribute them to the agency of glaciers in former years, were it not that their stratification is opposed to such a doctrine, and we have moreover no data from which to infer the existence of a colder climate over these tracts in former ages, than now.

My own impression is, that they belong truly to the tertiary period, of which both the Bolan Pass and the Shawl district possess some deposits.

It is probable that the destruction of these hills, composed as they are of friable sandstones and beds of clay, has furnished in modern times a great portion of the soil of the desert tract of Cutchi, for the materials of that arid plain are arenaceous clays, containing particles of foliated gypsum. The decay in these outlying hills is not however to be attributed to any more violent agents than are now furnished by the atmosphere; for their destruction is still going on gradually and surely, and it is probable that a great portion of the less indurated strata will eventually disappear. The upper stratum is generally an indurated sandstone of a brownish colour, while the underlying beds are of far greater thickness, but are excessively yielding and friable, and not being sufficiently hard to resist the action of rains, they are consequently crumbled down, and their ruins spread over the plains; the lower beds alternate with clays, and the whole present a wasting appearance. The immediate vicinity of these hills is scattered over with rounded pebbles of limestones containing nummulites and a few other marine shells.

Between this range and the main tract of mountainous country is interposed a fertile plain on which stands the town of Dadur. The cultivation is here well watered from the hill streams, which are usually dammed up at no great distance from their debouchere to prevent the waters from being swallowed up and lost in the thirsty sands beyond, and also to insure a sufficient supply to fill the canals and water cuts which branch out among the cultivation. This system however, while it insures water to a few villages in the vicinity of the hills, effectually cuts off all supplies from the towns situated lower down on the plains, and often reduces them to great distress during the heats of summer.

The entrance to the Bolan Pass on this side is wide and stony, forming a broad defile, through which runs a clear and plentiful supply of water; the Pass being in fact nothing more from one end to the other, than the bed or channel of the mountain streams which drain through it. The road, if such it can be called, is a mere bed of water-rolled stones the whole way; while here and there are intermingled the larger blocks, which the action of the elements on the neighbouring and overhanging rocks has detached and hurled down from their proper sites. The sides of the defile rise up to a considerable height, and in many places are exceedingly precipitous, standing like mighty walls on either hand, and affording a narrow channel for the stream, which winds along through its shingly bed with such a tortuous course, that in some marches we crossed it no less than sixteen times, to the great annoyance and delay of both man and beast. The sides of this Pass at the lower or

Dadur end, are composed of alternating strata of *sandstone*, coarse *sandstone*, *conglomerate*, and beds of semi-indurated or *friable sandstone* and *clay*, which yield like the outlying hills below Dadur, to the action of the weather, and crumble down into sandy clays, which are washed away to the plains of Cutchi by the force of the stream. The matrix of the conglomerate is also friable, and the imbedded pebbles of sandstone, quartz, and various limestones are consequently let loose and strewed in beds over the bottom of the defile. The pebbles thus detached often contain marine shells and coralloids.

The conglomerate is the prevailing rock up to Candye, which was our first march; from whence it extends downwards to Dadur, where it forms a great part of the high undulating land around the town, and is cut into deep ravines by the drainage from the hills. As we approached Candye the defile became narrower, and the sandstone conglomerate which in some places rose high and appeared resting against the sides of the mountains, suddenly gave place to a compact and pale-coloured *nummulitic limestone*, which continued onwards to Keirtah, where it was found to contain a few scattered *nummulites* and a species of *Clypeus*. This rock is in all respects identical with that which crosses the Indus at Sukkur. At Keirtah, the defile opens out and forms a wide stony plain enclosed on the left by strata of shales and clay, and on the right by nummulite limestones, the beds of which appear to be of a pale buff colour below, surmounted by other beds of deeper or yellowish brown shade. The strata on either side have the same dip and apparently north-east.

At Beebee Nanee, which is the third stage, the sides of the defile again approach, and form a mere narrow passage between rocks of nummulite limestone. From this place onwards to Ab-i-goom, the Pass again widens, and the rocks on either side are the same as those towards Keirtah, consisting on the left of thick beds of shales and clay, and the right of nummulite rock.

In the bed of the Pass at this place, but not *in situ*, I found several masses of indurated marly clays containing beautifully preserved specimens of fresh-water shells; some of these blocks were composed of yellowish sandy clay, containing shells of the genera *Planorbis*, *Melania*, *Paludina* and *Cyrena*, intimately mixed up together; and Mr. Benson, to whom I lately submitted specimens, thinks he can recognise some of the shells as still living in India, viz. *Planorbis indicus*, *Melania pyramis*, and *Melania elegans*;* other blocks were composed of hard bluish marl, and contained fine specimens of bivalves closely allied to, if not identical with, the genera *Unic* and *Cyrena*. A lengthened search, on my return through the Pass from Candahar in 1841, failed to discover from what locality these blocks had been torn, and I feel inclined to believe that they must have been swept into the Pass from some of the lateral glens, which open and drain into it. Their occurrence however is important, as tending to confirm an opinion which the presence of the deep beds of conglomerate and sandstone at the lower end of the Pass had already given rise to, namely, that they belong to strata of the tertiary formation, and I have since had further reason to rely on the correctness of that opinion, from finding no difference between the sandstone of the Pass and the fossilliferous sandstone of the Siwalik range; while moreover I have been informed by Dr. Falconer, to whom I showed specimens of the bivalves, that a fossil very similar to them, and imbedded likewise in a bluish marl closely resembling the matrix of the Bolan specimens, had been found in the tertiary strata of the Siwalik range.

Proceeding onwards towards Sir-i-Bolan and Sir-i-Kujöor, the shales and indurated clays of the coal formation pre-

* At Dadur I took living specimens of *Melania pyramis*, and in April 1839, the stream at Beebee Nanee abounded with *Melania elegans*; but in the end of February 1841, I could find no trace of a single shell.

dominate, the latter being of various colours, red, grey, greenish and yellowish, alternating frequently with each other. Dark blue limestones also occur, containing fossils such as *Echini* and some bivalves, one of which has the appearance of an *Isocardium?* Near Sir-i-Kujoor the clays increase in thickness, and are interstratified with *bituminous shale;* but no *coal* occurs, except at one spot where the strata on the left hand are nearly vertical. There it forms a thin and insignificant seam of about an inch thick, in the centre of a wider seam of bituminous shale, and appears to be very similar, in external characters, to the Anthracite of South Wales. The shale here occurs between two beds of greenish indurated clay, in the crevices of which occur nests of white *Asbestus.*

Here, lying in the bed of the Pass, and immediately in the vicinity of the shale, I found a mass of *clay ironstone* of a yellow ochreous colour, bearing traces of vegetable impressions, and found to contain a great portion of iron. Along with this I also procured a fine large specimen of the *brown fibrous carbonate of iron,* but owing to the precipitous nature of the rocks, and the impossibility of making research without imminent risk of being murdered, I was unable to find either of these minerals *in situ.**

The coal, of which so much has been said by different travellers through this Pass, is in this locality at least absolutely worthless from the small quantity in which it occurs; it is not improbable, however, that the seam may strike out in the direction of Sunnee, where the sulphur mine already alluded to is situated, and that it may there be more abundant. Should research be directed in that quarter, and the mineral be discovered there, it might no doubt in such a locality be turned to good account for the supply of the Indus steamers; and the line of country to

* I have lately had an opportunity of showing these specimens to a practised German Geologist, Mr. Reckendorf, who agrees with me in the names assigned to them.

be travelled over from the coal, supposing it to exist, would offer no impediment whatever to wheeled carriages; so that the transport of the mineral to Shikarpore and Sukkur might be easily effected. At all events, if a regular Steam navigation is to be established on the Indus, it would be worth while to ascertain by actual examination whether coal is procurable anywhere along the secondary ranges which bound the western side of Scinde. I made an offer of my services for this purpose, when stationed in Affghanistan in 1840, but met with a refusal: but the subject being of importance, should be followed up if practicable.

In the tract lying between Ab-i-goom, and that part of the defile called by the Army *the Zigzags*, deep beds of *alluvium*, composed of silt and rolled stones, imbedding boulders of enormous size, occupy the wide area; these are sometimes of considerable height, and appear to have once occupied the whole breadth of the Pass: they are however now divided by the streams, which descend from the heights. These beds are horizontally disposed, and overlie the edges of the clays, and limestones of the secondary strata. Opposite to the vertical strata of shales which contain the coal, the coarse sandstone conglomerate, which was met with at the entrance to the Pass, again occurs, towering up to an immense height; it is here much indurated, and conformable to the secondary strata on which it rests: this is quite distinct from the loose alluvial beds which occupy the bed of the Pass, and is more ancient.

From the entrance to the 'Zigzags,' so called from the sudden and frequent tortuosity of the narrow defile, onwards to the end of the Pass where it debouched upon the wide plain of *Dusht-i-be-dowlut*, the rocks are a succession of variously coloured clays and blue limestones, the latter sometimes exhibiting traces of fossils. This limestone continues beyond the Pass, and forms one side of the Dusht-i-be-dowlut, affording imperfect specimens of Echini and Gryphæa. The plain is composed of a hard arenaceous clayey soil containing calcareous matter, and at the time when I crossed it in April 1839, was clothed with wormwood, and decorated with various beautiful flowers, such as the Iris, red and yellow Tulips, pale Hyacinth, &c. It is bounded on one side by mountains of fossilliferous limestone; but towards the South the ranges are not continuous, being formed of detached masses between which the eye wanders down over an arid and desert plain, in all probability blending with the desert sands of Beloochistan. From this plain onwards to Sir-i-ab and Quettah, the formation seems to be the same; and at the latter place I again procured pebbles of nummulite limestone, and a fragment of a red coloured limestone (probably nummulite also) bearing the impression of an *Ammonite.* Many of the ravines leading down from the neighbouring heights, are strewed both with nummulite pebbles and fragments of dark-coloured flints, both of which appear to indicate the occurrence of the same rocks as those which were met with at the lower end of the defile and at Sukkur.

It may now perhaps be useful to revert to the physical appearances presented by the Pass, in order, if possible, to arrive at some just conclusion as to the formations met with, and the causes which have been instrumental to the more recent deposits there observable. When I marched through the defile in 1839, the thick beds of rounded water-worn stones which every where covered the ground, viewed in conjunction with numerous holes in the limestone rocks, which in some parts form the sides of the Pass, led me to think that several deep lakes must at some distant period have occupied the basin-like portions of the defile at Keirtah, Ab-i-goom, and other places, and that the escape of those waters had strewn the ground with the rounded pebbles. Subsequent wandering however in other parts of the country, served to convince me of my error in this respect, for the whole tract of country from Pisheen to beyond the river Helmund is strewed over in the vicinity of the Hills with pebbles similarly rounded, and the same holes and caverns occur in the limestone rocks in places where it is utterly impossible that any lake could have existed, and at heights on the mountains far beyond the reach of any waters save those of an universal inundation. That deep waters have at some remote period been in violent agitation over these parts, the vast accumulations of boulders and conglomerate sufficiently attest; but at the same time the magnitude of such accumulations and the conformable position in which they lie, at once forbid the supposition that the effects now apparent were produced by the transient passage of modern lakes and torrents.

Taking a retrospective view of what has already been noted, the following series of rocks would appear to compose the mountains intervening between the valley of Quettah and Dadur. At the entrance to the Bolan Pass from the Quettah side, we first come upon limestones of compact texture containing various marine fossils of the genera *Echinus, Gryphæa, Isocardium (?)* and others. This rock is probably equivalent to the *mountain limestone* of Europe, an opinion which is strengthened as we proceed by finding numerous alternating strata of variously coloured *indurated clays* and *bituminous shale* yielding traces of *coal;* while near the latter, in the bed of the Pass, although not *in situ*, we find detached masses of yellow ferruginous *clay stones* yielding a large proportion of iron, and imbedding carbonised fragments of plants: this, together with other specimens of *brown carbonate of iron*, is a still farther proof that the strata belong to the true *coal formation.* Again, at Ab-i-goom, in the bed of the Pass but not *in situ*, were found specimens of true *oolite*, one of which appears to be very similar to the fine-grained oolite at Bath, while others are of coarser texture, and composed of larger concretions.* These specimens, although not found *in situ*, are when coupled with the fore-mentioned rocks, sufficiently indicative of the occurrence of the oolite system in the vicinity of the defile, and the fragments obtained were no doubt brought down through some of the lateral glens by the waters which occasionally drain through them.

Lower down we perceive on one side of the Pass, the alternating strata of coloured clays and shales of the coal formation, and on the other thick beds of *nummulite limestone* belonging to the cretaceous system, the strata on both sides having the same north-easterly dip. Still farther down towards Dadur, the nummulite disappears beneath thick overlying beds of *sandstone* and *conglomerate;* the pebbles imbedded in the latter rocks being of *quartz*, *indurated sandstone* containing marine shells, and *limestone* containing coralloids and shells.

The conglomerate now prevails down to the mouth of the Pass, and continues to form undulating and broken ground even to Dadur, from whence on the desert side it disappears beneath *alluvial* soils. The conglomerate is also found opposite to the strata of shales near Sir-i-Bolan, where in fact it forms one side of the Pass, and runs conformably with the secondary strata. The sandstone appears to be in all respects identical with that of the Siwalik hills in Upper India; and this circumstance, coupled with the discovery of specimens of shells of the genera Planorbis, Melania, Cyrena and Unis, must stamp these rocks as belonging to the tertiary formation.

It would thus appear, that the mountains separating Cutchi and Scinde from Affghanistan, are composed of the usual

* The specimens of rocks and minerals, herein mentioned, being probably the only collection brought from Affghanistan, are destined for the Geological Society of London.

series of rocks and formations belonging to the European secondary and tertiary systems, from the mountain limestone (?) through the coal measures, oolite, chalk, tertiary strata, and diluvium.

From the conformable position of the conglomerate and sandstones, it is evident that they must have been deposited previous to the uprise of the secondary strata which support them ; but there are other vast accumulations of boulders, and loose or unconsolidated conglomerates which occupy the beds of the Pass at Sir-i-Bolan and other parts lower down, the occurrence of which is due to other and more recent causes. These have all the appearance of having been heaped together by waters, and in many places they appear unconformably to overlie the upturned edges of the secondary strata, that is, in a horizontal position. It may be inferred therefore, that after the deposition of the tertiary beds the uprise of the secondary rocks from beneath the ocean in which they had been formed, caused vast waves to rush down from the rising hills, through the glens and valleys to which the movement gave rise, and that the displaced waters carrying with them the boulders of the shattered rocks, together with vast quantities of the loose shingly beds of diluvium, gave origin to the accumulations of horizontal conglomerates now met with in the bed of the defile ; and these being subsequently exposed to the action of the elements and the streams which drain through the Pass from the surrounding heights, became furrowed out and channelled precisely as they appear at the present day.

It may probably be farther inferred, that the elevation of these mountains was contemporaneous with that of the Himalayas and Siwalik ranges, for nearly the same series of rocks is observable in both, and the tertiary and diluvial beds of the latter rest conformably against the secondary strata as they do in Affghanistan, while the probable identity of the sandstones and fossilliferous blue marls may be considered as farther evidence in support of this suggestion. The coal measures and oolite exist below Subathoo in the Western Himalayas, and are found in the Bolan Pass; they are greatly elevated and inclined in both localities; while the tertiaries are likewise found in both countries, containing identical strata, and in both instances resting conformably against the secondary rocks; the prevailing dip of the strata both in Affghanistan and in the Himalaya likewise appears to be the same, namely, towards the East and N. East.

It appears probable from the remarks of the late Dr. Lord upon the phenomena exhibited in the Khyber Pass, that the geological formations there met with are in a great measure the same as those of the Bolan Pass; but it does not likewise appear that the conclusions he has drawn from those phenomena are just or satisfactory, especially as regards the occurrence of fresh-water shells in a fossil state.

"Unquestionable geological facts," he observes, "such as the structure of igneous rocks poured out under strong pressure, the presence of fossil shells, &c. lead me to the belief that several, if not all, of these valleys were at some former time the receptacles of a series of inland lakes, and the nature of the shells found (principally Planorbes and Paludinæ) seems to indicate that the waters of these lakes had been fresh. In this manner three grand sheets of water separated by the mountain deflexions before alluded to, would appear to have occupied the entire country from Cabul to the Indus, and their basins may now be distinguished as the plains which afford sites to the three cities of Cabul, Jellalabad, and Peshawur. The drainage of these basins is most tranquilly carried on by the Cabul river, which runs along the northern edge of each, conveying their united waters to the Indus; but in former times, when more energetic means were necessary, the mountain barriers were burst, and the scattered fragments and rolled blocks that now strew the Khyber Pass, bear testimony to its once having afforded exit to a mighty rush of waters; while the Gida Gulla (Jackal's neck) or long defile East of the plain of Peshawur, clearly points out the farther course of the torrent towards the bed of the Indus, whence its passage to the ocean was easy and natural. While at Jumrood, I had an opportunity of observing a fact which strongly supports the idea I have ventured to propose; for a well, which the Sikhs were employed in sinking within their new fort of Futtehgurh, and which had already proceeded to the depth of 180 feet, had altogether passed through rolled pebbles of slate and limestone, the constituents of the Khyber range of hills. But the wells of Peshawur, generally twenty or thirty feet deep, never passed through anything but mud and clay strata. Now the fort I have mentioned is situated at the very mouth of the Khyber Pass, and Peshawur is twelve or fourteen miles distant, towards the other extremity of the plain. If then this plain were once the basin of a lake into which a stream had poured through the Khyber Pass, it is obvious that such a stream would at its very entrance into the lake have deposited the rolled pebbles and heavier matter with which it was charged, while the lighter mud and clay would have floated on to a considerable distance; in other words, the former would have dropped at Jumrood, and the latter gone on to Peshawur, and this is precisely the fact."*

It would appear from these remarks, that the Khyber and Bolan Passes must exhibit very nearly the same phænomena; each is a mountain defile rising gradually in elevation towards Affghanistan; each exhibits a bed of rolled

* See Dr. Lord's Report to Government; also Journal Asiatic Society, Bengal.

pebbles and boulders, and again each furnishes fresh-water fossils of the same genera, and the same indications of diluvial accumulations. The configuration of the defiles appears likewise to be in a great measure the same, presenting alternately broad basins and narrow gorges; yet for all this I cannot agree with Dr. Lord, that the phænomena met with are in the least indicative of the former presence of fresh-water lakes, and assuredly the fossils enumerated and adduced by him in support of the hypothesis, are imbedded in strata of an age long antecedent to the time when such fresh-water lakes are supposed to have occupied the Khyber Pass. The very position of the strata militates against such views, for they are conformable to those on which they lie, showing that they were deposited previous to the uprise of the secondary rocks. Now the fresh-water shells mentioned by Dr. Lord, are the same as those discovered by myself in the Bolan Pass, and belong to the tertiary strata, which being conformable to the secondary series, as already stated, clearly proves that such shells must have been imbedded in those rocks previous to the uprise of the mountains and to the collecting of the bodies of fresh-water which are supposed to have existed in the basins of the Khyber Pass; the shells alluded to are imbedded in rocks which may have dammed up the waters, but assuredly they never had existence in the imaginary lakes.*

That a violent rush of waters had once passed through both defiles there can, I think, be no reason to doubt; but it appears to me most probable, that those waters were the waves of that ocean which must have been violently displaced at the time when the secondary rocks were thrown

* If Mr. Benson is correct in assigning some of these shells to living species, the fact would somewhat tend to prove that the climate of the tertiary period in these regions was not very different from that of the present day, while the occurrence of the wonderful tropical forms so abundant in the strata of the Siwalik hills, would at least prove that it was *not colder*.

up by some internal volcanic movement. Powerful they must have been, or they could never have moved the vast boulders which are visible in the bed of the Passes.

Had lakes occupied the basin-like portions of these defiles, the deposits instead of being rolled stones and boulders, would have consisted of earthy particles, such as silts, clays, and mud; whereas the presence of blocks many tons in weight, together with the general stony character of the deposits, proves that violent action has been employed, for none other could have moved such masses. Wells sunk at the lower end of the Bolan Pass, would pass through beds of rolled pebbles like those at Jumrood, while a few miles farther removed the silts and clays of alluvial plains would be met with; but these facts are by no means sufficient to authorise the inference that lakes once existed in the bosom of the defiles which now constitute the Khyber and Bolan Passes, nor can the water-worn appearance of the pebbles be considered to favour the hypothesis, for such rounding must have occurred previous to the deposition of the conglomerates from which the pebbles are derived, and that deposition was evidently anterior to the elevation of the secondary rocks since they are seen to rest conformably upon them. These secondary rocks being of marine origin, must necessarily have been beneath the waves at the time when the convulsion, which elevated them into lofty dry land, took place, and the retreat of the displaced waters through the glens and valleys then formed, would have been fully equal to produce all the effects visible in these Passes, without any necessity for calling in the after aid of fresh-water lakes, which in the Bolan Pass at least, I feel quite certain never had existence.

To return then from this digression. It may be briefly stated, that the mountainous country situated between the plains of Cutchi and Affghanistan, is composed of secondary rocks, overlaid by tertiary and diluvial strata in a conformable position, and that the secondaries appear from inspection of the rocks in the Bolan Pass, to comprise the usual series from the mountain limestone up to the cretaceous system which is represented by the nummulite limestone, specimens of which I likewise received from the hills in the neighbourhood of Kilat, and others from the Gundava Pass to the southward of Dadur and Bagh.

The valley of Quettah is bounded by lofty mountains of fossilliferous limestone, being in fact a continuation of those at Dusht-i-be-dowlut. Towards Koochlak, however, as we proceed in the direction of Pisheen, indications of tertiary strata are again apparent, consisting of deep beds of differently coloured clays, red and grey many times repeated. In the vicinity of the mountains these beds rise into hills of some height, and exhibit alternate strata of reddish clay or marl and semi-indurated sandstones. In the marl beds are found masses of the same *foliated gypsum*, which occurs in the outlying hills beyond Dadur, which seem in fact to be identical with the beds of Pisheen. These strata of red clays and sandstones extend over a great portion of the Pisheen valley, and are cut into ravines and mounds of great depth by the winter rains and the drainage of the country. The surface is usually undulating, but in some parts conical masses stand up above the rest, having all the appearance of having been ringed by the long continued action of moving waters, and an unpractised observer could easily be persuaded to believe that the valley had once been a lake, the successive levels of whose subsiding waters were thus to be traced on the mounds in question. Plausible as such an hypothesis might at first sight appear to be, it is nevertheless quite erroneous, for the phenomenon is caused simply by the action of the elements upon strata of *unequal hardness;* the semi-indurated sandstones being able to resist the influence of atmospheric agents longer than the softer marly clays with which they alternate; the consequence is, that the edges of the softer strata are worn away, while the sandstone projects and gives the mounds the appearance of a water-washed rock. These strata are sometimes nearly horizontal, but in general they have a considerable inclination, and are conformable to the fossilliferous limestones of the secondary mountains in the vicinity. In the valley of Shawl, of which Quettah is the capital, the lime used in plastering is prepared from *fibrous gypsum*, which occurs in detached masses in the greyish marls, the fracture exhibiting beautiful long fibres of a satiny lustre; "the foliated variety occurs in large masses composed of thin laminæ," like that found in the tertiary strata of England.*

These clays and sandstones are spread over the Pisheen valley as far as Shahdezye, but beyond that they are lost beneath the alluvial soils which, as we approach the hills of the Kojeh Amram range, are thickly strewed over with loose water-worn stones. This district is by no means deficient in the useful minerals, producing sulphurets of antimony and copper; gypsum both foliated and fibrous; and salt which is manufactured by washing the soil and boiling to evaporation. Sulphate of iron is also produced in large quantities from the hills of the Kakur country. From the valley of Pisheen the route to Candahar leads across the Kojeh Amram range, not far from Killa Abdoollah, the fort of an Achukzye chief, by what is now usually known as the Kojuck Pass; the ascent is steep and somewhat difficult, and the height above 7000 feet above the sea, or 3000 feet above the plain. The rocks here offer nothing of particular interest, being composed of arenaceous and clay slates, apparently belonging to the transition series; in some parts of the range, however, granites occur, as also a secondary limestone of compact texture, and of a dark colour, thickly studded with the stems of a plant, or perhaps of a zoophyte

* See Mantel's Geology of the S. E. of England.

somewhat resembling a *Lithodendron;* the rock is most probably the mountain limestone: but as I had no opportunity of seeing it *in situ*, I am unable to decide.

From this range of hills to beyond the river Helmund at Greeshk, the whole country may be strictly termed a volcanic district, abounding in almost every rock and mineral of the trap formation. In many places are seen trap dykes running up vertically through the limestones, while in other parts vast black basaltic rocks appear to have carried up the secondary strata which now cap them in a nearly horizontal position. The surface of the country slopes very perceptibly from the hills on the north of the district, towards the great southern desert which bounds Affghanistan on the south, and which is composed of a red-coloured sand, in some places loose and shifting, in others producing the Jowassah or camel thorn, and a few other desert plants. Here and there are seen huge black basaltic rocks jutting up as it were from beneath the sands, which often lie high against the sides of these conical and isolated masses. This desert tract is divided from the cultivable soils nearer the mountains by a well defined line formed by the course of the river Lora, which finds its way down from the Shawl district through Pisheen, and is eventually lost in the desert sands before it can effect a junction with the more western streams. To the south of the river all is a bare arid waste of loose red sands, with isolated cones of volcanic rocks scattered over it; while to the right or north, the country gradually slopes up towards the mountains, which descend in nearly parallel ranges from the north-east. Between these ranges are interposed valleys of several miles in breadth, composed of sandy soils intermixed with clays, calcareous earth, and the decomposed particles of trap, which in the vicinity of water yields rich crops of grain and artificial grasses: more usually however these valleys present a broken surface of waste lands, thickly strewed over with rolled stones derived by some convulsion of nature from the neighbouring hills, and consisting of various porphyries, basalt, greenstones, toadstones, and limestones, with occasionally a few fragments of granite.

These stones are in all probability due to the agency of retiring waters, and are almost invariably rounded as if from long continued attrition. What makes the agency of water the more probable, is the fact, that these scattered stones cease altogether as we recede from the hills towards the southward, and give place to the fine desert sands; while they become both more frequent, and of larger size, as we proceed towards the rocks from which they have been derived. Specimens also occur of rocks which are no where met with in the vicinity, and must have been brought from some distance; of those for instance lying around Candahar, some are granites whose nearest site is in the Shah-muksood range, about thirty miles distant, and divided from the present position of the fragments by the river Argandab, and a broken range of limestone mountains. Others again consist of porphyries containing *glassy felspar*, *augite*, *diorite*, and *dolerite*, but none of them are observable *in situ*.

From the Kojeh Amram range to Candahar, the hills are narrow ridges of limestone, bearing traces in some instances of fossil shells, but the heat which these rocks have generally undergone from the intimate association of trap rocks, has rendered such phenomena almost illegible, the presence of shells being now only traceable on the dark matrix, in white and imperfect figures of crystalline carbonate of lime. The whole of these ranges are accompanied by a low basal or outlying ridge of basalt or greenstone running parallel with the mountains, and associated in some instances with *porphyry* and *common serpentine*; iron pyrites, both cubic and nodular, is abundantly disseminated throughout the trap.

The city of Candahar stands in a valley between two parallel ranges of limestone hills of inconsiderable elevation;

these run in a direction from N. E. to S. W., and the dip of the strata where apparent, is easterly with a little northing.

On the west of the town, at about $2\frac{1}{2}$ miles distant, rises a mass of greenstone, black and polished on the exterior surface, and exhibiting the stair-like structure so common to this class of rocks; with this is associated beautiful veins, and dykes of white clay-stone, and common serpentine of several shades of green and red; thin flinty slates and red ferruginous clays much indurated, as well as red and green jaspers, are also disposed conformably along the base of the dark blue limestone,* which forms the dividing range between the Candahar valley and that of the river Argandab, which latter, farther away to the westward, is bounded by another parallel range of mountains of considerable height, and termed Koh-i-Shahmuksood. Both valleys are terminated to the south by the desert tract of red sands, from which they are divided by narrow rivers; the Candahar valley being crossed by the Doree, and the Argandab valley by the westward turn of the river of that name.

The soil of the cultivated lands around Candahar is rich and productive, being composed of calcareous and arenaceous clays, and other matter derived from the decomposition of trap rocks. The cultivation is entirely irrigated by canals connected with the Argandab, whose waters are brought through breaks in the limestone range. Without this aid the city would be deprived both of cultivation and water, and the whole valley would become an arid waste; even as it is, with an abundant supply from the canals, the central line only is under cultivation, all beyond rising gradually on either side towards the mountains, and presenting a barren tract thickly strewed with rolled pebbles of various kinds and sizes, and such indeed are the characteristic features of every valley in this part of Affghanistan, those

* Specimens of this rock lately shown to a practised Geologist, Mr. Reckendorf, were pronounced by him to belong to the Muschelkalk of Germany.

tracts to which water can be artificially brought, or through which it naturally flows, being productive, and well cultivated; while all beyond the reach of irrigation, (and this is always by far the greater portion of the valleys) remains an arid waste.

Selenite, or sulphate of lime, is dug out of the plain on the Ghuznee side of Candahar, and when burnt to lime forms the finest plaster used in the buildings of the city. It is said, that the discovery of this mineral was made in the time of Ahmed Shah, who considered it so valuable an acquisition, that he caused public prayers and thanksgivings to be offered up, and celebrated the event with feasting and charitable gifts. The mineral is known to the Affghans by the name of "*Gutch*," and occurs about three feet below the surface of the alluvial soil; it contains many pebbles of trap rocks and limestone imbedded in it, which would tend to prove it to have been an aqueous deposit, unless indeed, which is perhaps more probable, it has arisen from the infiltration through the soil, of water holding sulphuric acid derived from the decomposition of pyrites and the volcanic rocks of the district, which acid combining again with the calcareous particles derived from the limestone ranges and disseminated through the soils, may have formed a bed of loosely aggregated crystals of sulphate of lime.

The range of hills dividing the valley of the Argandab from Candahar, is composed of limestone intimately associated with volcanic rocks, a range of which runs parallel along the base of the mountains, consisting of greenstone, basalt, serpentine and clay-stones; while the shelving plains around are covered with fragments of granite, syenite, greenstone, basalt, and various porphyries: some of these have been brought from a distance, especially the granite and some limestones, for I found specimens of both of the latter rocks which I only know positively to occur *in situ* in the Shah-muksood range beyond the Argandab. Water appears to be the only agent which could have brought them so far from their natural sites, for had glaciers ever descended from any of the ranges which bound the valleys of Affghanistan in the southern tracts of which I am speaking, they must naturally and of necessity have followed the direction of the valleys and the drainage of the country, instead of crossing the district transversely; besides which the configuration of all these valleys is such as to preclude the possibility of any glacier crossing the country from west to east, for they one and all present a sloping surface from either side towards the centre, which generally more or less forms the line of drainage towards the south, and these slopes are invariably covered over with fragments of rocks, chiefly volcanic, and diminishing in frequency as they recede from the ranges, which on either side, wall in the valleys. Besides which there are no accumulations of debris against the sides of any of the ranges, to indicate the transverse passage of glaciers, nor indeed is it possible that they could so have passed, because it is only reasonable to suppose that at the time when these southern ranges produced glaciers, the higher and more northerly mountains with which they are connected, were likewise covered with ice; and in such case the passage of the northern glaciers would have been down the sloping valleys towards the southern desert, sweeping with them or before them, the glaciers of the district of which I am speaking.

In the valley of the Argandab, the river has carved its channel along the eastern side, leaving a very narrow strip between it and the limestone range, dividing it from the Candahar valley; consequently the right bank is the highest ground, and slopes up rapidly for some miles towards the base of the Shah-muksood range, which is in some places very lofty, and furnishes evidence of greater volcanic irruption than any other range which I had an opportunity of examining. Vast masses of basalt and greenstone not only run along its base, but extend far in among the granites and primary limestones which constitute the mass of the formation. The granite too, varies exceedingly in texture and composition, and seems to pass by gradation from a volcanic product to true granite: this is particularly apparent at Kishk-i-nakhood, on the road to Greeshk, for the mountains there exhibit three kinds of granite, which have very much the appearance of being stratified; the fact is however, that the mass constitutes truly but one bed, the lower part of which is in contact with basalt, and has quite the appearance of a volcanic rock; this feature fades away higher up, and the granite assumes a different colour and texture, while the surface portion again changes to a true granite. This triple bed is not abruptly terminated at the points of change, nor is there any division of it to authorize the inference of stratification, but the basal structure passes gradually into the central, and that again into the true granite. There is also a curious dyke of granite possessing the structure of the lower part of the mass, which not only traverses the whole granitic bed, but runs up to the very summit of the range through thick strata of variously coloured limestones traversed in all directions by veins of crystallised carbonate of lime, where it terminates, without overlying them. It would seem from this circumstance as if the heat of the volcanic rocks beneath had fused the lower portion of the granite, and caused it to burst upwards through the superincumbent strata, retaining the colour and texture of the heated mass from which it had been suddenly ejected. Shortly after our arrival at Candahar, I was despatched with an escort of fifty Affghan horsemen, to seize some grain which was reported to have been concealed in a village in the valley of Kakraez, and although my errand proved "*a wild goose chase*," it gave me an opportunity of seeing something of the rocks which form the mountains on the western side of the Argandab. Our route lay west of Candahar, and after crossing the river, and the cultivation which borders it, we proceeded towards the hills across a shelving tract of waste and stony land strewed over with fragments of trap and granite. After traversing this plain we entered a narrow gorge in the mountains, the width of which was only sufficient to admit of one horseman at a time, and the rocks composing the sides of the defile towered up to a considerable height over head. The formation at first consisted of nearly vertical strata of parti-coloured limestones, but these soon gave way to black and frowning masses of basalt, whose sombre hue imparted a gloominess to the narrow passage, which was any thing but cheering. We travelled on through this gorge for several hours, the basalt continuing the whole way on either side, and at length we had to climb the step-like sides of the rock, in order to reach the summit of the defile; to perform this we were obliged to dismount, and pull our horses up one by one over the broken and crumbling rocks. From the summit of the Pass we looked down into a long valley studded here and there with paltry villages, and bounded in the distance by lofty mountains. The name of this valley was Kakraez. The soil consisted as usual of clay and calcareous sands, scantily watered through the central line, which showed signs of partial cultivation around a cluster of huts or a village, while all beyond was a barren stony desert, rising gradually towards the base of the distant mountains. The higher ranges are composed of granite, based generally upon volcanic rocks; limestone is also abundant, and has evidently undergone a change from its vicinity to the trap, being usually of a pure white with a foliated structure and highly crystalline. Quartz-rock also occurs, containing ores of yellow copper and magnetic iron, which are said to be rich, although neither are now worked, (1840). A curious mineral is likewise procured from Shah-muksood, the virtuous properties of which are much vaunted by the Affghans. It is said to ooze in thick drops from a lofty peak of limestone, but dries into a hard earthy substance on exposure to the air; it possesses a strong and rather unpleasant bituminous odour; is of brown colour, and earthy texture, when dry from exposure to the air, and is called by the Affghans *Momiaye;* it is also met with in Persia, and known there by the same name. The mineral appears to be earthy bitumen or maltha, and is doubtless connected with the trap formation. The Affghans, who are great lovers of the marvellous, ascribe all sorts of virtues to this substance, and declare, among other absurdities, that if a broken limb be well plastered round with the fresh mineral, a cure will be effected without fail in a few days.

A dolomitic limestone of a yellow colour and granular structure, occurs in veins in the limestone rocks, and when of a dark green shade, which is sometimes the case, is highly prized, and worked into beads and cups; it is reported that a single bead of a fine clear green, and about the size of a large pea, has often been sold for 100 rupees; in general the colour varies from green to yellow, with occasional veins of pure white, and the stone is always in repute among the Mahometans, who make rosaries of the beads, a string of which usually sells from eight annas to a rupee.

It is remarkable, that from the Kojeh Amram range to beyond the Helmund at Greeshk, there is always in every valley a thick stratum, more or less deep seated beneath the superficial alluvium, of a hard compact conglomerate, the matrix of which is calcareo-arenaceous, and contains pebbles and boulders of various sizes, from a pea to a cannon-shot, and all rounded and water-worn. This conglomerate is laid open by a river bed at Melmandeh, and is again seen at Greeshk, where it forms undulating plains of great extent, and is deeply cut through by the Helmund, whose banks are composed of it. It is probable, that this conglomerate and that of the Bolan Pass may date from the same period.

Although in some valleys it comes to the surface and forms undulating plains scattered with loose fragments, yet in other places it lies deep, and is covered over by several strata of unconsolidated sands and clays; such, for instance, is the case between Kishk-i-nakhood and Kak-i-chowpan, and the Karaez, or line of wells, by which at the latter place the patch of cultivation is watered, is sunk through those sands to some depth without exposing the conglomerate. The surface here slopes down as usual from the distant hills towards the river Argandab, which pursues a westerly course across the valley, and skirts the edge of the red southern desert. The ground is scattered over with fragments of volcanic rocks, granites, quartz and limestones, and beneath these is first a stratum of loose greyish sand of considerable depth overlying a second stratum of a yellowish-coloured sand, and beneath this again is a stiff marly clay; the water appears to be held in the clay, and is brought by a succession of wells connected by a subterranean channel, from the foot of the hills down to the cultivable lands extending along the right bank of the Argandab, at a height which is inaccessible to the water of the river, and which, but for this artificial irrigation, would necessarily remain for ever waste land. The conglomerate, although not perceptible at Kak-i-chowpan, comes to the surface shortly after leaving it, and with the occasional occurrence of a patch of alluvial soil, continues to form a broken and undulating plain up to the banks of the Helmund, from whence it stretches away again beyond Greeshk for many miles, both to the west and south, for it is met with as forming the solid substratum thirty miles below the fort at the junction of the Helmund and Argandab, where stand the ruins of the ancient town and fortress of Killa Beest.

Captain E. Conolly, in speaking of the Helmund, remarks that—"As soon as it has left the hills, its bed is generally four or five miles in breadth, the water more easily penetrating the readily yielding sides than the bottom, converted into a sort of pavement by the stones rolled down from the mountains. The stream has not however of late years occupied the whole breadth, though in former times, before it had cut itself so deep a bed, it would appear to have done so near Girishk: for example, there are ruins at opposite sides of the river, of forts known to have been contemporaneous, and under which the water must have flowed (for they are built in a semicircle, without a wall on the river face,) though there is a space of four miles between them. The stream now hugs the left bank, above which rises in vast mounds the sandy desert. The ancient right bank is well marked by the high cliffs of the plain before mentioned, which are every where hollowed and indurated by the action of water. The rich space between this band and the modern channel, of which the average breadth is rather more than two miles, is the country of Gurmsehl."*

The "*sort of pavement of stones*," here alluded to as forming the bottom of the river's bed, is the *conglomerate*, and the "*yielding sides*" are the sands and alluvial soils which, as we travel south, are seen to overlie the conglomerate. The cliffs forming "*the ancient right bank*," are composed of the same indurated conglomerate, but that induration is in no way caused by the action of the river, as Captain Conolly's remarks would lead one to suppose, but is due to causes which must have been in operation before the river Helmund commenced its existence. The plains extending for many miles on either side of the river at Greeshk are composed of the same rock, and it is therefore evident that in such situations its waters could have exercised no influence whatever. The river certainly has not filled its bed for many years, and the high conglomerate banks, between which and the modern stream a broad belt of rich cultivation intervenes, and which forms in truth the

* Vide Journal As. Soc. Bengal, No. 103, page 712.

valley of the Helmund, must have been cut through by the retiring waters at the time when the neighbouring mountains attained their present elevation, and the drain thus formed has served ever since as the bed of the river, which probably then first had origin. The river although it occasionally overflows a portion of the alluvial belt in its bed, never reaches to the old right bank; and that it exercises little influence on its own modern left bank is proved by the existence of the old fort alluded to by Captain Conolly. I do not think however, that the mere absence of a wall on the river face can furnish any evidence that the Helmund once occupied the whole space between the two forts, for the height and abruptness of the banks themselves furnish a much more efficient defence than the walls above, which are raised in most cases to guard against the attacks of robber horsemen.

Besides which we require to know how the river could a few years since furnish a body of water *four miles in breadth,* and from 30 to 40 feet deep; while at present it seldom exceeds 8 or 9 feet in depth, even at the flooding or spring time, when the snows are melting.*

Still stronger proof however that the river has not changed for many years, is to be gathered from the fact that the ancient town and fortress of Killa Beest remain uninjured on the left bank of the Helmund at its junction with the Argandab. The town has not been inhabited for the last century, and is said to have been flourishing in the time of Nousherwan: it is built *upon the conglomerate* immediately within the fork formed by the confluence of the two rivers. Between the fortress and the Argandab there is a belt of cultivation, while the Helmund flows immediately beneath the walls of the fortress. Both rivers are therefore seen to hug their left banks, and that they did so *before Killa*

* It is not its depth, but its force and rapidity which render it impassable at these times.

Beest was built, seems proved by the fact of its ruins still remaining in tact upon the left bank of the Helmund to the present day.

The mountains up to and beyond the Helmund are composed of rocks similar to those already described, the whole district being, strictly speaking, volcanic ranges of basalt, greenstone, serpentine, and occasional granitic peaks, supporting or running parallel with limestones both primary and secondary. This continues onwards to the neighbourhood of Warshér, where a greywacké slate exists, but beyond that I have no precise information, except that basaltic masses studded with cubic iron pyrites here and there occur, as likewise secondary limestones containing marine shells.

Having thus imperfectly noted the principal rocks which occur along the line of country over which I had occasion to travel, I shall now hazard a few remarks on the general features of the country and the minerals it produces, craving the indulgence of the geological reader, and pleading as an excuse for the imperfections and scantiness of the information afforded, the difficulties and danger of collecting scientific data during a hurried march, at a time when every man's hand was against his neighbour, and when we were considered in the light of infidel invaders, to sacrifice whom was a sure passport to the joys of Paradise.

From the specimens and information obtained from different parts of the country through the kindness of various friends, and likewise from my own observations, it would appear that the mountains, in the southern portions of Affghanistan, from below Ghuznee, and stretching across from Dadur in the east, to about Warshér on the west, are composed of the usual series of primary and secondary rocks, from granite upwards to the chalk formation, which is evidently represented by the nummulitic limestone and other chalky beds containing flints and marine shells. In some localities these secondary rocks are conformably overlaid by tertiary strata containing fresh-water shells, and by diluvial deposits ; as yet however no evidence exists of the occurrence of the remains of mammalia in which the tertiary strata of India have been found to be so rich.

All these formations are accompanied in some part of their course by volcanic rocks, and from the Kojeh Amram range to some distance beyond Greeshk, and extending from the southern desert tracts upwards towards Ghuznee, evidence exists, in the occurrence of vast masses of basalt and greenstone, both in dykes and detached conical hills, of the activity in by-gone times of violent disruptive forces. If moreover the testimony of respectable and well informed Affghans is to be relied on, it would appear that such forces are not yet altogether quiescent, for an intelligent chemist of Candahar, who had travelled much, and who professed to be somewhat of a *Savant*, declared to me more than once, in presence of others who implicitly believed him, that an active volcano is still in existence among the Huzzarah mountains, although, as he said, few are now (1840,) in existence who remember to have seen it in a state of irruption. He described the mountain as being in the form of a cone abruptly truncated at the summit, where a hollow or bowl-shaped depression exists, from which many years ago he had heard that flames were seen to issue, and he added, that the sides of the mountain were strewed over " with *cinder-like* and *slággy-stones*, similar to those produced from a furnace." These fragments may possibly be nothing more than decomposed volcanic rocks and trap-tuff, yet the description tallies so well in all respects, even to the fragments of scoriæ and lava, with the appearance of a volcanic mountain, that were not the Affghans, according to the testimony of their own countryman, Shah Shooja, regardless of truth, I should have had no hesitation in at once accepting the story as true. It is to be observed however, that as my informant had no possible object to gain by deceiving me, and as he could not possibly have seen any other volcanic mountain from which to draw his description, his information may yet be entitled to some degree of credit; and taking this account in conjunction with the actual volcanic nature of the country generally, and the frequent occurrence of earthquakes in Affghanistan, I feel disposed to believe that such a volcano does actually exist, more especially as the story was repeated to me on several occasions without change or discrepancy, even after close cross-questioning by myself and natives who were present.

It would appear, that the volcanic rocks extend even to the neighbourhood of Cabul, for I received from the late Major E. Sanders of the Engineers, specimens of Actynolite picked up by him near Ghuznee, and from another friend I likewise received a specimen of common massive Iron pyrites precisely similar to that which occurs so abundantly in the trap-rocks around Candahar.* From Zemindawur again, I received mica-slate, granite, and greenstone, the last of which I was informed was abundant there; while from the Huzzarah hills I obtained through the kindness of Major Lynch of the Bombay Army, fine specimens of granite, basalt, hornblende in quartz, lapis lazuli, lamellar magnetic iron ore, and red oxide of iron, together with the sulphuret, green carbonate, and red oxide of copper.

The following is an imperfect list of the useful minerals occasionlly procurable in Candahar, and which are partly the produce of the country, and partly imported from other states.

Iron Ores.

1. *Common wrought iron ore.* Is brought from Ubbergoon, and sold by the traders at Pirmool near Ghuznee; it is worked and smelted at Ubbergoon, three days' journey to

* As an instance of the false impression an unskilful observer may convey of the mineral riches of a country, I may state that both the above specimens were given to me as "*copper ores;*" while from a third party I once received a collection labelled as "*copper,*" the whole of which proved to be *greenstone.*

the south of Peshawur, and is said to be of three kinds. The first sort is called *Pullee*, and is wrought into bars; it sells from $4\frac{1}{2}$ to $5\frac{1}{2}$ annas per seer at Purmool, and in Candahar from $10\frac{1}{2}$ to $11\frac{1}{2}$ annas per seer. The second sort is termed "*Bél-ka-lohar*," or "*Ahun-i-bél*," and is turned into spades, ploughshares, &c.; it is sold by the traders from 4 to 5 annas, and in Candahar the price is from 10 to 11 annas per seer. The third sort is called *Kyhee*, and is converted into hoes, knives, hinges, &c.; it is said to be the worst, and is distinguished as being "sukht," or brittle; the price at Purmool is $2\frac{1}{2}$ to 3 annas, and at Candahar from 5 to 6 annas per seer. The duty is 1-40th. The ore is the same, but undergoes three smeltings, by which the three qualities are produced. It is consumed in large quantities.

2. *Iron pyrites, or sulphuret of iron.* Is abundantly distributed throughout the trap formation of the country, but is not in use. It occurs both massive and cubic.

3. *White iron pyrites*, in octohedrons. Is sometimes brought in small quantities from Persia, but I am not aware of its being in use for any thing.

4. *Magnetic iron ore*, or "*Gowr-sung*." Is abundant in many parts of the country. It occurs both earthy, massive, and lamellar. The two former are found in the Shah-muksood range, west of Candahar; and the last is from the Huzzarah mountains. They are not now used.

5. *Fibrous red iron ore, or red hæmatite.* Occurs disseminated in nodules among the trap-rocks at Melmandeh; it is unknown as an ore to the Affghans.

6. *Red oxide of iron.* Occurs in the Huzzarah mountains, but appears to be unknown in Candahar.

7. *Yellow clay ironstone.* This was found by myself in the Bolan Pass, but is not known in Candahar; it is of a yellowish ochery colour, and yields much iron on analysis. The fracture is dull earthy, and traces of carbonised plants are observable in the stone.

8. *Carbonate of iron, or brown spar.* Found also in the Bolan Pass with the last, but not *in situ.* It is massive, and appears to have been imbedded in the yellow clay ironstone, or to have formed a vein through it: the specimen formed a flat tabular mass; both were found lying near the vein of coal.

9. *Sulphate of iron.* It is termed "*Kussees*," and is brought from the hills of the Kakur district. It consists of three varieties; the red, yellow, and grey. The red sulphate is scarce, and is only used by chemists in search of the philosopher's stone, after which both high and low are to the full as mad as were Europeans in former days. It sells at from 2 to 3 Co.'s Rs. per tolah. The yellow sulphate is called *Pistye*, and is used for polishing and watering blades of swords and other cutlery. It sells at 12 annas per seer; this is the true sulphate of iron, and its yellow colour is caused oxydation on exposure to the atmosphere or to light: the fresh crystals are pale green; it is probably produced by the decomposition of iron pyrites which is so abundant in the trap-rocks of Affghanistan. The grey sulphate is called *Miskye*, and is used by curriers to blacken leather; it sells at 6 annas per seer. There is no duty charged upon these minerals as they are considered as mere earths. The red variety I could not procure, and know not therefore what it is; the grey variety I am inclined to consider a sulphate of copper, but I could procure no specimen of it.

10. *Iron sand.* Scales of iron occur in the sands of the river Indus, not far from Roree.

Copper Ores.

11. *Copper pyrites.* Appears to be very abundantly distributed over the country; specimens of it were brought to me in white quartz from the Kojeh Amram range, but proved exceedingly poor. A rich ore of this copper is said to exist in the Shah-muksood range, and that it was first

worked in the time of Nadir Shah. Subsequently the Sirdars of Candahar worked the mines, and report says to great advantage : some accounts state the profit to have been 900 per cent.! Others 1,900 per cent., and that the ore was sold in Candahar at the same rate as European sheet copper imported from Bombay. This may be taken as a fair example of the exaggeration to which the Affghans are so prone.

All accounts agree that a profit was made, and that copper money was coined and cannon cast from the metal. It must at the same time be borne in mind, that the villagers in the neighbourhood of the mines *were compelled* to work them *free*, so that one very considerable portion of the usual expences was thus saved, and the Sirdars could well afford to sell the ore at a cheap, and yet with remunerating price to themselves since it cost them little or nothing. Another copper mine occurs at Nésh, and produces a rich yellow copper ore ; a man who resides there and is a dealer in braziery, declared that for every outlay of 20 rupees he would derive a profit of 20 tomauns, *i. e.* he would gain clear 19 tomauns or 380 rupees upon his outlay, or a profit of 1,900 per cent. This tallies with the accounts given me by others of the profits derived by the Sirdars, but I do not believe it for all that, and these accounts may serve to show the difficulty of arriving at the truth from persons so regardless of it as the Affghans generally are.

The copper now used in Candahar and the neighbouring districts even to Herat, comes partly from Bombay and partly from Persia. That from Bombay is in sheet, and comes from Europe ; it sells in Candahar at two rupees and a quarter per seer of eighty tolahs, and is said to cost in Bombay about ¼ Rs. per seer. The duty at Candahar is 1-40th. European sheet copper also finds its way to Cabul, Bokhara, and other northern states. Although copper ores are abundant in many parts of Affghanistan, and some of them undoubtedly rich, yet I do not think they could be worked to any advantage except perhaps for home consumption in towns in the immediate vicinity of the mines; certain it is that the metal would never equal in purity the European article now imported, and for exportation it would never pay the expences of working and of the long and dangerous land-carriage likewise.

12. *The blue and green carbonates of copper.* Are found in the Huzzarah mountains, and sparingly likewise in other parts; but they do not seem to be used by the natives.

13. *Red oxide of copper.* Is also found in the Huzzarah mountains.

Gold.

14. *Gold,* called *Pillah.* Is said to be procured in small quantities from the sands of rivers, and is brought from Sadmoneir and Bokhara, from a river called Ammoo. The best sells at 17 and 18 Co.'s Rs. per tolah, and the impure at 10 Rs. per tolah. It is also said to occur imbedded in rocks in the Huzzarah mountains, but this is just as likely to be iron pyrites or copper ore, as both were often brought to me as gold.

Antimony.

15. *Sulphuret of antimony.* The mineral improperly named "*Soorma*," by the natives both of India and Affghanistan, is a sulphuret of lead. Antimony is not used, but occurs abundantly in some of the mountains to the northward of Killa Abdoollah in Pisheen, from whence I procured specimens. It is accompanied by the oxide or white antimony.

Lead.

16. *Sulphuret of lead.* A dark impure kind containing iron is procured in abundance from Teereen; it is used by painters and potters, and sells in the raw state at 12 annas per Tabreez maund, or three annas per Co.'s seer. It occurs also in the Shah-muksood and Huzzarah mountains.

Pure galena, in large cubes, is found in the same localities, and usually sells in the raw state at 12 annas per seer; when cleared and reduced to powder it forms the so-called "Soorma," or antimony of Affghanistan and India, and sells at from 5 to 6 rupees per seer.

Granular galena. Is also found in Teereen. The common lead of commerce is called "*Soorb*," and is brought from Teereen and the Huzzarah country; it is made at the mines, and the dealers sell it in Candahar at 6 to 7 annas per seer, and in the shops it is retailed at 11 to 12 annas per seer. The duty is 1-40th.

17. *Semi-vitrified oxide of lead, or litharge*, is known as *Moordasung.* It is imported from Hydrabad, Tatta, Herat, and Koh-i-Pir-kisree in Gurmsael. It is manufactured from the yellow oxide of lead, and sells in Candahar at 2 rupees per seer. It is much used in the Affghan materia medica as a cure for cuts and sores, being applied in the form of a burnt powder; it is also used by painters. It is also reduced to powder and mixed with lime, and applied to the hair which it dyes black, but caution is necessary or it may burn the hair off.

18. *Argentiferous galena.* Occurs in the Huzzarah hills, from whence it is exported to the Punjab.

19. *Silver*, called *Nookrah* and *Sufeid Tillah.* Sells at one Co.'s rupee for rather less than one tolah; it is extracted from argentiferous galena, and is said likewise to occur in veins in the Huzzarah hills.

20. *Quicksilver*, is called *Parah* and *Seem-ab.* It is brought from Muscat, and is said to occur also in Gurmsael at Pir-kisree, where it is dug out of the ground. It constitutes an article of materia medica, and sells at 2 to 3 rupees per tollah.*

* A report was spread by some of the Savans, who accompanied the Army, that quicksilver was found in the Bolan Pass. This proved to be true, but it was the quicksilver from a *broken Barometer tube!*

21. *Cinnabar* of commerce, called *Sheengruff.* Is brought from Persia, India, and Turkey, and sells at from 3 to 5 annas per tolah. It is used as a pigment for house and book painting; it also forms an article of the materia medica as a cure for wounds, and is taken internally as calomel to induce a change of system.

22. *Native sulphur,* called *Go-gurd.* Is imported from Bulk, Gurmsael, and from Sunnee near Bagh in Cutchi. That from Gurmsael is the worst, and consequently sells at a less price than the others. When the markets are well stocked the best sulphur sells at 2½ to 3 annas per seer; that from Gurmsael at one anna less. In the winter when travelling is impeded, and also at times when the supply is scanty, it sells at 7 to 8 annas per seer.

It is used in the manufacture of gunpowder and sulphuric acid, and constitutes an article of materia medica. It occurs both massive and crystallised in the mine at Sunnee, but the manufactured brimstone alone reaches Candahar. The duty is 1-40th.

23. *Coal.* Is found in the Bolan Pass, but apparently in very small quantity; it may probably occur however more abundantly in some other parts of those mountains, and in situations where it could be turned to account. Coal is said to occur abundantly in some parts of the Huzzarah mountains.

24. *Petroleum.* Is found in the sulphur mine at Sunnee, where it drops from the roof into a small hollow below; it is boiled with the dust and impurities of the native sulphur, and produces a dark-coloured brimstone.

25. *Mineral pitch, or earthy bitumen.* Is found in the Shah-muksood range, where it is said to ooze in thick drops from a lofty limestone peak. It is called *Mumi-aye,* and is esteemed as highly efficacious in curing cuts and fractured limbs!

26. *Salt,* is distinguished by the names of "*Shireen*" and "*Shore.*" The Shireen, or white salt, is procured in the

valley of Pisheen by washing the soil, and boiling the water to evaporation; it sells on the spot at 30 to 32 seers per Candahar rupee (12 annas), and in Candahar during winter it is retailed at 10 to 12 seers, and in summer at 16 to 20 seers per Candahar rupee.

At Kishk-i-nakhood on the road to Greeshk, a salt is also made in the same manner, and sells at 50 seers per Candahar rupee; while in Candahar during summer the price is 20 to 22 seers per Candahar rupee, and in winter from 12 to 14 seers. The best salt comes from Gurmsael, where it is reported to be carried down in solution by the waters of a stream from the hills. These saliferous waters are said to spread over the plain, and to form an extensive swamp where the water evaporates and the salt remains in cakes, and is broken up like ice. It sells on the spot at 12 Rs. per camel load of 7 to 8 maunds in weight, and in Candahar during summer it is retailed at 12 to 16 seers per Candahar rupee, and in winter at 8 to 10 seers. The duty on the loads brought to Candahar, is 1½ annas per donkey load, and 2 annas per camel load.

This account would lead one to believe, that the stream in question must proceed from hills where the salt formation occurs. Rock-salt comes from the Kohistan of Cabul, and is sold in Candahar at 7 to 8 seers per Candahar rupee, and is retailed by the shops at 4 to 5 seers.

The variety termed "*Shore*," is gathered from the surface, and is an impure subcarbonate of soda, which in some parts of the country is very abundant, covering large areas like snow.

27. *Saltpetre*, or *Shorah*. Occurs at Killa Azim, not far from Candahar on the road to Cabul, and is obtained in the same manner as the salt of Pisheen; the earth is dug from the plain, and well saturated with water, which is afterwards drawn off into a vat, and then boiled to evaporation. It sells in Candahar at 6 to 7 annas per seer. The duty is the same

as that upon salt. It is used in the manufacture of gunpowder, and forms also an article of the materia medica.

28. *Potash*, called "*Sudjee*." Like the salt, it is distinguished by the names of *Shireen* and *Shore*, or pure and impure.

The shrubs from which it is made are called *Ashkhar*. The method adopted in making it, is to dig a pit in the ground which is filled with the plant, to which fire is applied; the juice and ashes are received through a hole in the bottom of the pit into a small basin or pot beneath, where it cools and becomes potash.

The "*Shore*," or impure, sells at 12 annas per puckah maund in the summer time; and in winter when the plants are dried up, and the article cannot be made, its price is doubled, or 12 annas per 20 seers. This sort is used only in the preparation of leather, and is mixed with salt.

The "*Shireen*," or better sort, sells in summer at 1 anna per seer, and in winter at 2 annas; it is used in making soap, in dyeing cloths, as a flux for reducing some lead ores, and is also mixed with colours in staining pottery. The plants grow abundantly in the sandy plains, and the potash is prepared on the spot, and afterwards conveyed to Candahar for sale, where it pays a duty of 2 annas per camel, and 1½ annas per donkey, load.

The soap-boilers are said to consume about 200 maunds annually; and the dyers and others take about 400 maunds more. It is likewise used by the poorer classes as substitute for soap in washing their clothes.

29. *Alum*, or *Phitkirrie*. There are four kinds, namely vellori, red, white, and grey. The first is brought from Meshid, and sells at 8 annas per seer; the second is from Bunnoo Daman in the Lahore district, and sells at 5 annas per seer; the third is from Hindostan, and sells at 2 to 2½ annas per seer; and the last is made in Zemindawur, and being very impure, sells at one anna per seer.

It is used by dyers as a mordant, and is besides an article of materia medica, being given to infants as an aperient.

30. *Arsenic*, or *Hurtal.* It is procured from Herat, and sells in Candahar at 12 annas per seer. It is used by house-painters.

31. *Lapis Lazuli*, or *Lajword.* This mineral is brought from Sadmoneir and Bijour, where it is said to occur in masses and nodules imbedded in other rocks. It likewise occurs in the Huzzarah mountains, from whence I received a small specimen from Major Lynch. It is said to exist near Kilat. It sells on the spot from 2 to 5 Co.'s rupees per seer, and after it has undergone the process of cleaning, and is made into ultramarine, it sells at 80 to 100 Co.'s rupees per seer. It is used in house painting, and book illuminating.

32. *Sulphate of Lime*, or *Gutch.* This is apparently due to the action of sulphuric acid on the calcareous earth contained in the alluvial soil; it is dug out of the plain, about two miles from the Cabul gate of the city. It occurs about three feet below the surface, and forms a thick bed beneath the alluvium, containing pebbles of trap, clay-slates (of the trap,) and limestone. It is burnt to lime, and used as a plaster in the buildings of the city; it hardens almost immediately, and is very tenacious and durable. Fibrous, foliated and compact gypsum is found in the Shawl district and other parts of the country, and are all used for lime.

It now only remains to notice the general features of the country, which may be thus briefly described. In traversing the southern portion of Affghanistan from Dadur towards Herat, a succession of mountain ranges occur, running nearly parallel with each other, and pursuing a direction from N. E. to S. W.; these, with the exception of a few peaks, are usually of inconsiderable elevation, and present bare unwooded masses of a black and sombre aspect, consisting for the most part of limestones and volcanic rocks. Between these ranges are interposed ill cultivated stony plains, varying in breadth, and shelving down from the hills on either side towards the centre, the surface being for the most part thickly strewed over with loose rounded stones. The direction of all these valleys is of course that of the ranges by which they are bounded on either side, and these, running from N. E. to S. W., cause likewise the rivers, which flow between them, to pursue a course nearly parallel to the barriers which wall them in on either bank. Many of these rivers are lost in the sands, without effecting a junction with each other, such as the Lora from Shawl, the Doree, and the Turnuk, but others rising in the lofty mountains to the northward, afford a plentiful supply of water all the year, and eventually discharge themselves into the great Lake of Seistan.

The direction of all the rivers is at first direct for the sandy desert, which stretches across the southern end of the valleys from the district of Shorawuk, through Gurmsael, Seistan, and across the frontier, until it becomes apparently incorporated with the desert of Kirman, and the great salt desert of Khorassan.

On reaching the desert however, instead of continuing on their course, and diffusing vegetation in their progress, the direction of all is suddenly changed from S. W. to about West, by which means the desert is merely skirted by them, and its sands being deprived of the fertilizing effects of their waters, are left to drift before the wind in endless barrenness.

This sudden change in their course which is common to all the rivers, namely the Lora, Doree, Argandab, and Helmund, evidently betokens a fall in the level of the country, which causes the streams as soon as they have freed themselves from the restraint of the mountain ranges, to obey the laws of nature, and turn westward down the slope, until such as are not previously lost in the sands, either effect a junction with each other, or empty themselves singly into the great Lake of Seistan; while the very occurrence of that lake is sufficiently indicative of a hollow, and furnishes a reason for their change of course. This change however, while it tends perhaps to fertilize a greater extent of land lying immediately within the limits of Affghanistan, most effectually consigns the sands of the south to a hopeless state of barrenness, by depriving them of the only means of producing vegetation to bind the loose and shifting soil.

The Lora, Doree, and Turnuk, after traversing their respective districts for some miles, are all suddenly dried up in the thirsty soil, and the only really permanent rivers of importance, are the Argandab and Helmund, which after diffusing vegetation along their banks, eventually unite and empty themselves into the Lake of Seistan.

The Argandab rising among the lofty peaks of the Gilzye mountains to the north, at first like the other rivers, pursues a S. W. course consequent on the direction of the mountains which bound its valley, but after passing the southernmost flank of these ranges, it turns away suddenly to the west, until it effects a junction with the Helmund, immediately below the old town and fortress of Killa Beest.

The Helmund rising among the northern highlands, also preserves a S. W. course until it receives the waters of the Argandab, when it also turns away to the west, but takes again a somewhat backward N. westerly course to about the neighbourhood of Dooshak in Seistan, when it once more turns to the west and falls into the lake.

Beyond the Helmund I had no opportunity of travelling, but the information kindly given me by Lieutenant C. F. North, of the Bombay Engineers, who travelled to Herat, and surveyed the route, tends to show that the features of the country are nearly the same throughout. As there appear to be more rivers laid down upon the maps than actually exist, it may be useful to quote from that Officer's letters.

" Between Girishk and the Khaush, there is not a single stream excepting during the winter; but there are many of what, in India, are called nullahs. I cannot say whether the Ibrahim Jooee is a natural stream or a canal cut from the Furrah, though I am disposed to think it the former.* It does *not* join the Khaush, being lost long before reaching the plain of Bukwa. On the upper road from Girishk to Herat, the Ibrahim Jooee, at the place at which it is crossed, has all the appearance of a natural nullah; lower down its waters are drawn off over the plain, and at Bukwa its place is scarcely known. There is *no* branch or tributary of the Khaush between Dilaram and Bukwa.

" From the hills north of the plain of Bukwa, all the water-courses tend S. West. Looking South and S. West from Bukwa, the ground evidently slopes away towards the desert of Seistan. Next comes the Furrah river, too large to be misplaced much, but I am not aware of any other stream between it and the Adriskund; there are plenty of nullahs, but unfurnished with water except for a few days in winter. The Adriskund is a decent stream, flowing from the hills to the N. E. of the road, in a south-west direction, *apparently* into the Subzawar river, which eventually, I believe, joins the Furrah river, before entering the Zurrah lake. Midway between the Adriskund and the Heri Rood, or Herat river, or Pool-i-Malan (the latter name from Elphinstone, is the name of a bridge over the river) *is a high range*, South of which all the streams run S. W.; and North of it, all water-courses trend to the Heri Rood, of the valley of which this range is the southern boundary. The Heri Rood runs West for some distance, and then turning N. West is lost in the sands."

The courses of all these streams is thus seen to be influenced by the mountainous nature of the districts which

* Its name leads me to suppose it a canal, being literally " *Ibrahim's canal.*"

bound Affghanistan on all sides. Thus, descending rapidly from the N. East, they are prevented from pursuing their way to the South by interposition, in that direction, of the high sandy desert sloping up to the mountains of Beloochistan, which, extending from Mustoong on the East, pass southerly till they form the Much Mountains, where they again turn upwards N. Westerly, precisely as does the river Helmund.

Now, as according to the late Captain Edward Conolly, a range of mountains stretches across the western side, running in " a south-west direction from probably near Ghorian to the Surhud,"* it will at once be evident that the country of Seistan must necessarily form a hollow basin, in consequence of its being every where surrounded by rising grounds stretching away to the distant mountains. The fall of the country from the northward is immense, being no less than six feet per mile between Greeshk and the ruins of Killa Beest, a distance of about 30 miles, which will fully account for the great rapidity of the Helmund, and for its being impassable from the rush of its waters during the spring months, when the snows are melting in the higher hills.

Thus the rivers all shape their course according to the nature of the country, which being high on every side, naturally turns them off towards the basin of Seistan as soon as they are disengaged from the parallel ranges whose direction they are at first obliged to follow. The most obvious characteristic of the whole southern portion of Affghanistan is barrenness, arising less from the infertility of the soil, than from the total want or partial distribution of water. Although no doubt the cultivation might be materially extended and improved, were security of life and property afforded by the laws, yet the very nature of the country forbids its ever becoming the smiling paradise we were most of us inclined to

* Vide Journal Asiatic Society Bengal, No. 103, page 710.

believe it when we first started on the Campaign of 1838-9. The mountains are not sufficiently elevated to retain the snows beyond the spring months of the year, and as the heat is then great,* the snow melts rapidly, filling the streams for a few weeks only, so that the water is all expended by the sudden thaw, before the crops are sufficiently advanced to ripen without its aid. Thus the valleys are left dry and arid all the summer, at the very season when in more favoured situations the crops are looking vigorous and healthy. This causes the cultivators in the vicinity of the hills to dam up streams, and thus preserve a body of water for themselves, by the aid of which a rich but local patch of cultivation is produced; at the same time this practice is most pernicious, for while it secures water for a few cultivators near the hills, it is prejudicial to all the country beyond, which being deprived of even a temporary supply of water, is doomed to barrenness all the year through. Thus the whole country wears, generally speaking, the same dreary desolate aspect, forming one wide waste studded here and there with bright and smiling patches of cultivation. Where a permanent supply of water is insured, the case is somewhat different, although cultivation is still restricted, from the conformation of the valleys, to a mere narrow belt on either side of the river; for instance, about five miles from Candahar, the river Argandab runs along a broad vale, and as it rises among the highlands to the nothward, and always furnishes an abundant supply of water throughout the year, a beautiful and glowing scene presents itself on crossing the range of hills which divides Candahar from the valley of the Argandab. Both banks are richly cultivated with barley, wheat, lucerne, and red clover fields, intermixed with orchards of mulberry, peach, nectarine, apri-

* In May and June, hot winds prevail at Candahar, and the Thermometer in our tents stood at 114° to 120°.

cots, plumbs and cherries, pomegranates, pears, figs, and grapes of delicious flavour and large size ; melons too are abundant, and the whole view is one of great and striking beauty. Through the midst of this green strip rushes the rapid river, split into numerous channels, and generally of good breadth ; but beyond the immediate influence of the stream the valley again becomes a barren stony plain, stretching away for miles towards a range of volcanic hills, which bound it on the West. From the left bank of the river numerous canals are cut, by which the water is conducted through breaks in the limestone range, into the valley of Candahar, which is thus rendered fertile, but which, as it furnishes no water of its own, would necessarily, without this aid, remain for ever waste land. Again on the road to Cabul, fine crops are sometimes met with to break the dreary monotony of the stony plains, but are generally confined to the immediate banks of the Turnuk, whose waters are subsequently lost before they can effect a junction with the Doree.

In other parts where there are no streams at all, the method adopted to procure water for irrigation, is to sink a deep well on the higher lands near the hills, until the water stratum is reached; a second well is then sunk lower down at a little distance from the first, and the two are connected by boring a subterranean communication through which, as the water rises into the first, it is conducted into the second, and from it into a third, and so on until it is carried from the base of the hills towards the lower and distant cultivable lands, on which it debouches at the surface. By this means a stream is raised, on the principle of Artesian wells, from a deep-seated stratum, whose dip from the hills would otherwise prevent the water from coming to the surface, and large tracts of land, which are now rendered exceedingly rich and fertile, would otherwise remain for ever desolate and waste.

If the mountains of India were of no greater elevation than those of Affghanistan to the south of Cabul, there would be no snows to feed the noble rivers which now fertilize its broad plains, and it would consequently present an appearance nearly as bare and sterile during the hot season as Khorasan now does; but besides the everlasting reservoirs of its lofty snowy ranges, India enjoys no small advantage in the occurrence of its periodical rainy season, of which Affghanistan is totally deprived, the only rains it experiences being those of winter, when cultivation is at a stand still. The early melting of the snows fills every stream to overflowing during the spring months, but like all mountain torrents, so rapidly does the water disappear, that it is almost all gone before the summer has fairly set in, and from there being no summer showers to refresh the earth, the greater portion of the country continues arid and waste all the year round. From these natural defects, if such we may presume to call them where all is wisely ordered, the country can never be rendered a rich one in an agricultural point of view, though doubtless the expenditure of capital, if well directed, might improve it vastly from what it now is; but unfortunately for Affghanistan, security of property is wholly unknown, and capital, alas! is about as scarce as the water itself: consequently it is to be feared, that a long day must elapse ere its valleys can be made to wear a different and more desirable aspect.

Correspondence.

Letter from Dr. Wight *to* J. M'Clelland, *dated Coimbatore,* 10*th September* 1845. *Received through* Dr. Wallich, *October* 1845.

My dear Sir,—Your last number (22nd) reached me last night. On looking over the extracts from my letters, regarding the preservation of Griffith's Herbarium, one passage struck me as objectionable, and which must, most inadvertently, have dropped from my pen, in the hurry of unpremeditated composition, and which, at the time of writing, did not present itself to me in the same light that it now does.

On reperusal at this distance of time it immediately struck me as objectionable, inasmuch as it appears to convey an unmerited reflection on Dr. Wallich, which I certainly never intended. The passage to which I allude, is in these words—"If sent to the garden, it (*i. e.* Griffith's Herbarium) might chance some years hence to suffer the fate of Roxburgh's, which would be bad indeed."

The fate which befell Roxburgh's Herbarium, that of being sent to England, and, as it were, swamped among nearly 10,000 species of plants, and finally transferred from India to England, is what, when writing, I considered bad; as I have long thought that that Herbarium ought, in a most especial manner, to have been preserved for the Calcutta Garden, as furnishing the only really unquestionable authority for the names of many of his plants still growing there, and still more for others which have died out and been replaced by others supposed to be the same. But, at the same time, I do not attach much blame to Wallich for the share he had in the transfer. His error in the first instance was one of judgment, which the most sagacious and judicious of men might easily have fallen into, and is therefore a venial one. But, I believe, from what I know of the circumstances attending the transfer of the entire Indian Herbarium to the Linnean Society, partly originated in circumstances not at the time under his control.

But be that as it may, I wish you to make known to all who take an interest in such matters, that when writing the words above quoted, I was unconscious that I was doing Wallich an injury, and had not the most remote idea of reflecting on his conduct in the arrangement and distribution of the Indian Herbaria. On the contrary, I consider Botany, and especially Indian Botany, as owing him a large debt of gratitude for what he did, on that occasion, towards making the treasures of Flora known to the scientific world, and, to no inconsiderable extent, securing for the men who had been the means of collecting them, the honor of naming the plants they had discovered.

Previous to the distribution, the claims of English Botanists to original discovery, were daily being superseded by the very recent labours of foreigners having greater facilities of publishing their collections than fell to the lot of their English predecessors, while, through the limited extent of these, the Indian Flora though rich in English collections, still remained very imperfectly known. Now it is nearly as well known as that of most other countries of equal extent, and equally removed from Europe the centre of science.

To Wallich we are, in a great measure, indebted for this extension of our knowledge, as with him originated the idea, as well as the working out, of the plan of distributing among European public Herbaria, the collections of so many diligent explorers of India, which had for so many years been accumulating, but were still unknown to science.

One error, and that a grave one, was no doubt committed in this great work, which was, neglecting to preserve a complete set of specimens for India, among which Roxburgh's Herbarium ought to have had a distinct and distinguished place. But while I, as an Indian Botanist, deeply regret this oversight, I do not think that Wallich should be made to bear the whole blame, as circumstances not under his control had considerable influence in bringing it about. Could he have seen the end from the beginning, he certainly had it in his power to have done much towards preventing the evil: but we have no prophets among us now-a-days.

Should, what I formerly carelessly wrote, have had the effect of producing any unpleasant feelings in the mind of Dr. Wallich, or his friends, I trust what I have now said will be sufficient to remove them.

Note.—We received the above too late for insertion in our October number, and conceiving the occasion on which the expression complained of occurred, to be one on which a slight inadvertence might be excused, we thought it our duty before publishing the explanation, to refer to Dr. Wight. Allowing the removal of all the East Indian Herbaria from the country in 1827 to have been an oversight, as Dr. Wight regards it to have been, what steps, have since been taken to rectify it ?

The effect of the distribution was to take away from India the means of identifying plants in the country, and to confer them on Paris, London, Berlin, Geneva, Bale, Munich, Halle and other places. Thus leaving the Indian Botanist without any clue whatever as to the plants distributed, and rendering him incapable of describing his own collections until he can first visit Europe. Whatever benefit the distribution, may therefore have conferred on Indian Botany in the light in which it is viewed by Dr. Wight, it has tied the hands of the Botanist in India.

On this point we are furnished with the fullest details by the lamented Mr. Griffith, which enables us to write with the most perfect confidence.

In 1830 Dr. Wallich wrote thus : "Besides the homage which has been paid to the Company in many publications for their princely liberality in thus affording these ample means for the diffusion of a knowledge of the Botany of the East Indies, a still more effectual method of testifying a sense of the general obligation they have conferred upon the scientific world, has been adopted by a number of celebrated Botanists, who have undertaken to publish monographs of the more extensive and interesting families, thereby powerfully contributing to the completion of a scheme so truly worthy of the British East India Company. It is a source of pride for me to introduce here, the names and separate labours of those who have thus zealously come forward to advance the interests of science."

In the Bot. Reg. v. for 1828, v. 14 t. 1203, in an account of Conocephalus naucleiflorous, this remark in reference to the distribution of the collections—"In short, the obligations imposed upon us by these acts of truly oriental munificence are of such a nature, that it has become the bounden duty of all men who have the interest of science and of civilisation at heart, to take every opportunity of expressing the deep sense which they cannot but feel, of measures which so redound to the honour and glory of the Company."

The following is a list of the monographs promised in the Pl. As. Rar. A. D. 1830. Those marked ! are entirely due ; those marked + have been incorporated in general works ; those printed in Capitals are the only ones that come under the engagements, but unfortunately most have appeared in huge and inaccessible works.*

List.

Mr. Arnott.—Ranunculaceæ ! Nymphæaceæ ! Papaveraceæ ! Droseraceæ ! Acerineæ ! Tamariscineæ !

Mr. Bentham.—Caryophylleæ ! LABIATÆ, Lineæ ! Melastomaceæ ! Memecyleæ Alangieæ ! Onagrarieæ ! Salicarieæ ! SCROPHULARINEÆ, *Orobancheæ*+, Cyrtandraceæ ! Myriceæ !

Profr. Besser of Crzmieniec.—Artemisia !

Mr. Adolphe Brongniart of Paris.—Celastrineæ ! Rhamneæ !

Mr. Brown.—Anonaceæ ! Capparideæ ! Rubiaceæ ! Gramineæ ! Sonerila !

M. Cambesedes of Paris.—Hippocratiaceæ ! Sapindaceæ ! Ternstroemiaceæ.+

* The three families without marks may probably have appeared in the 8th vol. of the Prodromus.

Profr. Choisy of Geneva.—Guttiferæ! Hypericineæ! Convolvulaceæ+
Profr. DeCandolle of Geneva.—Araliaceæ+, Umbellifeaæ, Saxifrageæ+, Cunoniaceæ+, Capri foliaceæ+, Loranthææ+, Valerianeæ+, Dipsaceæ+, Compositæ+, Polemoniaceæ, Ebenaceæ+, Sapoteæ+, Styracineæ+, Sesameæ, Gentianeæ! Aristolochieæ!
M. Alphonse DeCandolle of Geneva,—Flora Burmannica! Campanulaceæ+, Bignoniaceæ! Myrsineæ+, Urticeæ!
M. Duvau of Paris.—Pedicularis! Veronica!
Profr. Graham.—Leguminosæ!
Dr. Greville.—Algæ! Filices! Geraniaceæ!
Mr. Haworth.—Crassulaceæ! Portulaceæ! Sedeæ!
Profr. Hooker.—Myristiceæ! Filices! Musci!
Profr. Adr. Jussieu of Paris.—Tiliaceæ! Malpighiaceæ! Rutaceæ! Meliaceæ!
Profr. Kunth of Berlin.—Bombaceæ! Buttneriaceæ! Sterculiaceæ! Dombeyaceæ! Malvaceæ! Elæocarpeæ! Terebinthaceæ! Combretaceæ! Verbenaceæ!
Mr. Lambert.—Coniferæ!
Profr. Lehmann of Hamburgh.—Potentilla! Boragineæ! Primulaceæ! Hepaticæ!
Profr. Lindley.—Rosaceæ! Amentaceæ! Orchideæ+, Antidesmeæ! Aurantiaceæ! Bixineaæ! Grossularieæ! Guaiacanæ! Halorageæ! Jasmineæ! Olacineæ! Oleinæ! Podophylleæ! Resedaceæ! Rhizophoreæ Samydeæ! Santalaceæ! Schizandraceæ!
Prof. Von Martius of Munich.—Amaranthaceæ! Palmæ+, RESTIACEÆ, Aroideæ! Hydrocharideæ! Scitaminæ!
Profr. Meisner of Bale.—Begoniaceæ! POLYGONEÆ, Thymeleæ!
Profr. Nees Von Esenbeck of Breslau.—ACANTHACEÆ, SOLANACEÆ, LAURINEÆ, Piperaceæ!
Mr. Prescott.—Cyperaceæ!
Profr. Richard of Paris.—Menispermeæ! Myrtaceæ! Asphodeleæ Smilaceæ!
Profr. Röper of Bale—Euphorbiaceæ!
M. Seringe of Geneva.—Salix!
Profr. Schultes of Landshut.—Various miscellaneous genera!
Profr. Sprengel of Halle.—Berberideæ! Cruciferæ! Polygaleæ! Ericineæ! Apocyneæ! Asclepiadeæ!
Profr. Henslow—Balsamineæ! Dilleniaceæ! Hippocastaneæ! Stylideæ!
Count Caspar Von Sternberg.—Saxifrageæ+.

On this list, which exhibits such an extraordinary deficiency, comment is hardly necessary. Among the incorporators M. DeCandolle is conspicuous;—among the performers of their engagements, M. Ness Von Esenbeck;—besides, this distinguished Botanist has published the Wightean and Roylean Cyperaceæ in Wight's Contributions, and has long finished the MSS. of the Gramineæ of the same collections; these we hope are not kept back by Dr. Arnott to keep the others company.

It is also to be noticed, that some monographs have been finished wholly or in part, by parties who did not undertake to do them; for instance, the Asclepiadeæ, Guttiferæ and Myrtaceæ, by Dr. Wight, and the Musci by Mr. Harvey and Dr. Joseph Hooker,

Some of the recipients are dead; most will, it is to be feared, be so before their labours are begun, resumed? or finished? Had we a voice in the affair, we would recommend all the outlying materials to be called in and entrusted to M. Nees Von Esenbeck, Mr. Bentham, M. Decaisne and Dr. Wight.

Dr. Wallich concludes his list by these words—" On the above co-operation, exhibiting an unparalleled instance of zeal and liberality in the promotion of a common cause, I can offer no comment, nor can I adequately express the gratitude which I feel towards those who have thus generously relieved me from some of the most difficult parts of my labour."! ! !

Extract of a Letter from W. Lewis, Esq. *Assistant Resident, Penang, to* J. M'Clelland, *dated* 25*th October*, 1845.

" Referring to your exertions for the introduction of Indian manufactured Isinglass, I send by Dr. Scott of your service, an air-bladder of a fish, I fancy of the Polynemus, brought from Rangoon. It weighs 18¼ oz. and beats all I have before seen. Captain Bogle, in the " Calcutta Journal of Natural History," page 615, of Vol. II. staggered me no little, in quoting the dried air-bladders at 8 oz. and averaging them at 4 and 5 oz.; but this one I send beats all. Dr. Royle, I see, averages the best Russian Isinglass, (vide page 16, of his Notices) 7½ lbs. for 1000 fish, which would be only 4⅓ oz. each fish.*

" I have been doing all I can to get the merchants here to do something in Isinglass, but I fear there is too small a field for it. It would however surely be worth while for Officers under Government on the different seaport stations in India, to instruct the natives how to cure fish maws for the English market, by which they would readily get 50 to 75 per cent. more than they do by preparing it merely for the China market. I saw some lately from Nagore (Coromandel coast) very large and fine, selling for 66 rupees the pecul, or 133 lbs. avoirdupoise, say two lbs. for a rupee, which I have no doubt would sell for three shillings in England.

" I bought a little of it as it was very clean, but smelt slightly ; and requested a Broker in England to give me a particular report on it.

" The highest I have obtained for muster cured by myself here, say 1000 lbs., was 3*s*. 2*d*. per lb. clear of duties. This did not cost 20*d*. per lb. including freight, insurance, &c. But the most profitable here would be the kind procured from the Siluroid (Pimelodus Gagore,)

* The Suleah, or Polynemus sounds are sold by the score ; 10 score to the maund of 160 lbs. which gives an average weight of 12⅘ oz. to the sound of each fish. We have one from Arracan, which weighs 1 lb. 12 oz.—Ed.

which in England is classed as "honey-combed:" it can be landed in London for nine-pence per lb. A sample I met in 1844, above 100 lbs., sold for 2*s.* 8*d.* per lb. Of this 2500 to 3000 lbs. can be procured here per annum.

"I am sorry I have not kept the largest of my specimens beat out, but some were from 28 to 31 inches, weighing 3 oz. 6 drams to 3-12 each. This specimen from Rangoon, if it had been perfectly cleaned, would I dare say have weighed 16 oz.*

"The Brokers write me, that the Brewers do not wish the Isinglass to be beat out, but prefer it as hitherto bottle-shaped, tongue-shaped, or as a purse, but divested of all vascular membranes and smell.†

"The Siluroid although exported by the Chinese, is not used in their food, but forms a chief ingredient in the manufacture of a kind of felt cap used in the more northern parts of China. It is in shape like the sailor's red woollen cap, used here generally by Chinese fishermen, who are much exposed in fishing with nets.

"The large Bolah sample weighs 7½ oz. Very few of these are to be got here. It has been cured by my Chinaman very carelessly, but is free from bad odour.

"I send you some specimens prepared by me. The Broker says, they are the finest yet sent from India."‡

* They ought to lose very little in cleaning; what they are in danger of losing is the purer part, this being soluble by washing, while the impurities are not to be thus removed.—Ed.

† The bottle or purse-shape is incompatible with the purity of the article, as it is necessary to open the sound in order to strip it of the inner vascular lining. For the latest method of preparing Indian Isinglass, see the last Quarterly Report of the Bombay Chamber of Commerce.—Ed.

‡ The specimens forwarded by Mr. Lewis are all very good, and some of them very clean and well prepared. We shall forward them to the Chamber of Commerce, to be placed with the other specimens there deposited, and trust his valuable observations may aid in directing attention to the subject.—Ed.

Section of two New Coal Pits near Newcastle.

We are indebted to a friend for the following two useful Memoranda that have not before been published. The first is a Section of two new Pits that have been opened near Newcastle; and the second, on the Strength of Iron Rails.

Account of Strata passed through in the Lady Pit, Wingate Grange Colliery, to the shaft of the Main Coal seam; and afterwards in the Lord Pit, from the shaft of the Main Coal seam, to the Harvey Coal.

	F.	Ft.	In.
Soil	0	1	0
Stony blue clay	9	1	0
Blue clay with marly partings	5	1	0
Mild light-coloured limestone	13	3	0
Yellow limestone with water	30	1	0
Blue limestone	0	5	6
Yellow sand	0	1	2
White post	2	4	0
Red metal	6	1	0
Grey metal	3	0	0
Blue metal	1	0	0
$\frac{3}{4}$ Coal { *Coal*	0	1	8
Band	0	0	1½
Coal	0	1	6
Band	0	0	3
Coal	0	1	0
Band	0	1	2
$\frac{5}{4}$ Coal. *Coal*	0	4	1
Splint	0	1	2
Grey metal	1	3	6
White post	1	2	1
Grey metal	0	3	6
Coal and black stone	0	1	5
Grey metal	2	2	5
Coal	0	0	4
Black stone	0	0	10
White post	5	5	8
Grey metal	0	2	2
Blue metal	0	2	6
Grey metal	0	1	3
Coal. 'Main coal'	0	4	8
	87	5	11½
From this seam the section is continued in the Lord Pit—being 6 fms. deeper from the Trouble between the pits—the Lady Pit only sunk to the Main Coal. Depth of the Main Coal, in Lord Pit, Dip side of the dyke.	94	0	0
Black stone	0	1	8
Silt stone	0	0	11
Blue metal	3	0	3
Post girdles with metal partings	1	1	7
Blue metal	0	3	1

	F.	Ft.	In.
Coal	0	0	7
Grey metal	1	0	7
Blue metal	0	4	8
Grey metal with post girdles	0	4	8
White post	2	0	11
Grey metal	0	2	10
Dark grey post..	3	1	2
Blue metal	0	2	5
White post	1	3	6
Blue metal	0	1	4
Dark brown post	0	3	6
White post	2	5	11
Grey metal with post girdles	0	4	11
Coal. 'Low main'	0	1	8
Black stone	0	0	7
White post	0	1	1½
Grey metal with post girdles	5	4	10
Blue metal	3	0	3
Grey metal	0	4	0
White post	0	2	10
Grey metal with post girdles	1	2	7
Post	0	2	1
Blue metal	4	3	5
White post	0	2	1
Blue metal	1	4	7
Coal—"Hutton Seam" ..	0	2	8
Grey shift	0	3	3
Grey metal	2	1	11
White post	0	4	6
Grey metal with post girdles	0	5	1
Blue metal	0	2	0
Grey metal	0	4	9
Dark brown post	1	2	3
Grey metal	0	4	6
Dark brown post	0	4	5
White post	3	0	0
Blue metal	6	1	6
Grey metal	1	0	4
Black metal	0	1	4
Coal	0	0	8½
Grey metal with post girdles	0	0	5
Coal	0	0	3½
Stony metal, stone with post girdles	3	3	0
Coal. 'Harvey Seam,' .	0	0	8
Total depth	157	5	3½

WILL. ARMSTRONG.

Analysis of Tyne Coal.

	Carbon.	Hydro.	Azote & Oxygen.	Ashes.
Splint, ...	74·82	6·18	5·08	13·91
Main coal, ...	84·85	5·04	8·43	1·67
Colliery coal, ...	87·95	5·24	5·42	1·39
Ditto, ...	83·27	5·17	9·04	2·52

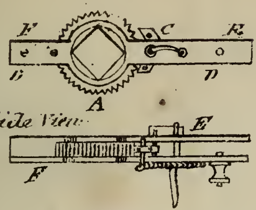
Experiments on the Strength of Great North of England Rails.

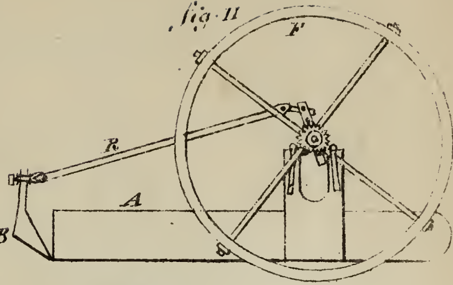
Expt. No. 1.	Inch.	No. 3.	Inch.	No. 5.	Inch.
10 cwt. deflection,	1-16	10 cwt. deflection,	1-8	10 cwt. deflection,	3-32
20 ,, ,,	3-16	20 ,, ,,	1-4	20 ,, ,,	1-4
30 ,, ,,	9-32	30 ,, ,,	3-8 bare	30 ,, ,,	5-16
40 ,, ,,	7-16	40 ,, ,,	15-32	40 ,, ,,	7-16
50 ,, ,,	9-16 full	50 ,, ,,	11-16	45 ,, ,,	15-32
55 ,, ,,	13-16	55 ,, ,,	15-16		
Leaving a permanent set of 5-16 of an inch.		Leaving a permanent set of 7-16 of an inch.		Leaving no set.	

No. 2.	Inch.	No. 4.	Inch.
10 cwt. deflection,	1-8	10 cwt. deflection,	1-8 bare
20 ,, ,,	1-4	20 ,, ,,	1-4
30 ,, ,,	5-16 full	30 ,, ,,	5-16
40 ,, ,,	7-16	40 ,, ,,	7-16
50 ,, ,,	9-16	50 ,, ,,	9-16
55 ,, ,,	11-16 full		
Leaving a permanent set of 3-16 of an inch.		Leaving a permanent set of 1-16 of an inch.	

BISHOP'S COLLEGE PRESS.

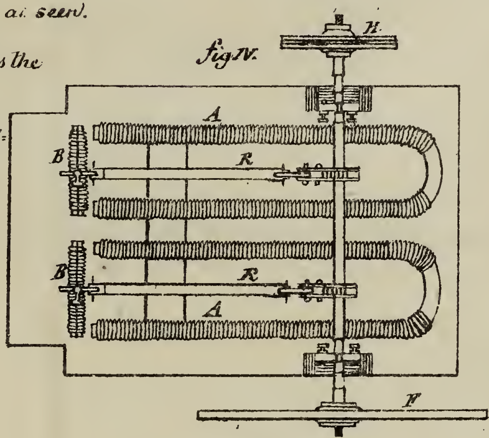
Fig. III.

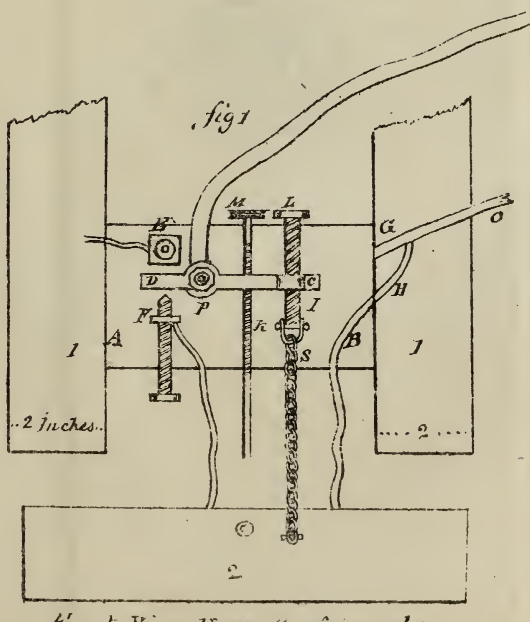




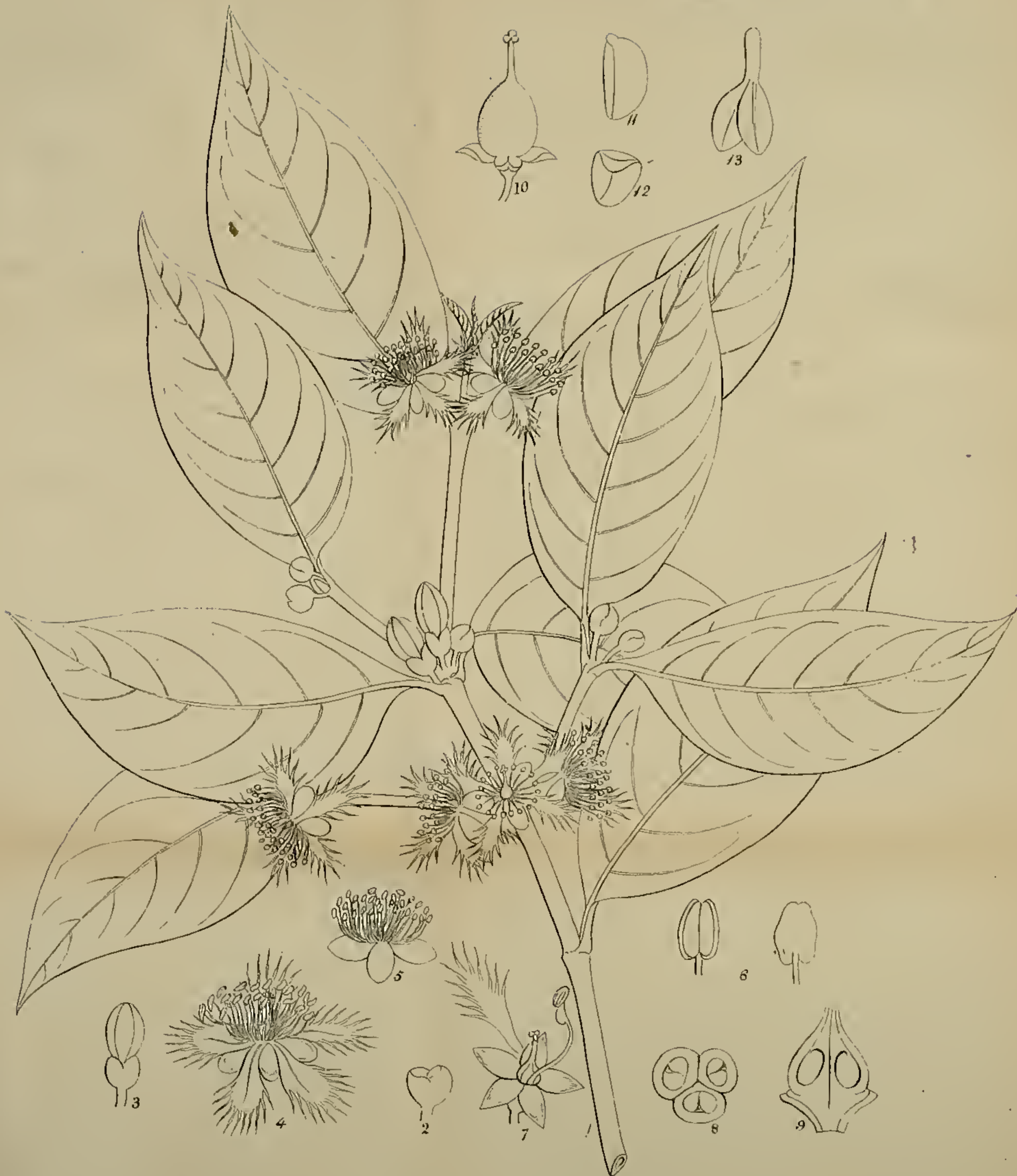
Reference to figrs. II. & IV.

A. Electro-magnets.
B. Keepers, Working as seen at fig. II.
R. Rod, which Works the Crank.
F. fly Wheel.
H. Small Wheel Working as Screw, or fan paddle

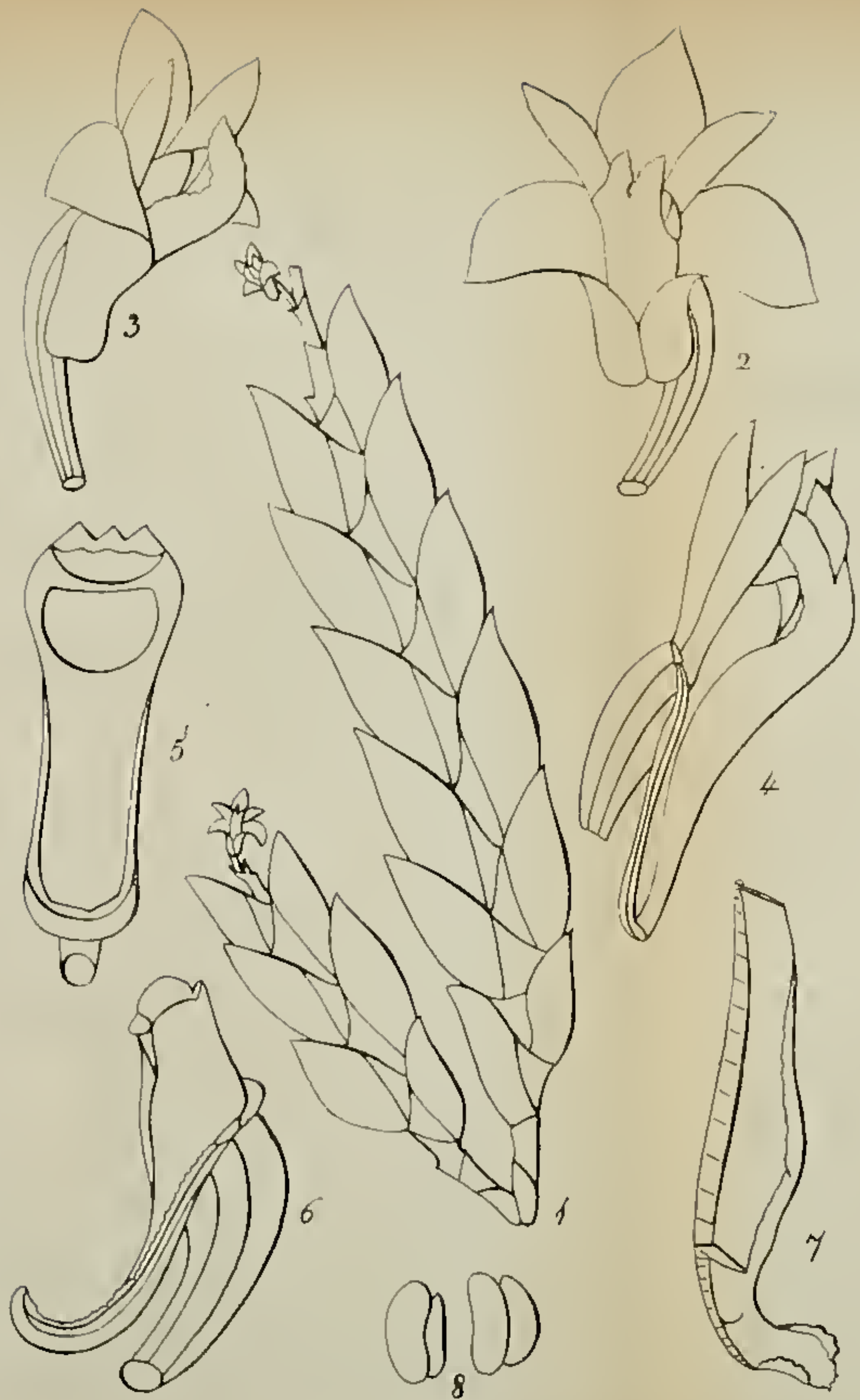




Front View, Upper Surface only



Anstrutheria Ceylanica Gardn



Aporum micranthum

Didymoplexis pallens

GENERAL INDEX.

New Subscribers.

Dr. Row, Dum-Dum.
Dr. McLeod, 58th Regt. N. I.
Dr. Hutchinson, Civil Assist. Surgeon, *Arrah.*

Papers Received.

Contributions towards a Flora of Ceylon, by George Gardner, F.L.S., Supdt. of the Royal Bot. Garden, Kandy.

Notes on Indian Botany, by Robt. Wight, M.D., F.L.S. &c.

Errata in No. 21 of Journal.

Page 37, 10th line from bottom for "*Paris*" read "*Pure*"
39, 4th line from top for "40*lbs.*" read "40 *Rupees.*"
41, 19th ———— for "*Bad*" read "*Bar.*"
43, Last line, for "*dued*" read "*due.*"
44, 2nd line from top for "*Reitron's*" read "*Neitron's.*"
46, 6th line, for "*on Dissolving*" read "*as on Dissolving.*"
—, 12th line from bottom for "*giving*" read "*given.*"
—, 4th line, for "10*d. per*" read "10 *or.*"
47, 6th line from top for "£200" read "200 *Rupees.*"
—, ———— for "*half*" read "*one fifth.*"
—, 6th line from bottom, for "*Does*" read "*As.*"
—, 5th ———— for "*Become*" read "*Becomes,*"
—, 4th Take out the note of "*Interrogation.*"

ERRATA.

Page 459, first line of heading, *for* 'Coleopterus,' *read* 'Coleopterous,'—(Reading the headings throughout in the same manner.)

,, 460, line 12, from bottom, *for* 'uniform,' *read* 'reniform.'

,, 461, line 14, from bottom, *for* 'inflated in the form,' *read* 'inflated in form.'

,, 462, line 5, from top, *for* 'centice,' *read* 'antice.'

,, —–, line 2, from bottom, *for* 'Boys' Nehor species,' *read* 'Boys' Mhow species.'

,, 463, line 1, from top, *for* 'papilioform,' *read* 'papilliform.'

,, 464, line 7, from bottom, *for* 'threads,' *read* 'tufts.'

,, 465, line 13, from top, *for* 'P. nentidens,' *read* 'P. acutidens.'

,, 466, line 3, from top, *for* 'clava,' *read* 'clavæ.'

,, —–, line 2, from bottom, *for* 'within a final one,' *read* 'within an apical one.'

,, 467, line 10, from top, *for* 'corner,' *read* 'cornu.'

,, 470, line 4, from bottom, *for* 'the form Leiomatocerus,' *read* 'the term Leiomatocerus.'