





PHILOSOPHICAL  
TRANSACTIONS:

Giving some

ACCOUNT

OF THE

Present *Undertakings, Studies, and Labours*

OF THE

INGENIOUS,

In many

Considerable Parts of the WORLD.

---

V O L. XVIII. For the Year 1694.

---

L O N D O N :

Printed for *S. Smith* and *B. Walford*, Printers to the *Royal Society*, at the *Prince's Arms* in *St. Paul's Church-yard*. 1695.

PHILOSOPHICAL  
TRANSACTIONS

Giving form

ACCOUNT

OF THE

Present Undertakings, Studies, and Labours

OF THE

INGENIOUS

In many

Considerable Parts of the World.

NO. LXXIII. For the Year 1695.

L O N D O N :

Printed for S. Smith and B. Walford, Printers to the Royal  
Society, at the Printer's Shop in St. Paul's Church-yard, 1695.

---

---

To the HONOURABLE  
Sir ROBERT SOUTHWELL, Kt.  
P R E S I D E N T ;

And to the  
Council and Fellows

OF THE  
Royal Society  
OF  
L O N D O N ,

FOR THE  
Advancement of *Natural Knowledge*,

This Eighteenth Volume

OF THE  
PHILOSOPHICAL TRANSACTIONS

Is humbly Dedicated

By *Richard Waller*, S.R.Secr.

ST ROBERT SOUTHWELL  
PRINTED

Council and Fellows

**IMPRIMATUR,**

*Vol. XVIII. Philosoph. Transact.*

Feb. 13. 1697

*Rob. Southwell,  
P. R. S.*

Advancement of Natural Knowledge

The Righteous Values

OF THE

PHILOSOPHICAL TRANSACTIONS

is humbly Dedicated

By Richard Waller, S. R. Secy

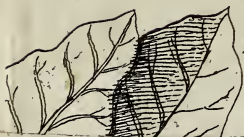
N. 192

*Myrtus arborea, folijs laurinis, aromata.*  
Pimienta or Jamaica-pepper-tree



*Arbor baccifera, laurifolia, aromatica,*  
*fructu viridi calyculato racemoso.*  
Cortex Winteranus or wild-Cinnamon-tree.

*Myrtus arborea, folijs laurinis, aromata*  
Pimienta or Iamaica-pepper-tree



*a, aromatica,*  
*acemoso.*  
mamon-tree.

# PHILOSOPHICAL TRANSACTIONS.

For the Months of *January* and *February*. 1697.

## The CONTENTS.

- I. **A**N Advertisement. (2.) *An Account of an Observation of an Eclipse of the Moon observed at Moscua in Russia on April 5. st. v. 1688. and compared with the same observed at Lipsick, whereby the Longitude of the former place is ascertained. Together with the Latitudes of several principal Places in the Empire of Russia.* (3.) *A Discourse concerning the most seasonable time of Felling Timber, written by the advice of the Honourable Sam. Pepys Esq; Secretary of the Admiralty, and presented to his late Majesty. By Rob. Plott LL. D. and R. S. Soc.* (4.) *A Description of the Pimienta or Jamaica-Pepper Tree, and of the Tree that bears the Cortex Winteranus, communicated by Hans Sloane M. D. and Reg. Soc. S.* (5.) *An account of the Circulation of the Watry Vapors of the Sea; and of the Cause of Springs: presented to the R. Society, By E. Halley.* (6.) *A Discourse concerning the Modern Theory of Generation, by Dr. George Garden of Aberdeen; being part of a Letter to Dr. Will. Musgrave LL. D. and R. S. Soc. and by him communicated to the Royal Society.* (7.) *Observatio Mercurii sub sole Visi, ultimo Octobris. 1690. st. vet. habita Noribergæ ab Astronomo accuratissimo. J. P. Wurtzelbaur, atque ab eodem cum Regia Societate communicata.* (8.) *An Account of*

*an Experiment of the Injection of Mercury into the Blood, and its ill effects on the Lungs: as it was communicated to the Royal Society, by their late worthy Member A. Moulin, M.D. (9.) An Account of a Book; Medicina Hydrostatica or Hydrostaticks applied to the Materia Medica, shewing how by the weight that divers Bodies used in Physick have in Water, one may discover whether they be Genuine or Adulterate; By the Honourable ROBERT BOYLE, Fellow of the Royal Society. London. Octavo. 1690.*

---

## Advertisement.

**T**HE Publication of these Transactions having for some time past been suspended, chiefly by reason that the unsettled posture of Publick Affairs did divert the thoughts of the Curious towards Matters of more immediate Concern than are *Physical* and *Mathematical* Enquiries, such as for the most part are the Subjects we treat of, with exclusion to many others wherewith the forein Journalist usually supply their monthly Tracts: These are now to Advertise, that for the future the *Royal Society* has commanded them to be Published as formerly, and if possibly Monthly. And all lovers of so good a Work are desired to contribute their Discoveries in Art or Nature, addressing them as formerly to Mr. *H. Hunt* at *Gresham* College, and they shall be inserted herein, according as the Authors shall direct.

*An Account of an Observation of an Eclipse of the Moon, observed at Moscua in Ruffia, on April 5. 1688. compared with the same observed at Lipsick; whereby the Longitude of the former place is ascertained: Together with the Latitude of several principal Places in the Empire of Ruffia.*

THE Royal Society being desirous to contribute what they may to the rectifying of Geography, and determining the Longitudes of Places, amongst others did recommend the procuring an Eclipse to be observed at *Moscua*, to an eminent Merchant trading there; at whose instance one Mr. *Timmerman*, a Mathematician, residing on the place, returned the following account.

*April 5. 1688.* half a quarter of an hour after seven in the Evening, the Moon arose clear, but of a deep red colour without any sign of Eclipse: at  $7^h \frac{1}{2}$  the Moon went into a thick Cloud, but was again clear at  $7^h 38^m$  when the under-side of the Body of the Moon was begun to be obscured, in a clear Sky; she being then in the  $25^{\text{th}}$  degree of *Libra*, and  $6^\circ \frac{1}{2}$  above the Horizon. (*Suppose the Center.*)

At  $9^h$  the whole under-side of the Moon was eclipsed, and about 8 minutes after nine, it was at the height, or rather seemed to decrease. At  $9^h \frac{1}{2}$  there was still a third part of the Moon eclipsed. (*Suppose of her Circumference.*)

About ten it decreased apace, and at  $10^h \frac{1}{2}$  there was but little to be seen: At  $10^h 45'$  it was certainly ended, the Moon being then about  $22^\circ$  high. Thus far the Observer.

The duration of this Eclipse is here made from  $7^h 38'$  to about  $10^h 45'$ , which agrees within 8 or 10 minutes with our Tables, that never err sensibly in the continuance of Eclipses; and so much ought to be allowed to an Observer not sufficiently instructed to distinguish the *Penumbra* from the true shadow, though a small Telescope

lescope were used in this Observation, as we are since informed. Let us conclude then, That the end was at 10<sup>h</sup> 40' at *Moscua*. We do not find that this Eclipse was observed at *London*, and it was in probability cloudy, and otherwise only the latter part thereof would have been visible: However this defect is in good part supplied by an Observation thereof made at *Lipsick*, by Mr. *Gottfrid Kirck*, and published in his *Ephemerides* for the Year 1689. where the end is determined at 8<sup>h</sup> 54' P.M. Hence *Moscua* will be 1<sup>h</sup> 46' to the Eastwards of *Lipsick*; and the difference of Meridians between *London* and *Lipsick* being already determined 49 min. it will follow that *Moscua* is 2<sup>h</sup> 35' to the East of *London*, or 38° 45' of Longitude, which from other Accounts we find to be very near that of the City of *Aleppo* in *Syria*.

By the same Hand we have procured the Latitudes of the following Places, observed, as 'tis said, with a large Quadrant.

	°	'
<i>Moscua</i>	55	34
<i>Yereslaw</i>	57	44
<i>Wologda</i>	59	19
<i>Wostak</i>	61	15
<i>Arkangel</i>	64	30

A DISCOURSE concerning the most seasonable Time of Felling of Timber; Written by the advice of the Honorable Sam. Pepys Esq; Secretary of the Admiralty, and presented to his late Majesty. By Robert Plot LL.D. and R. S. Soc.

May it Please your MAJESTY,

WHEN I first imparted to your Majesty the manner of felling of Timber in the County of *Stafford*, with the advantage it might give to your Royal Navy, were all the Timber used in building your Fleet so felled; according to your Majesties command, I immediately (the same day) waited upon Mr. Secretary *Pepys* and Sir *Anthony Dean*, and communicated the Matter to them, who both promised me they would acquaint your Majesty I had so done, and give your Majesty an account of their present Thoughts of it: but the former, *viz.* Mr. Secretary *Pepys*, received so strong an impression of the usefulness of the Experiment, and thought it (after consideration) of that importance, that he desired me, the day following, further to consider this Subject, and see what might be added to what I had already written in my History of *Staffordshire* relating to it; and what material Observations made, why this Custom of *Staffordshire* and the Neighboring Counties, might not be practised here in the South of *England* as well as there; and so put all into Writing for your Majesties use.

For the performance whereof, with as much brevity as perspicuity will allow me, your Majesty is first desired to recollect what I told your Majesty in *May* last, that the Custom of felling Timber here in the South of *England*, differs from that of *Staffordshire*, only in two things, *viz.* In the time of Felling, and manner of Barking. It be-

A ing

ing felled here in the Spring, as soon as the Sap is found to be fully up, by the Trees putting out, and then Bark'd after the Trees are prostrate, the Sap yet remaining in the Bodies of them: Whereas there it is first barked, (in the Spring as here) but before it is felled, the Trees yet living and standing all the Summer, and not felled till the following Winter, when the Sap is fully in repose: Whether of which Customs of felling Timber, either for Ships or other Buildings, is most eligible, is the Point to be discuss'd.

In the clearing whereof, May it please your Majesty first to take notice, that all Trees in the Spring Season (when usually we fell them in the South of *England*) and some time after, are pregnant, and spend themselves (as Animals do in their respective Off-springs) in the production of Leaves and Fruits, and so become weaker than at other times of the Year; their Cavities and Pores being then turgid with Juices or Sap, which (the Trees being felled at that time) still remain in the Pores, having now no manner of means of being otherwise spent, and there putrifie; Not only leaving the Tree full of these Cavities which render the Timber weak; But secondly breeding a Worm as both *Pliny* and *Mr. Evelyn* testify, that will so exceedingly prejudice it, that it becomes altogether unfit for strong Incumbencies, or other robust Uses. Thirdly, That all Timber fell'd at this time of Year, whether the Juices putrifie, or otherwise sweat forth, or dry away, is not only subject to rift and gape, but will shrink so considerably, that a Piece of such Timber of a Foot square will usually shrink in the breadth  $\frac{1}{4}$  of an Inch; than which, says *Vegetius*, nothing is more pernicious if used for the building of Ships. To which, Fourthly, The first and greatest Roman Emperor *Julius Caesar* adds, That tho Ships may be made of such moist Timber fell'd in the Spring, yet they will certainly be Sluggs, not near so good Sailers as Ships made of Timber fell'd later in the Year.

In all which Circumstances I find most of the Antients so very well agree, that none of them advise the felling of Timber for any sort of use before Autumn at soonest; others not till the Trees have born their Fruit, which says *Theophrastus* must always be proportionably later, as their Fruits are ripe later in the Year: a third sort not till Mid-winter: not till *November* says *Palladius*, nay, not till the Winter Solstice, says the Wise *Cato*; and then too in the decrease or wane of the Moon, between the 15th and 23d day of her Age, says *Vegetius*, or rather according to *Collumella* between the 20th and the New Moon. In general says *Theophrastus*, the Oak must be fell'd very late in the Winter, not till *December*, as the Emperor *Constantinus Pogonatus* positively asserts, the Moon too being then under the Earth, as 'tis for the most part in the day-time in the first part of its decrease. And the felling of Oak within those Limits, they call *Tempestiva casura*, *Felling Timber in Season*, which they all unanimously pronounce (if thus fell'd) will neither shrink, warp, nor cleave, nor admit of decay, in many years, it being as tough as Horn, and the whole Tree in a manner (as *Theophrastus* asserts) as hard and firm as the Heart; with whom also agrees our Country-man *Mr. Evelyn*, if you fell not Oak (says he) till the Sap is in repose, as 'tis commonly about *November* and *December*, after the Frost has well nipped them, the very Saplings thus cut, will continue without decay, as long as the Heart of the Tree.

And the reason of this is given in short by *Vitruvius*, *quia aeris Hyberni vis comprimit & consolidat arbores*, because the Winter Air doth close the Pores, and so consequently consolidates all Trees, by which means the Oak (as He and *Pliny* both express it) will acquire a sort of Eternity in its duration; and much more will it so, if it be barkt in the Spring, and left standing all the Summer, exposed to the Sun and Wind, as is usual in *Staffordshire*,

and the adjacent Counties, whereby they find by long Experience the Trunks of their Trees so dried and hardened, that the sappy part in a manner becomes as firm and durable, as the Heart it self.

Which way of barking and felling of Timber, tho it were unknown to the Antients (as perhaps it is to all the World besides those few Counties) yet they seem not unacquainted with the rationality of the Practice: For *Seneca* observes the Timber most exposed to the cold Winds, to be most strong and solid, and that therefore *Chiron* made *Achilles's* Spear of a Mountain Tree. *Homer* also tells us that the Spear of *Agamemnon* was ἀνευρηφές ἔργον, made of a Tree so exposed, for which *Didymus* gives the reason πῶς ἀνέμου (says he) πλείον γυμναζόμενα δένδρα, στερέα, for that being continually Weather-beaten, they become harder and tougher. And *Pliny* says expressly as much for the Sun, as they for the Wind, viz. That the Wood of Trees exposed to the Sun-shine, is the most fast and durable, for which reason 'tis too that the Great *Vitruvius* prefers the Timber on the South side the *Appennine*, (where it winds about and incloses *Tuscany* and *Campania*, and strongly reflects the constant Heats of the Sun upon it, as it were from a Concave;) incomparably before that, which grows upon the North side of the same Hill, in the shady moist Grounds: of which his opinion he renders us this reason, for that the Sun does not only lick up the superfluous moistures of the Earth, whence the Trees are supplied in such shady places with too great a quantity, but in great measure exhales the remaining Juices (after the production of Leaves and Fruits) out of the Trees themselves, rendering the Timber of them the more close, substantial and durable; which certainly it would do also much more effectually, if the Bark were taken of in the Spring of the Year, as is accustomed in *Staffordshire*, where the

People

People are content to use this method in their provision of Timber, tho' but for private Uses.

Much rather should it be done then in so publick a concern as the building of Ships, where tough and solid Timber is much more necessary than in ordinary Buildings. Nor can I yet meet with any material Objection, either from *Staffordshire* Gentlemen (many of whom I have consulted about this Affair since I informed your Majesty of the advantage of it) or from any other, why this Practice may not be used here in the South of *England*, as well as there. There is indeed an Act of Parliament 1 *Jac.* 1. chap. 22. whereby your Majesties Subjects are forbid felling Timber for ordinary Uses (in consideration of the Tan) at any other time but between the first of *April* and last of *June*, when the Sap is up and the Bark will run, made on supposition (I guess) that should they have admitted felling Timber in any other Season, the Tanners would have wanted a supply of Bark. To which I readily answer, That I fear the Legislators that press'd the making that Act, were ignorant that the Bark might be taken off in the Spring, and that the Tree notwithstanding would live and flourish till the Winter following, as I have seen many in *Staffordshire*: So that tho' the Tree be not fell'd till the Winter Solstice, or *January* following, yet the Tanner is not at all defeated of his Tan, but has it here in as due Season as in any of the Southern Counties. The Legislators I say were ignorant of this, otherways they would never have made an Act so pernicious to the whole Kingdom, as felling Timber at this Season is, for the sake of a few Tanners.

But notwithstanding this ignorance, yet then they were so wise as to except in that Act the Timber to be used in building of Ships, which may be fell'd in Winter, or any other time; as I am told all the ancient Timber remaining in the *Royal Sovereign* was, it being still so  
hard

hard that 'tis no easie matter to drive a Nail into it, so that your Majesty has no need of giving your self the trouble of procuring the alteration or repeal of that Act, upon this account only, tho it may possibly be desirable (because profitable to the Subject) upon many others.

'Tis true indeed that the barking or peeling the Tree standing, is somewhat more troublesome, and therefore somewhat more chargeable, than when they are prostrate; and that 'tis likely People therefore have usually fell'd their Timber, as well for Shipping as other uses, in the Spring of the Year, for the sake of the more easie and cheap barking it only, than any thing else. 'Tis true too, that Timber is harder to fell in Winter, it being now so compact and firm, that the Ax will not make so great imperffion, as it doth in the Spring, which will also encrease the price of the felling some small matter, and its sawing afterwards; but how inconsiderable these things are in comparison of the great good your Majesty will reap by this manner of felling, (as is plain from what has been said above,) I need not acquaint your Majesty, it being (I think) self evident.

The greatest Objection, that I can foresee will be urged here in the South against this practice, is, That if the Timber be not fell'd till Mid-winter or *January*, where it grows in Copses and Woods, they cannot perhaps inclose their young Springs so soon as some may imagine needful, and therefore will be backward to fell their Timber (so growing) at that Season.

To which I answer, First, That the Timber so fell'd in the Wood or Copses may be easily carried off before the second Spring, and so the prejudice small, and the first it must be there where ever it is fell'd: but secondly, that which will quite remove this inconsiderable difficulty, is, That perhaps your Majesty may think it expedient, that no Timber whatsoever growing in Woods or Copses be at all bought into your Majesties Yards, for that

that Timber growing in such shady places, and so fenced from Sun and Wind, as Timber in Woods for the most part is, cannot be so good as that which comes from an exposed situation, such as it usually has in your Majesties Forests, and in the Parks and Hedge-rows or open Fields of your Subjects, where too it is indifferent at least, if not better for the Proprietor, that it be fell'd in Winter (when the Grass and Corn is gone) than in the Spring it self: So that I cannot see what your Majesty has more to do in this Matter, in case your Majesty think fit to make use of this Method, than to order your Officers assigned for that purpose to buy all their Timber under such Conditions as to be fell'd in Winter; enjoying the Proprietor (unless your Majesty think fit to buy the Bark) to take it off in the Spring in due time, making him some small allowance for the trouble he will have in peeling it standing.

Which is all I have met with further at present to inform your Majesty of, concerning this matter, wherein, if it should so happily fall out, that I have done your Majesty any the least Service, the internal Satisfaction I shall conceive from it, together with your Majesties favourable Acceptance, will be an ample Reward to

*Your Majesties, &c.*

A Description of the Pimienta or Jamaica Pepper-Tree, and of the Tree that bears the Cortex Winteranus : Communicated by Hans Sloane, M. D. and Reg. Soc. S.

*Myrtus arborea foliis laurinis aromatica* : five  
Pimienta, Jamaica-Pepper, or All-Spice-Tree.

**T**His Tree has a Trunk as thick as ones thigh, rising streight about 30 feet high, covered with an extremely polite or smooth Skin of a gray colour, and branched out on every hand, having the ends of its Twigs set with Leaves of several sizes, the largest being 4 or 5 inches long, and 2 or 3 broad in the middle where broadest, and whence it decreases to both extremes ending in a point, smooth, thin, shining, without any incisures, of a deep green colour, and standing on inch-long footstalks; when bruised very odoriferous, and in all things like the Leaves of a Bay-tree. The ends of the Twigs are branch'd into bunches of Flowers, each footstalk sustaining a Flower made up of four herbaceous or pale-green *Petala* bowed back or reflected downwards, within which are many *Stamina* of the same colour. To these follows a bunch of crowned or umbilicated Berries (the Crown being made up of four small *Foliola* or Leaves) which are bigger when ripe than Juniper-berries, at first when small, greenish; but when ripe, they are black, smooth and shining, containing in a moist, green, aromatick and biting Pulp two large *Acini* or Seeds, separated by a Membrane lying between them, each whereof is a Hemisphere, and both join'd make a Globe or Spherical (appearingly one) *Acinus*, whence *Clusius* makes it one Seed divisible into two parts.

It grows on all the hilly parts of the Island of Jamaica, but chiefly in the North-side thereof; and where-ever these

these Trees grow, they are generally left standing when other Trees are fell'd, or they are sometimes planted where they never grew, because of the great profit from the cur'd Fruit sent in great quantities yearly into *Europe*.

It flowers in *June*, *July* and *August*, but in several places sooner or later, according to their situation and different Season for Rains: and after it flowers the Fruit soon ripens; but 'tis to be observ'd, that in clear'd open Grounds, 'tis sooner ripe than in thicker Woods.

There is no great difficulty in the curing or preserving of this Fruit for use, 'tis for the most part done by the *Negro's*; they climb the Trees, and pull off the Twigs with the unripe green Fruit, and afterwards carefully separate the Fruit from the Twigs, Leaves, and ripe Berries; which done, they expose them to the Sun from its rising to setting for many days, spreading them thin on cloaths, turning them now and then, and carefully avoiding the dews (which are there very great.) By this means they become a little wrinkled or rugous, dry, and from a green change to a brown colour, and then they are fit for the Market, being of different sizes, but generally of the bigness of black Pepper, something like in smell and taste to Cloves, Juniper-berries, Cinamon, and Pepper; or rather having a peculiar mixt smell, somewhat akin to them all, whence the name of *All-Spice*. The ripe Berries are very carefully separated from those to be cured, because their wet and plenteous Pulp renders them unfit for Cure. Whence these Berries always coming unripe dried into *Europe*, has been the occasion of Naturalists thinking it to be *fructu umbilicato sicco*. The more fragrant and smaller they are, they are counted the better.

This Fruit with water distilled *per Vesicam*, yields a very odoriferous Chymical Oyl sinking to the bottom of water like Oyl of Cloves. It may deservedly be counted

red the best and most temperate, mild and innocent of common Spices, and fit to come into greater use, and to gain more ground than yet it hath of the *East-India* Commodities of this kind, almost all of which it far surpasses by promoting the digestion of Meat, attenuating tough Humours, moderately heating, strengthening the Stomach, expelling Wind, doing those friendly offices to the Bowels we generally expect from Spices.

It is now commonly sold by Druggists for *Carpobalsamum*, which I suppose came from *Hernandez*, who says it may be its *succedaneum*; but it is not that Fruit, but seems more fragrant and less adstringent and balsamick. *Clusius* says, that it takes away, if chew'd, a stinking Breath. *John de Barrios* tells us, 'tis one of the Ingredients of Chocolate in *New Spain*, and *Franciscus Uria*, who brought it from *New Spain* and gave it to *Redi*, said it was there commended against the Epilepsie and *Gutta serena*, which he in divers persons tryed, but without success; but he at the same time says, he thinks it a good Stomachic and Cephalick Medicine moderately given, *Exper. Nat. pag. 132.*

It has been taken by *Clusius* for *Pliny's Caryophyllon*, and by others for *Amomum*: But 'tis not likely that it was known to the Ancients, not being known to grow in the *East*, but *West-Indies*, whence it was brought into *England*, and sent to *Clusius*, who first described and figured it, giving it this name *Amomum quorundam*, An *Caryophyllon Plinii*, *Exot. p. 17.* from whence came that in *Gerard*, *Amomum quorundam, forte Caryophyllon Plinii*, p. 1610. and that of *Parkinson*, *Amomum aliud quorundam, & Caryophyllon Plinii à Clusto suspicatum*, p. 1567. likewise that of *Caryophyllus aromaticus fructu rotundo*, C. B. p. 411. & *Amomum quorundam odore Caryophylli*, J. B. Tom. 2. p. 194. *Redi* in his *Exper. Nat. p. 132.* speaks of this, and figures it under the name of *Piper Chiapæ*. And *Dr. Trapham* in his Discourse of the  
State

State of Health in the Island of *Jamaica*, calls it the Bay-tree or Spicy Piemento, p. 38. And Dr. *Grew* in his *Museum Regalis Societatis* calls these, being very large, Aromatick Indian Berries, or *Cocculi Indi aromatici*, p.

211.

It is also very likely that *Hernandez* does describe this under the name of *Xocoxitl*, seu *Piper Tavaſci*, p. 30. his Description agreeing in every thing only the Flower, which muſt, if he rightly describes it, make it different; for he makes it to have a Scarlet Flower like to the Pomegranate, ſmelling like Orange-flowers, no way agreeing to this. And *Ximenes* in the Spanish History of *Hernandez* printed at *Mexico*, describes it the ſame way by the name of *Xocoxitl* o *Pimienta de Tavaſco*, fol. 2. ſo that I remain in doubt, but am apt to believe it the ſame, only ill deſcribed by this Author.

I am likewiſe, on account of an ill deſcription, very much at a loſs to know whether this be the Tree *Piſo* deſcribes in the firſt Edition of his Book, p. 98. 1648. under the name of *Anhuiba miri*.

*Arbor Baccifera, laurifolia, aromatica, Fructu viridi calyculato ramoſo.*

*Wild Cinamon-tree, commonly but falſly called Cortex Winteranus.*

**T**HIS Tree has a Trunk about the thickneſs of ones Thigh, riſing to about 20 or 30 foot high, having many Branches and Twigs hanging downwards, making a very comely Top. The Bark conſiſts of two parts, one outward, and another inward. The outward Bark is thin as a mill'd Shilling, of a whitish Aſh or gray colour, with ſome whiter ſpots here and there on it,

and several shallow Furrows of a darker colour, running variously through it making it rough, of an aromatick taste. The inward Bark is much thicker than Cinamon, being as thick as a mill'd Crown-piece, smooth, of a whiter colour than the outward, of a much more biting and aromatick taste something like that of Cloves, and not glutinous like Cinamon, but dry and crumbling between the teeth. The Leaves come out near the ends of the Twigs without any order standing on inch-long foot-stalks, they are each of them two inches long, and one inch broad near the end where broadest, and roundish, being narrow at beginning, from whence it augments in breadth to near its end, of a yellowish green colour, shining and smooth, without any incisures about its edges, and somewhat resembling the Leaves of Bay or *Laurocerasus*. The ends of the Twigs are branched into bunches of Flowers, standing something like Umbels, each of which has a foot-stalk, on the top of which is a *Calix* made up of some *Foliola*, in which stand five Scarlet or Purple *Petala*, within which is a large *Stylus*. To these follow so many *calyculated* Berries of the bigness of a large Pea, roundish, green, and containing, within a mucilaginous pale-green thin Pulp, four black shining Seeds or *Acini*, of an irregular figure.

All the parts of this Tree, when fresh, are very hot, aromatick, and biting to the taste, something like Cloves, which is so troublesom as sometimes to need a remedy from fair water.

It grows in the Low-land or *Savanna* Woods very frequently, on each side of the Road between *Passage-Port* and the Town of *St. Jago de la Vega* in *Jamaica*, in *Antigua*, and other the *Caribbe* Islands.

The Bark of this Tree is what is chiefly in use, both in the Plantations of the English between the Tropicks in the *West-Indies*, and in *Europe*, and is without any difficulty cured by only cutting off the Bark, and letting it dry in the shade. It

It is in use in the *West-Indies* by the more ordinary sort of People in place of all other Spices, being thought very good to consume the immoderate humidities of the Stomack, help Digestion, expel Wind, &c.

It is likewise as well there as in *Europe* thought a very good Remedy against the Scurvy, and to cleanse and invigorate the Blood, being in *London-Druggists* and Apothecaries Shops used for those purposes, under the name of *Cortex Winteranus*, which it is not, that being different (as may appear from the Descriptions) but may very well supply its place: it is in the *West-Indies* mixed and given with Steel, and other Medicines; but if the Patient be any way of a hot Constitution, it does more harm than good, being very warm.

*Rum*, a vinous Spirit drawn from Molossus or bad Sugar fermented with Water, if it be mixed with some of this Bark, loses in part its loathsome empyreumatick Smell.

This Bark if mixed with Water, and distilled *per Viscam*, yields an aromatick Oil sinking to the bottom of Water like Oil of Cloves, with some small quantity of which it being mixed has sometimes been sold for true Oil of Cloves.

The first Author I find to mention this was *Peter Martyr* in *Decad. Ocean*, under the name of *Cortex Cinnamonis saporem, Gingiberis amaritudinem & Caryophylli suavem odorem præ se ferens*. *Nicolaus Monardes* was the next, who describes this under the name of *Lignum Aromaticum*, from whom the *Hist. Ludg.* took the same, and *Clusius* in his Comment on this Author corrects him, giving it the name of *Lignum seu potius Cortex Aromaticus, Exot.* p. 324. & *Johannes Bauhinus. Lignum Aromaticum seu potius Cortex Monard. Hist. pl. tom. 1. p. 460.*

By the Description, &c. of another Bark, in Authors under the name of White Cinamon I question not, it is the same with this, every thing agreeing.

This

This is therefore

*Canella alba quorundam. Clus. Exot. p. 324. I. B. p. 461.*

*Canella alba Park. p. 1581.*

*Canella alba ex arbore, Ejusdem ibid.*

*Cinamomum sive Canella tubis minoribus alba. C. B. p. 409.*

It is likewise what *Linschoten* in his Description of *America*, translated into French gives an account of, as I suppose from *Peter Martyr*, under the name of *Arbre ou les Pigeons nichent*; and what *Dr. Trapham* in his Discourse of the State of Health of *Jamaica*, calls *Winter-Bark*, or *West-Indian Cinamon Tree*, p. 38. *Hernandez*, p. 43. and *Ximenes* who publish'd his History at *Mexico* in Spanish, fol. 9. likewise describe this under the name of *Caninga*.

It may be doubted whether this be *Ascopo* of *Hariot*, which he mentions p. 24. of his Latin Edition of his Voyage by *Theodore de Bry*, and by *Hakluyt* in his Collection of Voyage, p. 275. of *Vol. III.*

Thus far this most excellent Botanist; who was likewise pleased to communicate the elegant Figures of these Plants hereto annexed, by which the Reader may see what may be hoped in *Natural History* from so Curious a Hand.

*An Account of the Circulation of the watry Vapours of the Sea, and of the Cause of Springs, presented to the Royal Society. By E. Halley.*

SOME time since, I shewed an Experiment of the Quantity of Water raised in Vapour from the surface of the Sea in a days time, which was so far approved by some honourable Members of this Society, that I have received their Commands to prosecute those Enquiries, and particularly in relation to the Method used by Nature to return the said Vapours again into the Sea, which  
is

is so justly performed that in many hundreds of years we are sufficiently assured that the Sea has not sensibly decreas'd by the loss in Vapour; nor yet abounded by the immense quantity of fresh it receives continually from the Rivers. To demonstrate this Equilibre of receipt and Expence in the whole Sea is a Task too hard for me to undertake, yet in obedience to those whom I have the honour to serve, I shall here offer, what to me has hitherto seem'd the most satisfactory Account of this Grand *Phænomenon*: I have formerly attempted to explain the manner of the rising of Vapour by warmth, by shewing that if an Atom of Water were expanded into a Shell or Bubble so as to be ten times as big in Diameter as when it was Water, such an Atom would become specifically lighter than Air, and rise so long as *that Flatus* or warm Spirit that first separated it from the mass of Water shall continue to distend it to the same degree; and that warmth declining, and the Air growing cooler and withal specifically lighter, the Vapours consequently shall stop at a certain Region of the Air, or else descend, which may happen upon several Accounts as I shall by and by endeavour to make out. Yet I undertake not that, this is the only principal of the rise of Vapours, and that there may not be a certain sort of matter whose *conatus* may be contrary to that of Gravity: as is evident in Vegetation wherein the tendency of the sprouts is directly upwards or against the Perpendicular. But whatever is the true cause, it is in fact certain, that warmth does separate the particles of Water and emit them with a greater and greater Velocity as the heat is more and more intense, as is evident in the steam of a boiling Cauldron, wherein likewise the Velocity of the Ascent of the Vapours does visibly decrease till they disappear, being dispersed into and assimilated with the Ambient Air. Vapours being thus raised by warmth, let us for a first supposition put, that the whole surface of the Globe were

all

all Water very deep, or rather that the whole Body of the Earth were Water, and that the Sun had his Diurnal course about it: I take it, that it would follow that the Air of it self would imbibe a certain quantity of Aqueous Vapours, and retain them like Salts dissolved in Water; that the Sun warming the Air and raising a more plentiful Vapour from the Water in the day time, the Air would sustain a greater proportion of Vapour, as warm Water will hold more dissolved Salts, which upon the absence of the Sun in the Nights would be all again discharged in Dews, Analogous to the precipitation of Salts on the cooling of the Liquors; nor is it to be believed that in such case there would be any diversity of Weather, other than periodically, every year alike; the mixture of all Terrestrious, Saline, Heterogeneous Vapours being taken away: which as they are variously compounded and brought by the Winds seem to be the causes of those various Seasons which we now find. In this case the Airy regions every where at the same height would be equally replenished with the proportion of Water it could contain, regard being only to be had to the different degree of warmth, from the nearness or distance of the Sun; and an Eternal East Wind would blow all round the Globe, inclining only to the same side of the *East*, as the Latitude doth from the Equator; as is observed in the Ocean between the Tropicks.

Next, Let us suppose this Ocean interspersed with wide and spacious Tracts of Land, with high ridges of Mountains such as the *Pyrenean*, the *Alps*, the *Apennine*, the *Carpathian* in *Europe*; *Taurus*, *Caucasus*, *Imaus* and several others in *Asia*; *Atlas* and the *Montes Lunæ*, with other unknown Ridges in *Africa*, whence came the *Nile*, the *Nigre*, and the *Zaire*. And in *America* the *Andes*, and the *Apalatean* Mountains: each of which far surpass the usual height to which the Aqueous Vapours of themselves ascend, and on the tops of which the Air is so cold  
and

and rarified as to retain but a small part of those Vapours that shall be brought thither by the Winds. Those Vapours therefore that are raised copiously in the Sea, and by the Winds are carried over the low Land to those Ridges of Mountains, are there compelled by the stream of the Air to mount up with it to the tops of the Mountains, where the Water presently precipitates, gleeing down by the Crannies of the stone; and part of the Vapour entring into the Caverns of the Hills, the Water thereof gathers as in an Alembick into the Basons of stone it finds, which being once filled, all the overplus of Water that comes thither runs over by the lowest place, and breaking out by the sides of the Hills, forms single *Springs*. Many of these running down by the Valleys or Gutts between the ridges of the Hills, and coming to unite form little Rivulets or Brooks: Many of these again meeting in one common Valley and gaining the plain Ground, being grown less rapid become a River: and many of these being united in one common Channel make such streams as the *Rhine*, the *Rhone*, the *Danube*, which latter one would hardly think the collection of Water condensed out of Vapour, unless we consider how vast a Tract of Ground that River drains, and that it is the sum of all those Springs which break out on the South side of the *Carpathian* Mountains, and on the North side of the immense Ridg of the *Alps*, which is one continued Chain of Mountains from *Switzerland* to the *Black Sea*. And it may almost pass for a Rule, that the Magnitude of a River, or the Quantity of Water it Evacuates is proportionable to the length and height of the Ridges from whence its Fountains arise. Now this Theory of *Springs* is not a bare *Hypothesis* but founded on Experience, which it was my luck to gain in my abode at Saint *Helena*, where in the Night time, on the tops of the Hills about 800 yards above the Sea, there was so strange a condensation, or rather precipitation of the Vapours, that it was a great Impediment to my Celestial Observations;

for in the clear Sky the Dew would fall so fast as to cover, each half quarter of an hour, my Glasses with little drops, so that I was necessitated to wipe them so often, and my Paper on which I wrote my Observations would immediately be so wet with the Dew, that it would not bear Ink: by which it may be supposed how fast the Water gathers in those mighty high Ridges I but now named.

Thus is one part of the Vapours blown upon the Land returned by the Rivers into the Sea, from whence they came; another part by the cool of the Night falls in Dews, or else in Rains, again into the Sea before it reaches the Land; which is by much the greatest part of the whole Vapour, because of the great extent of the Ocean, which the motion of the Winds does not traverse in a very long space of time. And this is the reason why the Rivers do not return so much into the *Mediterranean* as is extracted in Vapour. A third part falls on the lower Lands; and is the *Pabulum* of Plants, where yet it does not rest, but is again exhaled in Vapour by the Action of the Sun, and is either carried by the Winds to the Sea to fall in Rain or Dew there, or else to the Mountains to be there turned into Springs; and though this does not immediately come to pass, yet after several vicissitudes of rising in Vapour and falling in Rain or Dews, each particle of the Water is at length returned to the Sea from whence it came. Add to this that the Rain-waters, after the Earth is fully sated with moisture, does by the Valleys or lower parts of the Earth find its way into the Rivers, and so is compendiously sent back to the Sea. After this manner is the Circulation performed, and I doubt not but this Hypothesis is more reasonable than that of those who derive all Springs from the Rain-waters, which yet are perpetual and without diminution, even when no Rain falls for a long space of time: Or than that that derives them from a Filtration or Percolation of the Sea-waters through certain imaginary Tubes or passages with-

in

in the Earth, wherein they lose their saltness. This besides many others labouring under this principal Absurdity, that the greatest Rivers have their most copious Fountains farthest from the Sea, and whither so great Quantities of fresh Water cannot reasonably be derived any other way than in Vapour. This, if we may allow final Causes, seems to be the design of the Hills, that their Ridges being placed through the midst of the Continents, might serve as it were for Alembicks to distil fresh Water for the use of Man and Beast, and their heights to give a descent to those Streams to run gently, like so many Veins of the *Macrocosm*, to be the more beneficial to the Creation. If the difference between Rain and Dew, and the cause why sometimes 'tis Cloudy, at other times Serene, be enquired, I can offer nothing like a proper solution thereof, only with submission to propose Conjectures which are the best I can find, *viz.* That the Air being heap'd up by the meeting of two contrary Winds, when the Mercury is high, the Vapours are the better sustained and kept from Coagulating or condensing into Drops, whereby Clouds are not so easily generated: and in the Night the Vapours fall down single as they arose in imperceptible Atoms of Water. Whereas when the Mercury is low and the Air rarified by the exhaustion thereof, by two contrary Winds blowing from the place; the Atoms of Air keep the Vapours not so well separated, and they coalesce into visible drops in the Clouds; and from thence are easily drawn into greater drops of Rain. To which 'tis possible and not improbable, that some sort of Saline or Angular particles of Terrestrial Vapour being immixt with the Aqueous, which I take to be Bubbles, may cut or break their Skins or Coats; and so contribute to their more speedy Condensation into Rain.

*A Discourse concerning the Modern Theory of Generation, by Dr. George Garden of Aberdeen, being part of a Letter to Dr. William Musgrave, L. L. D. Reg. Soc. S. and by him communicated to the Royal Society.*

THE Subject I pitch upon, is that of the formation of Animals. You know how wide and unsatisfying Mens Conjectures were upon this Head until this Age, in which first the deservedly Famous Dr. *Harvey* discovered the proper place of the formation of the Chick in the *Cicatricula* of the Egg, and the formation of the Parts so far as was discernable by the naked Eye; and after him *Malpighius* by the help of exact Glasses, observed the first Rudiments of it there, both before and after Incubation: And *R. de Graef* and others, having upon many Observations concluded that the *Testes Fæminei* were the Ovaries of Females, and consequently that all Animals were *ex ovo*; they began from hence to infer, that the Rudiments of each Animal were originally in the respective Females, and that the Male contributed only to give a new Ferment to the Mass of the Blood and Spirits, by which means a spirituous Liquor (which the Blood in its ordinary Ferment could not produce) did insinuate its self into the same Ducts and Pores of the Rudiments of those Animals which were in greatest forwardness in the Ovary, and so extend, and enlarge all their Parts, and at last bring them to perfection, as Mr. *Perrault* does ingeniously discourse in the third Part of his *Essais de Physique*; till now at last *Leemenhoeck* has discovered an infinite number of *Animalcula in semine marium* of all Kinds, which has made him condemn the former Opinions about the propagation of all Animals *ex Ovo*.

Now upon comparing the Observations and Discoveries which have been made with one another; these  
three

three things seem to me very probable. 1. That Animals are *ex Animalculo*. 2. That these Animalcles are originally *in semine Marium & non in Fæminis*. 3. That they can never come forward, nor be formed into Animals of the respective kind, without the *Ova in fæminis*.

The first of these seems probable from these three Observations. 1. That some such thing has been so often observed by *Malpighius* in the *Cicatricula* of an Egg before Incubation, as the Rudiments of an Animal in the shape of a Tadpole, as may be seen in his first, and in his repeated Observations *de formatione Pulli in Ovo*. 2. The sudden appearance and displaying of all the parts after Incubation makes it probable, that they are not then actually formed out of a Fluid, but that the *Stamina* of them have been formerly there existent, and are now expanded. The first part of the Chick which is discovered with the naked Eye is, you know, the *Punctum saliens*, and that not till three days and nights of Incubation be past, and then on the fifth day the Rudiments of the Head and Body do appear. This made *Dr. Harvey* conclude that the Blood had a being before any other part of the Body, and that from it all the Organs of the *Fætus* were both form'd, and nourished; but by *Malpighius's* Observations we find that the parts are then only so far extended as to be made visible to the naked Eye, and that they were actually existent before, and discernable by Glasses. After an Incubation of thirty hours are to be seen the Head, the Eyes, and the *Carina*, with the *Vertebræ*, distinct, and the Heart. After forty hours its Pulse is visible, and all the other parts more distinct, which cannot be discerned by the naked Eye before the beginning of the fifth day; from whence it seems very probable, that even the so early discovery of those parts of the *Fætus* by the Microscope, is not the discerning of parts newly form'd, but only more dilated and extended by receiving of Nutri-  
ment.

ment from the *Colliquamentum* ; so that they seem all to have been actually existent before the Incubation of the Hen. And what *Swammerdam* has discovered in the transformation of Insects, gives no small light to this, whilst he makes appear in the Explanation of the 13th Table of the General History of Insects, that in those large *ErUCA's* which feed upon Cabbage, if they be taken about the time they retire to be transform'd into *Aurelia's*, and plung'd often in warm Water to make a Rupture of the outer Skin, you will discern thro the transparency of their second Membrane, all the parts of the Butterfly, the Trunk, Wings, Feelers, &c. folded up. But that after the *ErUCA* is chang'd into an *Aurelia*, none of these parts can be discerned, they are so drencht with moisture, tho they be there actually form'd. Another Consideration is from the Analogy, which we may suppose between Plants and Animals. All Vegetables we see do proceed *ex Plantula*, the Seeds of Vegetables being nothing else but little Plants of the same kind folded up in Coats and Membranes : and from hence we may probably conjecture that so curiously an organized Creature as an Animal, is not the sudden product of a Fluid or *Colliquamentum*, but does much rather proceed from an Animalcle of the same kind, and has all its little Members folded up according to their several Joynts and Plicatures, which are afterwards enlarged and distended, as we see in Plants. Now tho this Consideration alone may seem not to bear much weight, yet being joyn'd to the two former they do mutually strengthen each other. And indeed all the Laws of Motion which are as yet discovered, can give but a very lame account of the forming of a Plant or Animal. We see how wretchedly *Des Cartes* came off when he began to apply them to this Subject ; they are form'd by Laws yet unknown to Mankind, and it seems most probable that the *Stamina* of all the Plants and Animals that have been, or ever shall

shall be in the World, have been formed *ab Origine Mundi* by the Almighty Creator within the first of each respective kind. And he who considers the nature of Vision, that it does not give us the true magnitude, but the proportion of things, and that what seems to our naked Eye but a Point, may truly be made up of as many parts as seem to us to be in the whole visible World, will not think this an absurd or impossible thing.

But the second thing which later discoveries have made probable is, that these Animalcules are originally *in Semine Marium & non in feminis*. And this I Collect from these Considerations. 1. That there are innumerable *Animalcula* discovered *in Semine Masculo omnium Animalium*. Mr. *Leewenhoek* has made this so evident by so many Observations, that I do not in the least question the truth of the thing. The reason of their multitude, and some of the difficulties which arise thereupon, he has cleared to very good purpose, so that I shall not repeat them. 2. The observing the Rudiments of the *Fætus* in Eggs, which have been fecundated by the Male, and the seeing no such thing in those which are not fecundated, as appears from *Malpighius* his Observations, make it very probable that these Rudiments proceed originally from the Male, and not from the Female. 3. The resemblance between the Rudiments of the *fætus in Ovo*, both before and after Incubation, and the *Animalcule*, makes it very probable that they are one and the same. The same shape and figure which Mr. *Leewenhoek* gives us of the *Animalcule*, *Malpighius* likewise gives of the Rudiments of the *Fætus*, both before and after Incubation, yea, and even the *Fætus*'s of Animals do appear so at first to the naked Eye, so that Dr. *Harvey* does acknowledge that all Animals, even the most perfect are begotten of a Worm, *De Gen. Anim. Ex. 18*. 4. This gives a rational account of many *Fætus*'s at one Birth, especially that of the Countess of

Holland

*Holland*, and how at least a whole Cluster of Eggs in a Hen are fecundated by one Coition of the Male. 5. This gives a new light as it were to the first Prophecy concerning the *Messiah*, that the Seed of the Woman shall bruise the Head of the Serpent, all the rest of Mankind being thus most properly and truly the Seed of the Man. 6. The Analogy I have already mentioned, which we may rationally suppose between the manner of the propagation of Plants and Animals, does likewise make this probable. Every Herb and Tree bears its Seed after its kind, which Seed is nothing else but a little Plant of the same kind, which being thrown into the Earth, as into its *Uterus*, spreads forth its Roots and receives its nourishment, but has its form within its self, and we may rationally conjecture some such Analogy in the Propagation of Animals.

The third Particular which later Discoveries make probable, is that Animals cannot be form'd of these *Animalcula* without the *Ova in fœminis*, which are necessary for supplying of them with proper Nutriment: And this these Considerations seem to evince. 1. It is probable that an Animalcle cannot come forward if it do not fall into a proper *Nidus*. This we see is the *Cicatricula* in Eggs, and tho a Million of them should fall into an Egg, none of them would come forward, but what were in the Center of the *Cicatricula*, and perhaps the *Nidus* necessary for their formation is so proportion'd to their bulk, that it can hardly contain more than one Animalcle; and this may be the reason why there are so few Monsters. This we see is absolutely necessary in *Oviparis*, and the only difference which seems to be between them and the *Vvipara* in this matter is in this, that in the latter the *Ova* are properly nothing more but the *Cicatricula* with its *Colliquamentum*, so that the *Fœtus* must spread forth its roots into the *Uterus* to receive its nourishment; but the Eggs in *Oviparis* may be properly term'd an *Uterus*  
in

in relation to the *Fœtus* ; for they contain not only the *Cicatricula* with its *Amnion* and the *Colliquamentum*, which is the immediate nourishment of the *Fœtus* , but also the materials which are to be converted into that *Colliquamentum*, so that the *Fœtus* spreads forth its roots no farther than into the white and yolk of the Egg, from whence it derives all its nourishment. Now that an Animalcicle cannot come forward without some such proper *Nidus*, Mr. *Leewenhoeck* will not readily deny ; for if there were nothing needful but their being thrown into the *Uterus*, I do not see why many hundreds of them should not come forward at once ; for as to what Mr. *Leewenhoeck* says, that one of them would bedwarf and choak the rest ; this might fall out in process of time : but at first I do not see why many of them should not grow together, whilst scattered in so large a Field : ( and yet no such thing is observed ) if there were not an absolute necessity of a *Cicatricula* for their growth and thriving. Now 2. That this *Cicatricula* is not originally in *Utero*, seems evident from the frequent Conceptions which have been found *extra Uterum* : Such as the Child which continued twenty six years in the Woman of *Tholouse's* Belly, mentioned *Numb. 139.* of the *Phil. Transf.* And the little *Fœtus* found in the *Abdomen de St. Mere*, together with the Testicle torn and full of clotted Blood recorded *Numb. 150.* both taken out of the *Journals des Scavans* : Such also seem to be the *Fœtus* in the *Abdomen* of the Woman of *Copenhagen*, mentioned in the *Nouvelles des Lettres*, for *Sept. 85. pag. 996.* all the Members of which were easily to be felt thro the Skin of the Belly, and which she had carried in her Belly for four Years ; And the seven Years *Gravidation* related by *Dr. Cole*, *Numb. 172.* of the *Transact.* That these two were undoubtedly *extra Uterum* is uncertain, because the last was not opened after her death, and the former may be yet still alive. Now grant-

ing once the necessity of a proper *Nidus* for the formation of an Animalcle into the Animal of its respective kind; these Observations make it probable that the *Testes* are the *Ovaria* appropriated for this use; for tho' the Animalcles coming thither in such Cases may seem to be extraordinary, and that usually the Impregnation is *in Utero*; yet it may be collected from hence, that the *Cicatriculæ* or *Ova* to be impregnated are in *Testibus femineis*; for if it were not so, the accidental coming of Animalcles thither could not make them come forward more than in any other part of the Body, since they cannot be formed and nourished without a proper *Nidus*. But 3. It is acknowledged by all, that the *Fœtus in Utero* for some considerable time after Conception has no Connexion with the Womb, that it sits wholly loose to it, and is perfectly a little round Egg with the *Fœtus* in the midst, which sends forth its Umbilical Vessels by degrees, and at last lays hold on the *Uterus*. Now from hence it seems evident that the *Cicatricula*, which is the Fountain of the Animalcles nourishment, does not sprout from the *Uterus*, but has its *Origine* elsewhere, and falls in thither as into a fit Soil from whence it may draw Nutriment for the growth of the *Fœtus*: else it cannot be easily imagined how it should not have an immediate Connexion with the *Uterus* from the time of Conception. If you joyn all these three Considerations together, *viz.* that an Animalcle cannot come forward without a proper *Nidus* or *Cicatricula*; that there have been frequent *Fœtus's extra Uterum*; and that they have no *Adhesion* to the *Uterus* for a considerable time after Conception, they seem to make it evident that Animals cannot be form'd *ex Animalculis* without the *Ova in Feminis*. To all these I shall subjoyn the proposal of an *Experimentum Crucis*, which may seem to determine whether the *Testes Fœmineæ* be truly the *Ovaria*, *viz.* Open the *Abdomen* of the Females of some kinds, and cut out these

these Testicles, and this will determine whether they be absolutely necessary for the formation of Animals.

There are some difficulties proposed against this Conjecture, which I think may be easily resolved. Some object the distance between the *Tubæ* or *Cornua Uteri* and the Testicles; but to this is opposed by *Swammerdam* and others, the like distance between the *Infundibulum*, in Hens and Frogs, and the Ovary, and yet it cannot be denied that the Eggs are transmitted thro this into the *Uterus*: and besides *R. de Graef*, and others, have by repeated Observations found that the *Cornua Uteri* do at certain times after Conception, embrace the *Testes* on both sides the *Uterus*. They object in the second place the great disproportion between the pretended Eggs in the Ovary, and the Aperture of the *Tubæ* or *Cornua Uteri*, the former being a great deal bigger than the latter: but both *R. de Graef* and *Malpighius* have cleared that matter by making appear, that these Bladders in the Ovary are not the *Ova*, but serve to form the *Glandules* within which the *Ova* are formed, which break through a small *Papilla* opening in the *Glandule*, which bears a proportion to the Aperture of the Tube. They object

3. The difficulty to conceive how these Eggs should be impregnated *per semen Maris*, both because there is no Connexion between the *Tubæ* and the Ovary for its transmission, and for that *Dr. Harvey* could never discover any thing of it in *Utero*. As to the last, *Mr. Leewenhoeck* has cleared that difficulty by the discovery of innumerable *Animalcula Seminis Maris in Cornubus Uteri*, and those living a considerable time after Coition. *Numb. 174. of the Transact.* And as to the former we may either suppose that there is such an Inflation of the *Tubæ* or *Cornua uteri tempore Coitionis*, as makes them embrace the *Ovaria*, and such an approach of the *Uterus* and its *Cornua*, as that it may easily transmit the Seed into the Ovary; or else that the *Ova* are impregnated by the

Animalcles after they descend into the *Uterus*, and not in the Ovary; the former seems probable for this reason, that at least a whole Cluster of Eggs in a Hen will be fecundated by one tread of the Cock; now this Fecundation seems to be in the Vitellary, and not in the *Uterus*, as the Eggs pass along from day to day, for it can hardly be supposed that the Animalcles should subsist so long, being scattered loosely in the *Uterus*, as to wait there for many days for the fecundation of the Eggs as they pass along. The latter conjecture has this to strengthen it, that the Animalcles are found to live a considerable time in the *Uterus*, and that if they should impregnate the *Ova* in the Ovary its self, the *Fœtus* would encrease so fast, that the *Ova* could not pass thro the *Tubæ Uteri*, but would either burst the Ovary, or fall down into the Abdomen from the Orifices of the *Tubæ*; and that from hence proceed those extraordinary Conceptions in *Abdomine extra Uterum*. But, 4. Mr. *Leewenhoeck* Numb. 147. of the *Transact.* to weaken the third Consideration about the Conceptions being like unto an *Ovum* in the Womb, proposes a Parallel between these Animalcles and Insects, and insinuates that as the latter cast their Skins and appear of another shape, so the other which at first seem like Tadpoles, may cast their outer Skin and then be round, and that this may be the occasion of the round Figure of the Conception in the Womb. To this it may be replied, that according to Mr. *Leewenhoeck's* own sentiment, the Animalcles cannot come forward if they do not find the *Punctum* or proper place for their nourishment, to which it seems they must have some *Adhesion*. Now the Conception in *Viviparis* is not fastned unto the Womb for many days, nor does adhere to any point of it, so that it seems this roundish Body is not the Animalcle thus chang'd after having cast an outer Skin, but is rather the *Cicatricula* or little Egg, into which the Animalcle has entred as its *Punctum*  
or

or place of nourishment : else I do not see why they should not be adhering to the Womb from the first Conception, or why (as I have said) many hundreds of them are not conceived and formed together, &c.

---

Observatio Mercurii sub Sole visâ, ultimo Octobris 1690. Stil. vet. habita Noribergæ ab Astronomo accuratissimo Johanne Phil. Wurtzelbaur, atque ab eodem cum Reg. Societate communicata.

**M**ercurius sub Sole inque ejus disco, hoc seculo vix aliquoties ope Telescopii, ante hujus inventionem autem ab orbe condito nusquam gentium observatus est. Sub finem Octobris labentis hujus anni denuò observandum ex Tab. Rudolphinarum calculo celeberrimi Logistæ prædixerunt. Cum verò nemo qui delicias Urania vel primis degustârit labris, rarissimum hujusmodi & jucundissimum Phænomenon contueri non summa aviditate exoptâret : eo ipso & ego invitatus illi observando invigilare decrevi, nihil morans, quòd cælum jam ab aliquot septimanis nube ferè continuâ obductum vix aliquid spei successus optati concesserit : Præcedentis equidem diei vespera noctisque primordia nubes aliquantulum dissipârunt, sed nox adulta Cælum ab omni parte denuò obvelavit, ut hora ante Solis exortum totum obductum extiterit, nec ipsemet Sol jam satis elevatus suis radiis invidos hosce vapores penetrare valuerit : Paulo verò postquam Zephyri à parte occidua Horizontem repurgare cæperunt, ingruens illinc serenitas addidit animum, ut voti compotem me futurum haud amplius desperaverim ; nubes etiam in plagâ orientali retro cedere, & ad horizontem constipari vident, Tubum illò ubi emersio Solis è nebulis expectanda erat direxi ;

direxi ; & postquam emergens ejus discus ad tabulam obser-  
vatoriam affluxerat, illum supernè macula quadam mediocri  
affectum animadverti, quam etiam nisi præsentia Mercurii  
expectanda fuisset, nec illa motum suum satis evidenter ac-  
celeravisset, pro solari arripuissem. Sed utinam paulò citiùs  
Sol è nebulis evasisset, ut Mercurii viam itinerariam & an-  
gulum orbita ejus cum Eclipticâ notare licuisset ; nam distan-  
tem vix ultra dimidium à limbo digitorum jamjam exiturum  
deprehendimus : accessit etiam auræ haud satis defecate in-  
commodum. Discus enim Solis ceu trans undam limpidissi-  
mam apparuit, ideoq; limbum & ipsè appropinquans Mercurii  
corpus ob undulationem terminis præcisè cernere non li-  
cuit : tandem cum limbi mutuo contactu se stringerent, in  
confinio lucis solaris exiens Mercurii corpus opacum rotun-  
ditatem suam, quam antea sub figura oblonga ostenderat,  
recuperavit, ita ut ejus diameter majori pristina Ellipseos  
diametro ferè æquaretur : & postquam limbus uterq; ad minu-  
tum ferè sibi invicem adhæsitare viderentur, H. 8. Min. 36.  
Oscillatorii nostri Mercurius totus disco exiisse observatus est.  
Reliqua momenta & que pro correctione eorum notabantur  
Culminationes & Altitudines Tabella sequens exhibet.

---

Mercurius

Mercurius in Sole observatus Nori-  
bergæ A.C.R. 1690. Die ult. Octob.  
a Joh. Phil. Wurzelbaur.

Temp. Horol.  
Oscillat.

Tempora  
Supputata

H. M. S. Die 30 Octob. P.M.

H. M. S.

6 32 00 Culminat os Pegasi

6 28 45

9 00 00 Culm. Cap. Andromedæ

8 52 17

9 04 00 Culm. Jupiter.

Die 31 Octob. A.M.

6 30 00 Cælum undiq; nubibus obductum ut

7 30 00 Solis exortus observari nequiret.

8 00 00 Nubes ob occasu vers. Ortum propelluntur, & v̄  
Ventorum ibid. ad Horizontem constipantur.

8 30 00 Sol è nubibus emerfit, Mercurius in disco ejus  
supernè in Tab. observatoria, a Verticali ad  
dextram (reverà ad levam) distans plus  
quam dim. dig. a limbo exiturus apparuit.

8 36 0 Mercurius postquam undulanti limbo Solis, ad  
Min. temporis adhæserat, exiit ad 14° à  
Zenith septentrionem versus.

H. M. S.

8 49 00 Altitudo Solis 10 05

H. M. S.

8 38 38

8 59 45 Alt. Solis 11 10

8 47 48

9 07 10 Alt. Solis 12 10

8 56 24

9 50 00 Alt. Sol. 16 28

9 38 07

11 01 30 Alt. Sol. 21 31

10 56 32

Ratio diætrorũ Solis & nuclei Mercurii, dum Lucido Solis  
disco immorabatur, quantum per auram haud satis defecatam  
conjici poterat, erat ut 1000 ad 8  $\frac{1}{2}$ . Postea quam ad limbum  
Solis pervenerat, ejusq; limbo undulanti ad Minutum ferè ad-  
hæstârât & genuinam rotunditatem suam (quæ antea ex luce  
Disci Solaris formam quasi ellipticam mentiebatur) recuperâ-  
rat, erat ut 1000 ad 12  $\frac{1}{3}$

An.

*An Account of an Experiment of the Injection of Mercury into the Blood, and its ill Effects on the Lungs; as it was communicated to the Royal Society by their late worthy Member A. Moulin, M. D.*

I Have promised last Meeting to give my Reasons this day why I conceive Mercury to be an Enemy to the Lungs: I shall only give an account of an Experiment I made on a Dog at Mr. *Boyle's* last Autumn, which I take to make out what I then promis'd. I injected into the jugular Vein about an ounce and half of crude Mercury, and observ'd the Dog soon after to have a dry short Cough, which by pretty intervals seiz'd him. I sew'd up the Wound, and sent away the Dog to be look'd after, observing no other effect of the Quick-silver at that time. But about two days after I saw him, and found him troubled with a great difficulty of breathing, making a noise like that of a broken-winded Horse; there was no Tumor about the root of his Tongue, neither was there any swelling found in the Maxillary or Parotide Glandules, though I diligently sought for it: neither was he observ'd to drivle, though I order'd him warm Broth in expectation of a Salivation. The fourth day after the injection of the Mercury he dyed, being for the two days before so troubled with an *Orthopnea*, that he could sleep only when he leane'd his head against something. I open'd him, and found about him a pint of bloody *Serum* extravasated in the *Thorax*. I found also the outside of the Lungs in most places blister'd, for what I at first took to be some preternatural dilatations of the *Vesiculae* of the *Bronchiae*, were only Blisters or a separation of the common Integuments of the Lungs from their substance. Some of these were larger than a Rouncival-Pea, others were smaller, but most of them contain'd Mercurial Globules, to be seen even without opening in several of them, thro' the

the outward Skin; opening discover'd it in most of those that I had the curiosity to examine. Several of these I found broken, and upon a little pressure observ'd the Mercury to run out, and with it a little *Sanies*: but upon a pretty strong pressure, I observ'd that a great quantity of that *Sanies* issu'd out.

When I open'd the right Ventricle of the Heart, I found some Particles of the Quick-silver in the very midst of coagulated Blood lodged there, and in that also contain'd in the *Arteria pulmonalis*. I observ'd moreover blood coagulated after a very different manner (which I want words to express) from what I have seen at any other time, notwithstanding the various Methods I had us'd to coagulate it, and this in the *Interstices* between the *Columnæ* of the aforesaid Ventricle; and in this a greater quantity of Quick-silver than any where else in the Dog. This *Coagulum* was in the *Vertex* of the Ventricle, adhering pretty closely to the *Columnæ* and *Parietes*.

Opening the left Ventricle, I found a very tenacious Blood coagulated and sticking firmly to the great Valve, including the Tendons of it, and a little resembling a *Polypos*. In this Ventricle I search'd diligently for Mercury, but found none; whence it may appear, that the Mercury pass'd no farther than the extremities of the *Arteria pulmonalis*: This occasion'd the aforesaid Blisters, and forced its way through the common Coat of the Lungs, partly by its weight, and partly by the propulsion of fresh Blood to the same extremities which by the Mercury were stop'd in its motion, and consequently forced its passage through that which most readily gave way, namely the common Coat of the Lungs.

I open'd the *aspera Arteria* down to the very *Bronchie*, but could find no Mercury in it, though I search'd diligently for it. Each of the subdivisions as well as divisions of the *Bronchiæ* was fill'd with a *Sanies*, which

when I wash'd away, I found Globules of Mercury in many places under the *Bronchiæ*, and upon Examination they prov'd to be in the *Arteria pulmonalis*. I have prefs'd these Globules backwards and forwards, and made some of them get out at the holes made in the *Vesicula* above describ'd. I took some pains to find where the *Sanies* was receiv'd into the *Bronchiæ*, but could not satisfie my self. From hence may appear the danger of using Mercury in humane Bodies, so as that it may get into the Mass of Blood, especially into the Lungs; they wanting that brisk strong motion which the Muscles have in other parts, which are able to force it along with the Blood, in order to the raising a Salivation. Their lax spongy Texture makes them extreamly unfit for clearing themselves of so troublesom a Guest as Mercury is. That it has this Effect on humane Lungs, is plain from what we daily see in persons that have been often-flux'd, who are after observ'd to dye of Consumptions that will not give way to Medicine.

---

*Medicina Hydrostatica, or Hydrostaticks applied to the Materia Medica, shewing how by the Weight that divers Bodies used in Physick have in Water, one may discover whether they be Genuine or Adulterate. By the Honourable ROBERT BOYLE Fellow of the Royal Society, London, 8<sup>vo</sup> 169c. Printed for Sam. Smith.*

**T**HE Honourable Author designs in this Treatise to shew, that by weighing Bodies in Water, comparing their weight in Air, and from thence deducing the proportion of weight to Water, the Specific Gravity of Bodies may be more exactly determined; counterfeits distinguisht from Genuine, and the mixture of mineral Particles in Stone discover'd. *Archimedes* first observ'd That a Body heavier than Water, weighs less in Water

Water than in the Air, by the weight of as much Water as is equal to it in Bulk. The difference then of the Weights in Air and Water, gives the weight of so much Water, and dividing the greater number by the lesser, the Quotient compar'd to unity, will be the proportion of the Weights of the solid Body and Water.

*Rock Crystal*, and the *Iccles of Vaults* are us'd as the Standard, ( being the most homogeneous and simple ) to compare other Stony Bodies with, which if found heavier are presum'd to contain matter heavier *in specie*. They are to water as  $2 \frac{2}{3}$  to 1. *Lapis Hæmatites* almost double to the Standard, and *Iron* is discover'd in it by the *Styptical* taste of its Flowers, and by the black colour when mixt with Galls. *Lapis Lazuli* having a vomitive Quality as 3 to 1. *Loadstone* more than 4 to 1. *Lap. Calaminaris*, us'd in the turning Copper into Brass, and of a Quality very restraining, appears to weigh as almost 5 to 1. *Coral*, truly therefore esteem'd a *Lithodendron* somewhat exceeds *Crystal*. *Pearl* near the weight of *Crystal*. *Calculi Humani* and *Bezoars* (Animal Concretions) amount not to twice the weight of Water, and are by a fifth part lighter than *Crystal*, by which counterfeit *Bezoars* are detected : such an one being found as heavy as a mineral. It is further observed that counterfeit *Crabs Eyes* are of much more weight than natural. *False Stones* are easily detected, the *Mineral* which gives the Colour making them preponderate to true *Gems*. *False Coyns* in this manner are easily discoverable.

Our Author having in these particulars shewn in what manner all solid Bodies heavier than Water may be compar'd to one another, and not only their Specific Gravity, but their qualities very often detected; comes now to consider and propose, 1. How Bodies *lighter* than Water may be examin'd in it, *viz.* by adding Lead to Wax or Fir-wood, and subducting for the heavy Body so added. 2. How Fluids, as Mercury, or Chymical Oyls of Cloves, &c. or Bodies dissoluble in Water, as *Sublimate*, *Alum.*  
*Vitriol*,

*Vitriol*, or Fragments of any brittle Body, *viz.* by a little Glass Bucket or Veil stoppt, which may receive these Bodies, adding so much Water as will fill the *Spatiola* of the *Fragments*, up to the brim of the Glass; for which allowance must be made in the computation of the weight, both in the *Air* and *Water*.

*Sublimate* which wants its due proportion of  $\varphi$  will be this way discover'd, and *Roman Vitriol* mixed with *Alum*. It is here observ'd that  $\varphi$  is to water almost as 14 to 1. But the more easie and simple Method of weighing Bodies dissoluble in Water, is to use the thinner *Oils*, such as *Oil of Turpentine* of the first rise in distillation.

Having hitherto examin'd Bodies by Water and Oils, our Author proceeds to examine the weight of *Liquors* by weighing *Solids* in them. For if a heavy Body in Water lose so much of its weight as the quantity of Water weighs that is of an equal bulk to the Body, the proportion of the weight of all *Liquors* will be easily obtained. For instance, A piece of *Amber* of between 3 and 4 Drams weighed in Water  $6 \frac{3}{4}$  gr. in *Red French Wine*  $8 \frac{1}{2}$  gr. in *Brandy*  $17 \frac{1}{2}$  gr. in rectified Spirit of Wine  $34 \frac{1}{2}$  gr. This way may be apply'd to compare all sorts of *Liquors*, as *Wine* in the Must, Mature, decaying, -vappid. Juices of Herbs, Beer, Sider, &c. But Acids are heavier than Water. Hence the Degrees of their Acidity may be observ'd. Of Waters, Rain Water seems the lightest, and scarce a 1000th part difference discover'd in any of them. This is particularly apply'd to the famed Water of *Ganges*, tho Travellers assert an extraordinary lightness in it.

In the last place the Bulk of solid Bodies may be found out by this Method. For since a Cubical Inch of Water weighs 256 gr. and as much of *Oil of Turpentine* 221 gr. if a Body of any magnitude and irregular shape lose so much or more times that weight in Water or Oil, it is of a Magnitude equal to one or more Cubical Inches.

In the subjoyn'd Tract, our Author treats particularly of Minerals, and observes that *Emery* is as 4 to 1 to Water. Yet lighter then *Crystal*; so is *Fossil Amber*, *Sulphur Vive*, *English* and *Venetian Talk*. In an *American Talk* heavier than *Crystal*, a Metalline Substance was observ'd. *Fine Gold* is as 19 to 1 to Water. Hence any Fallacious Mixture us'd by the Negroes in *Gold-Sand* may be observ'd. *Brass* is not quite half so heavy as *Gold*, &c. The whole Book is made up of curious Remarks and Experiments, such as usually proceed from its renowned Author, whose single Name is more than sufficient to recommend it to the perusal of the Studios. Naturalist.

# PHILOSOPHICAL TRANSACTIONS.

For the Months of *March, April, May, and June, 1691.*

## The CONTENTS.

1. **A**N account of a large and curious Map of the Great Tartary lately Publish'd in Holland by Mr. Nicholas Witsen, being an Extract of a Letter from the Author thereof to the Honourable Sir Robert Southwell *K<sup>nt</sup>*. and President of the R. Society. (2.) A discourse tending to prove at what Time and Place Julius Cesar made his first Descent upon Britain: Read before the R. Society by E. Halley. (3.) A Receipt for the Curing of Castorium according to the method us'd in Ruffia. (4.) Observations on the making of Cochineal, according to a Relation had from an Old Spaniard at Jamaica, who had lived many years in that part of the West-Indies where great quantities of that rich Commodity are yearly made. (5.) Some Experiments made of the force and pressure of the Water in great Depths, made and Communicated to the R. Society by a Person of Honour. (6.) Lumbricus Hydropicus; or an Essay to prove that the Hydaticides often met with in morbid Animal Bodies, are a Species of Worms or imperfect Animals By that learned and curious Anatomist Edward Tyson, M. D. and R. Soc. S. (7.) De visibili Conjunctione Inferiorum Planetarum cum Sole, Dissertatio Astronomica, Authore E. Halley. (8.) Some Observations made on the Spaw of Frogs, and of the Production of Todpoles therein, by the learned and curious Richard Waller

Waller Esq; Reg. S. Secret. (9.) *An account of a Ruminating Man, lately Living at Bristol, given in to the R. Society by the Experienced and learned Frederick Slare, M. D. and Reg. Soc. S. (10.) A Letter from that incomparable Botanist Mr. John Ray, R. S. Soc. giving an account of the Phytographia of Dr. Leonard Plukenet, M. D. lately Published.*

---

*An Account of a large and curious Map of the Great Tartary, lately Publish'd in Holland, by Mr. NICHOLAS WITSEN, being an Extract of a Letter from the Author thereof, to the Honourable Sir ROBERT SOUTHWELL K<sup>nt</sup>. and President of the Royal Society.*

*The Honourable NICHOLAS WITSEN late Ambassadour into England, and now one of the Principal Burgomasters of Amsterdam, having sent several of his New Maps of Tartary to the Fellows of the Royal Society, the Honourable their President, was pleased to write unto him as followeth.*

S I R,

I Have lately had a great Effect of your Bounty in the Maps of Tartary. This is Columbus like, the Discovery of a New World; at least Tydings of those Parts, which from the beginning have layn in the Dark. But the Enterprise being so vast, and the success so unexpected; the Publick are very impatient to be told by what Magick you have been able to master this Work. For it looks in one Part no less difficult then a Geographical Description of the Bottom of the Sea; I mean as to those impenetrable Deserts, the endless Boggs and Marshes, the inaccessible Mountains and those mighty Tracts, which by their Climate are rendred uninhabitable; since all these seem by Nature to have been condemned to an everlasting Solitude.

Now

Now for the rest, when I consider that the Caravans passing between *Muscovy* and *China* are not frequent; that they are confin'd to certain Paths and Lines of Trade; That the Merchants and common Travellers mind nothing but the Security and Certainty of the Journey, and the Profit that ensues; And that those who should inform them of Extents and Boundaries, are a Rambling and uncultivated Generation, and of various Languages. If after all these Impediments, you shall yet be able to shew the Credibility of your Survey, you need think no more of Fame, but only pray for Humility.

To which Mr. Witsen was pleased to Answer to the Effect following.

S I R,

'TIS almost 28 years since I Travelled into *Russia*, and being there merely for my own Satisfaction, I not only Convers'd with the Inhabitants of those Countreys, but with *Tartars* of all sorts. There I grew first informed not only in the Situation of those Parts, but of such Countries as lay very remote. I have not ceas'd from that time, by various Methods I have found, to send Letters unto, and receive Answers from the most Northern, and North-East parts of the World. For I have maintain'd a constant Correspondence in *Mosco*, *Astracan*, *Georgia*, *Ispahan*, *Polonia*, and *Constantinople*. I have had Letters every year from *Pekin*, the chief City of *China*. I have gathered Volumes of Journals and Registers, which set forth the Names of Mountains, Rivers, Cityes and Towns, together with a vast number of Drafts made by my own Order, which describe the Territories that I have mentioned.

'Tis from this Fund, which has been gathering for so many years, and by comparing and adjusting all these Materials, and by persevering without intermission therein, that the Map is made up.

After all, I am far from thinking it has no faults, 'tis very well if such as are found, be not many, or very gross. I confess my own greatest doubts are about the stretching of the Sea-Coasts. And 'tis therefore that I express them in a faint and pale Colour, to signify the uncertainty thereof. But as to the Latitudes, I have more assurance of their being well noted, and suspect but little mistakes, if there be any therein.

I am yet in suspense whether the North-East-Point which you see bearing off in the Map, may run quite on to *America*; or how far thither-ward it may reach.

I formerly thought *Nova Zembla* had been a Continent, and when I wrote my Opinion herein to Mr. *Oldenbourg*, he put it into one of his Transactions. But I have since been better informed, and retracted that Error. And whereas the late Monsieur *Vossius* would needs persuade himself, as well as he did others to their Ruine, that there was a passage to *Japan* by the North, and that the *Tartarian* Countreys behind *Nova Zembla* did immediately decline towards the South; I did always oppose it, and think I can even demonstrate the Impossibility thereof. So that what he wrote to encourage Mariners to that attempt, was even directing them to the point of Death, as it afterwards ensu'd.

My intention is, if I Live, and may have leisure for it, to make several particular Maps of the sundry Countries contained in this General One, and to give the Descriptions which appertain to each.

*A DISCOURSE tending to prove at what Time and Place, Julius Cesar made his first Descent upon Britain: Read before the Royal Society by E. HALLEY.*

**T**Hough *Chronological* and *Historical* Matters, may not seem so properly the Subject of these Tracts, yet there having, in one of the late Meetings of the *Royal Society*, been some Discourse about the Place where *Julius Cesar* Landed in *Britain*, and it having been required of me to shew the Reasons why I concluded it to have been in the *Downs*; in doing thereof, I have had the good fortune so far to please those worthy Patrons of Learning I have the honour to serve, that they thought fit to command it to be inserted in the *Philosophical Transactions*, as an instance of the great Use of *Astronomical Computation* for fixing and ascertaining the Times of memorable Actions, when omitted or not duly delivered by the Historian.

I. The Authors that mention this Expedition with any Circumstances, are *Cesar* in his *Commentaries lib. 4.* and *Dion Cassius* in *lib. 39*; *Livies* account being lost, in whose *105th.* Book, might possibly have been found the story more at Large. It is certain that this Expedition of *Cesars*, was in the Year of the *Consulate* of *Pompey*, and *Crassus*, which was in the Year of Rome 699. or the 55th. before the usual Era of Christ: and as to the time of the year, *Cesar* says that *Exiguâ parte æstatis reliquâ*, he came over only with two Legions, viz. the 7th. and 10th, and all Foot, in about 80 Sail of Merch

chant Ships, 18 Sail that were ordered to carry over the Horse, not being able to get out at the same time from another Port, where they lay Wind-bound. He says that he arrived about the Fourth hour of the Day, viz. between Nine and Ten in the Morning, on the Coast of *Britain*, where he found the Enemy drawn up on the *Cliffs* ready to repel him, which place he thus describes. *Loci hæc erat natura, adeo montibus angustis mare continebatur ut ex locis superioribus in littus telum adjici possit*, by which the *Cliffs* of *Dover* and the *South Foreland*, are justly described, and could be no other Land, being he says in the 5<sup>th</sup>. Book of his Commentaries, *in Britanniam trajectum esse cognoverat circiter millium passuum triginta à continenti*, the *Cliffs* of the *North Foreland* being at a much greater distance. Here he says he came to an Anchor, and staid till the 9<sup>th</sup>. hour, or till about between Three and Four in the Afternoon, expecting till his whole Fleet was come up; and in the mean time called a Council of War, and advertised his Officers, after what manner they were to make their Descent, particularly in relation to the Suff of the Sea, whose motion he calls *celerem atq; instabilem*, quick and uneven. Then, viz. about Three in the Afternoon he weigh'd Anchor, and having gotten the *Wind* and *Tide* with him, he Sail'd about Eight Miles from the first place, and Anchor'd against an open and plain Shore.

2. Here he made his Descent, and having told us the opposition that was made, and the means he used to get on shore, he comes to say, that after he had been *Four Days* in *Britain*, the 18 Ships with his Horse put to Sea, and were come in sight of his Camp, when a sudden Tempest arose, with contrary Wind, so that some of the Ships put back again, others were driven to the Westwards, not without great danger, and coming to Anchor, they found they could not ride it out: so when Night came on, they put off to Sea and returned

and from whence they came. *That same Night* it was *Full-Moon*, which makes the greatest Tides in the Ocean, and they being ignorant thereof, their Gallies, which were drawn on shore, were filled by the Tide, &c.

3. Then he says that the day of the Autumnal Equinox being at hand, after some days stay, wherein there passed no Action because he kept close in his Camp by the shore; and not thinking it proper to stay till the Winter came on, he returned into *Gallia*: The next year he made a further Expedition with 5 Legions and a good Body of Horse, but there is but little in the History thereof serving to our purpose, excepting that he says he set Sail from the *Portus Icinius* about Sun Set, with a gentle S. W. Wind, *leni Africo profectus*; that about Midnight it fell Calm, and being carried away with the Tide, by the time it was day, he found he had left *Britain* on the left hand; but then the Tide turning, they fell to their Oars, and by Noon reached that part of the Island where he Landed before, and came on shore without opposition, and then marched up into the Country, leaving his Ships at Anchor *in littore molli & aperto*.

4. This is all in *Cesar* that is any thing pertinent, and I find no where else any thing to guide us farther, except one passage in *Dion-Cassius*, who speaking of the first Landing of *Cesar*, says ἔ μὲντοι ἔ ἦ ἔδα προσερχεν, that is, as I Translate it. But he Landed not where he intended, for that the *Britains* hearing of his coming, had possessed all usual places of Landing, Ἀκεαν οὖν πνα προέχυσαν περιπλεύσας ἐπέμωσ παρεκρημίδη. Κανταῦδα τὲς προσμίξαντας οἱ ἐς τὰ πνάγη ἀποβαίνοντι νηκούς, ἔφθη τῆς γῆς κρατίους, in my English. Wherefore doubling a certain head Land, he made to the shore on the other side, where he overcame those that Skerished with him at the waters edg, and so got well on

Land. Here I make bold to translate the Words ἐς τὴν  
 ἑκδομήν, at the waters edg, which in H. Stephens Edition  
 is interpreted in paludibus, but I have the Authority of  
 Suidas, who says τὴν ἑκδομήν, πελαγία ἰλιεῖς, or the Sea Mud,  
 and is therefore properly the Ouse on the Sea Shore,  
 and by an easie Figure, may be put for the Shore itself,  
 where such Ouse commonly is found.

5. From these data, That it was in the Year of the  
 Consulate of Pompey, and Crassus; That it was *Exiguâ*  
*parte aestatis reliquâ*, and Four Days before a Full-Moon,  
 which fell out in the night time, The time of this Inva-  
 sion will be determined to a day: For by the Eclipse of  
 the Moon, whereof Drusus made so good use to quiet  
 a Mutiny in the Pannonian Army, upon the News of the  
 Death of Augustus, it follows that Augustus Died Anno  
 Christi 14. which was reckoned Anno Urbis conditæ 767.  
 and that this Action was 68 Years before, viz. in the  
 55th. Year before Christ Current. In which Year the  
 Full Moon fell out August 30. after Midnight, or 31 in  
 the Morning before day; and the preceding Full-Moon,  
 was August 1. soon after Noon; so that this could not  
 be the Full Moon mentioned, as falling in the day time:  
 nor that in the beginning of July, it being not 10 days  
 after the Summer solstice, when it would not have been  
 said *exiguâ parte aestatis reliquâ*. It follows therefore that  
 the Full Moon spoken of, was on August 30. at Night,  
 and that the Landing on Britain was August 26. in the  
 Afternoon, about a Month before the Autumnal equi-  
 nox; which agrees to all the Circumstances of the Story  
 in point of Time.

6. As to the Place, the high Land and Cliffs describ-  
 ed, could be no other than those of Dover, and are al-  
 lowed to have been so by all, it remains only to exa-  
 mine whether the Descent was made to the Northward  
 or Southward of the place where he first Anchored. The  
*data* to determine this, are first that it was Four days  
 before

before the Full Moon. 2. That that day by Three of the Clock in the Afternoon the Tide ran the same way he Sailed. 3<sup>ly</sup>. That a S. by E. Moon makes High-Water on all that Coast, the Flood coming from the Southward: hence it will follow, that that day it was High-water there about Eight in the Morning, and consequently Low-water about Two, wherefore by Three the Tide of Flood was well made up, and it is plain that *Cesar* went with it, and the Flood setting to the Northward shews that the open plain shore where he Landed was to the Northward of the Cliffs, and must be in the *Downs*; and this I take to be little less than Demonstration. A second Argument is drawn from the Wind wherewith he set out on his second Expedition, *viz.* S. W. as appears by the words *leni Africo profectus*, with which the Navigation of those times would hardly permit a Ship to Sail nearer the wind than eight Points, or a N. W. Course; which would serve indeed to go into the *Downs*, but would by no means fetch the Lowland towards *Dengyness*, which is much about West from *Calais*, and not more than W. N. W. from *Boulogne*, if it shall be said that that was the *Portus Icius* from which *Cesar* set out. Whence I take it to be evident that if *Cesar* was not bound more Northerly than the *South-Foreland*, he could not have thought the *Africus* or S. W. Wind proper for his passage, which was then intended for the place where he first Landed the year before.

7. Justly to determine which the *Portus Icius* was I find no where sufficient grounds; only *Ptolemy* calls the Promontory of *Calis-Cliffs* by the name of *Ἰμιον ἄνερον*, whence there is reason to conjecture, that the *Portus Icius* was very near thereto, and that it was either *Ambletense* on one side, or *Calis* on the other. The same *Ptolemy* places *Γισσῆριανον ἐπίγειον* in the same Latitude with the *Ἰμιον ἄνερον*, but something more to the East; which seems to refute those that have supposed the ancient

cient Port of *Gessoriacum* to have been *Boulogne*, whereas by *Ptolemy's* position, it must be either *Dunkirk* or *Gravelingue*, but the former most likely, both by the distance from the *Ἰκίον ἀκρον*, being about 20 Miles or half a degree of Longitude to the East, or  $\frac{2}{3}$  of the whole Coast of *Flanders*, which he makes but a degree and quarter from the *Acron Icion* to the mouth of the *Scheld* which he calls *Ostia Tabudæ*: as also for that *Pliny* l. 4. c. 16. speaking of *Gessoriacum*, says the *Proximus Trajectus* into *Britain*, from thence is 50 Miles, which is too much unless *Gessoriacum* were something more Easterly than *Calis*: *Dion Cassius* makes the distance between *France* and *Britain* 450 *stadia* or 56 Miles, and says likewise 'tis the nearest, τὸ σωπημώτατον. But this is in part amended by the explication given in the *Itinerary* of *Antoninus*, where the space between *Gessoriacum* and *Rutupium* is said to be 450 *stadia*, (for this was the ordinary passage of the *Romans* into *Britain*;) *Rutupium* being more Northerly and *Gessoriacum* more Easterly than the *termini* of *Cesar's* Voyage, and consequently the distance greater than 30 Miles which *Cesar* had observed: and now lately an accurate Survey has proved the distance between Land and Land to be 26 *English Miles* or  $28\frac{1}{2}$  *Roman Miles*, which shews how near *Cesar's* estimate was to the truth.

A farther Argument (but not of equal force with the former because of the modernness of the Author, who writ above 250 years after) may be drawn from the words of *Dion Cassius*, where he says ἀκρον πρὸς πρὸς χερσων περιπλεύσας ἐπέωσε παρενημίδι, that after his first Anchoring he Sailed about a Promontory to the place where he Landed; now there are no other Promontories on all that Coast but the *South-Foreland* and *Dengness*; the latter of which it could not be, because *Cesar* says he Sail'd but 8 miles; and the *Ness* it self is about 10 Miles from the South and nearest end of the *Chalk Cliffs* by the Town  
of

of *Hith*; and to have gone round that Point to the other side, the distance must have been much greater. So that the Promontory spoken of by *Dion*, must needs be the *South Foreland*, and *Cesar* must Anchor near over against *Dover*, from whence Sailing 8 Miles, he would double a Head-land and come to the *Downs*; which is such a Coast as he describes in one place by *apertum ac planum littus*, and in his 5th. Book by *molle ac apertum littus*. As to *Dions* word εἰς τὸ τεράγι, what I have already said about it seems sufficient to prove that he means no more than the waters edge; and the *Etymologists* derive it from τεργω *malesacio*, because the wash and breach of the Sea does always keep it wet. And this word τὰ τεράγι is used by *Polybius* for the Sea Ouse; and in another place he speaks of the difficulty of Landing at the mouth of a River Ἰσθμὸν τὴν τεραγῶν πρόρρον, *ob limosum accessum*, so that it is not to be doubted that it ought to be rendred in this place, *ad vadum maris* rather than *in paludibus*. And so this objection against the assertion that *Cesar* Landed in the *Downs*, which is known to be a firm Champain Country without Fens and Morasses will be removed; and the whole Argument will 'tis hoped be admitted by the Curious.

*A Receipt for the Curing of Castorium, according to the method us'd in Russia.*

**T**AKE the Beaver Stones and get the Milk out of them as clean as you can, then set upon the Fire a Skillet or Kettle with Water, big enough to contain the quantity of Stones you have to cure: let the water Boil, and put into it half a shovel full of clean Wood Ashes, then tie the Stones together in couples and put them into the water, and let them Boil therein for half a quarter of an Hour. Then take some Birch-Bark and lay it on  
the

the Fire, and let the Stones be well smoaked over it for the space of an hour, until they are well dried in the smoak; then hang them up in a Kitchin or in the Air for a week or more, until they are perfectly dry and hard, after which they may be pack'd up in a Cask or otherwise for Transportation. If there be more Stones than will conveniently go into the Skillet or Kettle, you may make another boiling of them, and add a proportion of fresh Ashes and order them as before.

---

*Observations on the making of Cochineal, according to a Relation had from an Old Spaniard at Jamaica, who had lived many years in that part of the West-Indies where great quantities of that rich Commodity are yearly made.*

THE Insect whereof it is made he confirms to be the same which we call the Lady-Bird, *alias* Cow-Lady, which he says at first appears like a small blister or little knob upon the Leaves of the Shrub on which they breed, which afterwards by the heat of the Sun, become a live Insect, as above, or small Grub. This Shrub is allowed by several Authors to be the same which we call the *Prickle-Pear*, or *Indian Fig*, having thick roundish Leaves that grow one out of another and full of sharp prickles. These Grubs in process of time becoming Flies like our Lady-Birds, as above, and being come to full Maturity, (which must be found out by experience in collecting them at several seasons) they Kill by making a great smother of some combustible matter, to Windward of the shrubs whereon the Insects are feeding, (having before spread some Cloths all under the Plants) whereby all the Insects being Smother'd and Kil'd, by shaking the Plants will tumble down upon the Cloths. Thus they are gathered in great quantities

ties with little trouble. Then they spread them on the same cloaths in some bare sandy place, or stone pavement, and expose them to the heat of the Sun, until they are dry, and their Bodies shrivel'd up, which being rub'd gently betwixt ones Hands, will crumble into Grains and the Wings separate from them, which must be garbled out; others 'tis said, do expose them to the Sun in broad and shallow Copper Basons, wherein the reflection of the Sun will dry them sooner. These Plants called the *Indian Fig*, are easily and quickly propagated by putting a single Leaf above half its depth into the Ground, which seldom fails to take Root and throw out other new Leaves at the top thereof, ( of which Plant 'tis said in *Barbadoes* impregnable Fences are made ). Others say they may be raised from the Seed, or small Grains which are to be found in the proper season in the Fruit which is something like a Fig, arising out of certain yellow Flowers or Blossoms that grow out at the tops of the uppermost Leaves, which Fruit is full of a Red Pulp, that when full ripe stains the Hands of them that touch it, like Mulberries, with a Purple or Sanguin Color, whereon, or on the Blossoms, some say the Insects do feed; which happily may be the occasion of that rich Tincture within their Bowels. It may be enquired likewise, whether those Grains, which are the Seed of the Fruit, may not produce some Tincture as well as the dried Insects, or whether whilst they are Maggots, or small Grubs, being ordered and dried as above, they may not shrivel up like Grains, and be as good as when they are become Flies with Wings,

The Gentleman to whom we are oblig'd for these Communications, at the same time propos'd the following Quæries concerning *Salt-Petre* and *Indico*, to which 'tis hop'd some curious and knowing Persons may be prevailed with to furnish proper Answers, which would be very grateful to the Royal Society.

1. To enquire how the Salt-Petre is made in India; whether by the heat of the Sun or with Fire or both: what sort of Earth the Lye whereof the Salt Petre is made is extracted from: how the said proper Earth may be known, either by Colour or Taste or otherwise; in what Latitude or Climate it most abounds: whether it be found most, nigh to Rivers or the Sea side or in Woods from the falling of the Leaves, and how deep in the Earth it is to be search'd for.
2. To get a true Account of the whole Operation of Indico from Jamaica, or elsewhere, the managing of the Plants, and how raised, whether by Seed or otherwise, and to know the proper Season for Sowing if rais'd by Seed, and what sort of Soil is required for the same.

*Some Experiments and Observations made of the force of the pressure of the Water in great Depths, made and communicated to the Royal Society, by a Person of Honour.*

**A**Pril 8th. *st. v.* 1680. Being off of Pantalaria near Sicily in a Calm; I let down a Bottle 70 Fathom, stop'd with an excellent good tender Cork, well fitted, and bound down; and the Cork came up in the Bottle  $\frac{3}{4}$  full of Salt Water: Whereupon making some Reflection on the softness of the Cork, the Bottle was again fitted with an excellent good Cork, but of a woodiness or hardness as some Corks are, with the which, being let down in like manner, the Cork continued in its place, but as it were bruised, and the Bottle as before, about  $\frac{3}{4}$  full of Salt Water. Whereupon I took a good Ox Bladder, and bound it four-fold over the mouth of the Bottle without any Cork at all, only I put a piece of Leather to keep the Glas from cutting the Bladder,

as it might do, having somewhat a sharp mouth; and so order'd, it was let down as before, but taken up without any water, or the least moisture in it.

May 18, 1680. Being in a stark Calm some Leagues distant from the Coast of *South-Spain*, off the great Hills of *Granada*, in pursuance of the foregoing Experiment, we took a Bottle and clapt a Leather on the mouth of it, tying over that a single part of a Bladder, the which we let down 75 Fathom, but it came up again intire; whereupon imagining that the Leather in great part had contributed to the resistance the Bladder had made, being that the same was marked very much by the force of the pressure against the mouth of the Bottle: We made a hole in the Leather about the bigness of a large Pea, and let the same again down 75 Fathom, but it came up perforated in the vacant place where the Leather had the hole in it, and almost full of water; we then bound over another part of Bladder single, and let it down but 30 Fathoms, but it came up whole and intire; whereupon immediately we let it down 50 Fathom, but it came up broke and full of water. Then we again fitted the Bottle with the said perforated piece of Leather and a double Bladder, and let it down 50 Fathom, but it again came up intire: So again immediately we let it down 75 Fathom, but then it came up broke and full of water; when the wind bringing the Ship into motion hindered our farther trials.

June 24, 1680. Being in  $39\frac{1}{4}$  degrees of Latitude, and by the Ships account 150 Leagues Westward of *Portugal*, I caus'd a *Florence* Flask to be well stop'd with a Bladder over the mouth of it, and lower'd it down 30 Fathom, but it was taken up broke. Whereupon imagining that the roughness of the Leads halling so tender a Body so violently through the water, might be the breaking thereof, I caus'd another Flask in the like manner to be fitted, and close by it I tied likewise another

ther Flask, so as to be born with the mouth downwards, as were the other, but which was not stop'd; and these I caus'd to be taken up when they had been but 10 Fathom under water; and found them both entire, but the open Flask almost full of water; the which being emptied, were both let down again, and taken up at 20 Fathom, when the open Flask was entire, tho full of water, but the other broken to pieces.

---

## *Lumbricus Hydropicus ;*

O R

*An Essay to prove that Hydatides often met with in morbid Animal Bodies, are a Species of Worms, or Imperfect Animals. By that Learned and curious Anatomist EDWARD TYSON, M. D. and R. Soc. S.*

**T**HE Title of this Essay, I doubt not will be some surprise to the Reader, and may prejudice his Judgment in what I am to offer; which indeed doth give me caution in it. But that I might not impose upon his Belief; or what I shall mention might not hinder his farther inquiry, 'tis only as an Essay. If truth, others Observations will confirm it; if otherwise, 'twill be a great satisfaction to be better inform'd.

By the opportunity given me of dissecting a *Gazella*, or Antilope brought from *Aleppo*, I observed several *Hydatides* or *Films* filled with limpid Water, about the bigness of a Pigeons Egg and oval, which were fastened to the *Omentum*, and some in the *Pelvis* between the Bladder of Urine and the *Rectum*. Upon this occasion I was very desirous of satisfying my self as much as I could of some

some suspicions I had of the like watery Bags, or *Hydatides* I had met with in other Animals, for from what I could then observe, I was apt to believe them to be a particular sort of Insect bred in animal Bodies, but so different from any observed out of them, that unless upon fuller and farther considerations, I durst not trust my own thoughts about them.

My present Reasons of suspecting them to be Insects, or at least the Embrioes or Eggs of them, are these,

First, Because I observed them included in an outward Membrane like a *Matrix*, so loofely, that by opening it with my Fingers or a Knife, the inward Bladder containing the *Lympha* or *Serum*, seemed no where to have any connexion or hold to it, but would very readily drop out, still holding its Liquor without spilling any of it. Upon repeated Experiments of it in this, and other Animals, it gave me opportunity to think how it was possible this Humour could come into the inward Bladder without any cohäfion to the outward which involved it.

Secondly, Observing them farther by my naked Eye, I perceived that to this inward Bladder there was a Neck or white Body, more opake than the rest of the Bladder, and protuberant from it: but so as I could observe an Orifice at the extream of it, which then to me seemed to be occasioned by the retraction of some part of it inwards. By this I fancied it might as by a Mouth, suck the *Serum* from the outward Membrane, and so supply its Bladder or Stomach.

Thirdly, But in this Thought I was farther encouraged by the assistance of my very good friend Mr. *Richard Waller*, whose presence I desired at the Dissection, and by imparting to him my thoughts, that these *Hydatides* might be a peculiar sort of Insects bred in Animal Bodies; we were resolved to satisfy our selves of the Notion, and having observed what I have before mentioned, we found that this Neck (upon approaching it to the Candle) did really

really move, and that it did protrude and then shorten it self. But for a better satisfaction, I shall give the Figures made by his ingenious Hand; both Natural as they appear'd to the naked Eye, and what they were discover'd to be by the Microscope.

*Fig. 1.* Represents one of these watery Bladders in its natural bigness inclosed in its outward Membrane or *Chorion*, its shape was almost round, only flatted as a drop of Quicksilver will be by lying upon a solid. (*a*) shews the Neck, seen through the Membrane, which in

*Fig. 2.* is more plainly represented, (the outward Membrane being taken off) but as appearing to the naked Eye; where we may observe an open Orifice at the Extream of it, and that it is made up of circular Rings or Incisures; which in

*Fig. 3.* being viewed by a Microscope, do more evidently discover themselves: This part is granulated with an abundance of fine Eminences all over. The Orifice at the end seemes here to be occasioned by drawing it self inwards, and upon trial we found it so, for in

*Fig. 4.* Is represented the Neck of this Worm drawn out its whole length and magnified: Where may be observed the lessening of the Rings, and its tending to a point at the end. And having opened it; within we found two small strings (*aa*) proceeding from the Neck and floating in the Liquor.

What these two Strings may be, is hard positively to assert: Leaving others to their own conjectures, I shall deliver mine; That this Worm by protruding its Neck, sucks from the outward Membrane (which involves it, and is furnished with Blood-Vessels,) the moisture or nourishment which is conveyed by these two Strings or Pipes into the Stomach or Bladder, and from whence, as there is occasion; it may be supplied for the nourishing the whole Body of the Worm again; for I am apt to believe this Bladder is but the Stomach of the Worm, which will appear

pear less unreasonable if we consider in some Insects how prodigiously large the Stomach is in proportion to the other parts of the Body; in a Leech you may observe not a single but above Twenty Stomachs, emptying out of one into another, and running the whole length of the Body. And what *Malpighius* observes of the *Silk Worm*, that it would devour in one day as much as was the weight of its whole Body; a Leech will do far more at a Meal.

*De Bombyce*  
p. 40.

Some it may be will be more inclin'd to think that the whole is but an Egg or Embrio of another Insect a forming, and that this Bladder is as it were the *Amnion*, and the outward Coat that includes it the *Chorion*. But could they perfect any such discovery, I should think so too. But formerly in Dissecting a Rotten Sheep, wherein I found many of these *Hydatides*, and opening several of them, I could not observe but the same Structure exactly in all; and doubtless had it been otherwise, in so many, I could not but have met with some nearer to Perfection.

These *Hydatides* therefore I cannot but think are a sort of Worms or Insects *sui generis*, and because they contain so much water in them, and are usually to be met with in rotten Sheep which are *Hydropical*: I call them *Lumbrici Hydropici*; not that I think all those *Cists* to be met with in morbid Bodies are such; for in some I have not observed this Neck and Structure of Parts, but only a transparent Bladder filled with a *Lympha*, and those I take to be of another kind.

Thus in a Patient still Living and enjoying her Health better than all her life time before; about Ten Years ago I caused her Right Side to be opened a little below her short Ribs, whence issued out abundance of limpid Water, but what was most surprizing, together with it, a great many *Hydatides*; that first and last, as we guessed, there might come out about 500 of these Bladders: most were entire and fill'd with limpid Water; of others that were too large  
for

for the Orifice, the *Filmes* were broke, but in none of them could I observe the Neck, tho I was inquisitive to find it, which makes me think them to be different from our present subject.

As are likewise those I have frequently met with in the *Ovaria* or Testicles of Women who have died *Hydropical*, which I take to be only the Eggs contain'd there, which by an extravagant flux of Humours into them are often swelled, to that prodigious bigness, that I have taken sometimes several Gallons of Liquor out of them.

And what is mentioned *Philos. Transact.* N°. 188. of those Bladders of Water found in the Urine-Bladder, will come into the same number, having observed no Neck in any of them.

I shall only add, that these *Lumbrici Hydropici* I have always found hanging to the Membranous Parts, rather than included in the Body of any of the *Viscera*, as to the *Omentum*, *Peritonæum*, or the outward Membranes that cover the Diaphragm, Stomach, Liver, Colon, or other Intestines.

And we may be less surpris'd at the odd Structure in this Worm; since what I have observed of the *Lumbricus Latus* (*Philosoph. Transact.* N°. 146. p. 113.) and of the *Teres* (*Philos. Transact.* N°. 147. p. 153.) is as wonderful, tho in a different manner. And whoever has the curiosity of observing the Inwards of the vast Kingdom of Insects, cannot want Subjects enough for exciting his admiration.

## De Visibili Conjunctione Inferiorum Planetarum cum Sole, Dissertatio A- stronomica, Authore E. HALLEY.

**M**ercurii Venerisq; sidera Solis discum subintrare, ac instar Macularum nigricantium in lucido ejus Orbe aliquando conspici, tam ex verioris Astronomiæ principijs, quam ex indubitata Observantium fide, dudum compertum est. Qua vero lege, quibusq; conditionibus, quantisque annorum intervallis hæc phænomena nobis spectanda præbentur, nescio an aliquis ex Astronomis hodiernis rite desiniverit: Certe nihil hac de re inter Typis mandata hucusq; mihi visum est: Quapropter non ingratum fore arbitratus, huic inquisitioni serio operam dedi, ac dissertatione hac rem maxime perplexam paucisq; intellectam me plenius enucleaturum confido.

Has Planetarum horum Phaseis semper in retrogradientium cum Sole conjunctionibus fieri, cum scilicet Sol Nodis eorum adeo vicinus sit, ut Planetæ Soli juncti Latitudo Semidiametrum Solis non excedat, per se satis conspicuum est; quo vero facilius limites ac conditiones harum Conjunctionum pervestigem, cumq; calculi elementa omnino diversi sint, uterq; Planeta sigillatim tractandus est: à Mercurio itaq; exordiamur.

Hujus Planetæ Nodum Ascendentem, juxta nuperas ☿ accuratas observationes, prope  $15^{\circ}$ . Tauri, seu potius ad os.  $15^{\circ}.44'$  à  $1^{\text{a}}$  \* ♃, hoc nostro seculo reperiri, pro comperto habemus. Descendentem vero oppositum ad  $6^{\circ}.15^{\circ}.44'$  à  $1^{\text{a}}$  \* ♃. Angulus autem quo Planum Orbitæ Mercurialis ad Eclipticam inclinatur satis bene se habet apud Keplerum, viz.  $6^{\circ}.54'$ . Jam ex probatissimis Hypothesibus constat Mercurii in Nodo

*Ascendente constituti distantiam à Sole esse partium 31365, quarum media Solis distantia à Terra sit 100000; dum vero Nodum alterum occupat, distantia ista in iisdem partibus mensurata fit, 45308. Sol vero Nodo Ascendenti oppositus distat à Terrâ eidem junctâ partium istarum 98955: ad Nodum vero alterum eadem intercapedo fit 101007, atq; idcirco Mercurius Soli conjunctus ad Nodum Ascend. distat à Terrâ partibus 67591: ad Nodum vero Descend. partibus 55699. Quæ cum inter se valde discrepent, separatim etiam considerandæ veniunt Conjunctiones illæ, quæ ad diversos Nodos fiunt, Calculi elementis compendii gratia Synopticè expofitis.*

Conjungatur Mercurius Retrogradus cum Sole Centraliter ad Nodum Ascendentem, Mense Octobri; ac ex prædictis Hypothesibus habebitur.

	S	O	'	"
<b>L</b> ongitudo Solis à prima Stella Arietis	6	15	44	00
Longitudo Mercurii ex Sole visi	0	15	44	00
Distantia Mercurii à Sole, partium	31365			
Distantia Mercurii à Terra	67591			
Angulus Inclinationis Orbitæ Mercurii		6	54	00
Motus 6 Horar. Mercurii ex Sole Visi		1	30	58
Motus Solis in iisdem sex horis			15	5
Hinc Motus Mercurii à Sole; sex horis		1	15	53
Et Motus ejus à Sole ex Terra viso, 6 Horis		0	35	12
Et Angulus viæ Mercurii intra Solem visæ cum Ecliptica		8	15	00
Hinc motus Mercurii in orbitâ suâ visibili 6 Horis			35	40
Deinde motus Mercurii in Anno siderio ultra quatuor revolutiones	S	0	'	"
In Annis tredecim itaq;	L	24	45	8
Desunt itaq; ad Revolutiones 54 integras	II	21	46	44
	0	8	13	16

Quod

	d	h	'
<i>Quod spatium percurrit Mercurius in</i>	2	00	13
<i>Quibus promovetur Solis locus; ac ♀ in Nodo</i>			
<i>fitus tantandem distat à conjunctione Terræ</i>	2°	1'	00"
<i>At arcus iste ex Terrâ spectatus fit</i>	0	56	10
<i>Unde ex dato Angulo viæ visæ 8°. 15' prove-</i>			
<i>nit basis, sive distantia à conjunctione visibili</i>	0	55	34
<i>Qui arcus percurritur à Mercurio juxta</i>			
<i>Horariam datam horis</i>	9 <sup>h</sup>	21'	
<i>Excedunt vero 13 Anni Siderii totidem Ju-</i>			
<i>lianos cum Intercalationibus tribus, horis</i>	8 <sup>h</sup>	00'	
<i>Itaque Mercurius revertitur ad Solem post</i>			
<i>Annos Julianos 13 atq; insuper</i>	2 <sup>d</sup>	17 <sup>h</sup>	34'
<i>Vel cum quatuor intercalationibus, si præcede-</i>			
<i>ns annus sit tertius à Bissext.</i>	1	17	34
<i>Ex arcu vero 56', 10". S angulo dato, fit per-</i>			
<i>pendicularis sive proxima distantia ♀ à Sole</i>	0	8'	3"
<i>Itaque ♀ post 13 annos intra Solem conspicuus</i>			
<i>8'. 3" Borealius incedit</i>			
<i>Pari Argumento in 46 annis sideriis movetur ♀</i>	11 <sup>s</sup>	28°	36' 8"
<i>Desunt itaq; ad revolutiones 191 integras</i>	0	1	23 52
<i>Hoc est in tempore</i>		8 <sup>h</sup>	12'
<i>Quo promovetur Sol</i>	0°	20'	41"
<i>Hic arcus è Terra visus fit</i>	0	9	36
<i>Basis vero ei competens</i>	0	9	30
<i>Tempus vero quo Mercurius basin percurrit fit</i>	1 <sup>h</sup>	36'	00
<i>Excedunt vero 46 Anni Siderii totidem Juli-</i>			
<i>anos cum 11 Intercalationibus, horis</i>	19	3	00
<i>Ac Mercurius revertitur ad Solem post 46 an-</i>			
<i>nos Julianos atq; insuper</i>	1 <sup>d</sup>	4 <sup>h</sup>	51'
<i>Vel cum duodecim intercalationibus, ut fit cum</i>			
<i>annus præcedens sit secundus vel tertius</i>	0	4 <sup>h</sup>	51'
<i>à Bissextili</i>			
<i>Perpendicularis vero quæ Mercurius in Bore-</i>	0°	1'	22"
<i>am provehitur fit</i>			

<i>Periodus vero maxime accurata Mercurii ad</i>	}	h	I	II ½
<i>Solem absolvitur annis sideriis 263 atque</i>				
<i>insuper</i>				
<i>Hi vero siderii superant totidem Julianos</i>	}	IO	20	
<i>cum 66 intercalationibus, horis</i>				
<i>Unde post 263 Annos Julianos, Mercurius</i>	}	II	31 ½	
<i>ad Solem revolvitur, tardius vero</i>				
<i>Quod si præcedens annus Bissextilis fuerit ad-</i>	}	Id	II	31 ½
<i>dantur</i>				
<i>Post hoc demum intervallum Borealius incedit non nisi decem</i>				
<i>minutis secundis.</i>				

*Ceteræ vero periodi latiores ex jam inventis facili negotio eruuntur, suntq; vel Sex vel Septem Annorum.*

*Quæ septem annis absolvitur, Mercurium deprimit versus Austrum 22'. 47", ac septem dies integros minus 9 minutis citius provenit, si duæ fuerint intercalationes. At cum una intercalatione, cum scil: annus prior Bissextilis sit, 6 dies subducendi sunt, additis tantum 9 minutis, ut prius.*

*Rarius vero post sex Annos in Solis disco conspicitur iterum vagus ille Planeta, qui exacta hac periodo 30'. 50" Borealius transit; idq; tardius 8<sup>d</sup>. 17<sup>h</sup>. 25', si annus præcedens sit secundus vel tertius à Bissextili; aliter 9<sup>d</sup>. 17<sup>h</sup>. 25' addendi sunt.*

**Pariter si fiat Conjunctio ad Nodum Descendentem Mense Aprili.**

	S	O	"
<b>L</b> ongitudo Solis à prima stella Arietis	0	15	44 00
Mercurii Longitudo ex Sole visa	6	15	44 00
Distantia planetæ à Sole ut prius		45	308
Distantia ejus à Terra		55	699
Motus Mercurii è Sole visus Sex horis		0	43 21
Motus Solis in eodem tempore		0	14 29
Motus Mercurii à Sole		0	28 52
Hinc angulus Viæ Viſæ Mercurii intra Solis dis-	}	10	18 00
cum cum Ecliptica fit			
Motus vero visus à Terra in sex horis		0	23 52
			Unde

Unde sequendo methodum calculi præcedentis, evincitur Mercurium post 13 annos atque in super 3d. 7h. 37'. ad Solis conjunctionem revolvi; quod si præcedens Annus fuerit tertius à Bissextili, tunc addendi sunt 2d. 7h. 37'. tantum: ac tum Mercurius 16'. 55". Australius incedere reperietur. Post 46 vero annos, cum 12 intercalationibus addantur od. 7h. 14'. & habebitur Mercurius Soli conjunctus in tramite Australiore 2'. 53". si vero annus prior Bissextilis fuerit, vel ab eo primus, addendus est 1d. 7h. 14'. ut habeatur accurate Synodus. Similiter post 263 annos, quibus Mercurius in Austrum deflectitur 0'. 22". addendus est vel 1d. 11h. 49', vel 11h. 49'. juxta legem in priori casu præscriptam.

At annis sex vel septem ob viciniam Terræ ac planetæ, atque idcirco ob ampliatis arcus, ad hunc Nodum non revertitur ad Solem, ut intra discum appareat. Post Annos autem 33 Solem transit viâ magis Boreali 14'. 2". ac habetur momentum conjunctionis subducendo à prioris tempore 3d. 0h. 23'. si fuerit in anno tertio à Bissextili; aliter subduc 2d. 0h. 23'. tantum.

His inventis facile erit continuare calculum pro omnibus hisce conjunctionibus Mercurii cum Sole, idque cum summâ certitudine, ac sine ullâ hæsitatione an omnes possibiles habeantur, necne: Sola Additione obtinentur momenta conjunctionum ac distantie planeta à Centro Solis, unde etiam ope Tabellæ depromuntur durationes harum, ut ita dicam, Eclipsium: ut nihil sit quod in hac re desiderari videatur.

Epochas vero quod spectat, ea tutius Observatorum industria comparantur, quam Calculi cujusvis Subtilitate: adeoque elegimus in primo casu, notabilem illum transitum Mercurii quem ipse in Insula Sanctæ Helenæ perfectissime observavi, Octob. 28. Anno 1677, St. Vet. & cujus medium ex initio & fine determinavi in prædicta Insula quidem 0h. 4'. P. M. Londini vero 0h. 28'. P. M. Semita vero qua incedere visus est Planeta 4'. 40". Borealis erat Solis centro. In altero casu, viz. cum Mercurius Soli conjungitur

Mense

*Mense Aprili, Ex Cl. Hevelii Mercurio in Sole viso pag. 72. 75. Epocham desumere placuit; nempe quod Apr. 23. Anno 1661. St. Vet. 6h. 8'. P. M, Gedani, hoc est 4h. 52'. Londini, Mercurius Solis centro proximus apparuit, utpote in medio transitu, simulque distabat ab eodem centro 4' 27". ad Boream. Hinc juxta præcepta præmissa, omnes ordine visibiles conjunctiones Mercurii cum Sole simul exhibere, exigui laboris opus erit: ac in exemplum quod cuivis in posterum imitari licet, accipe hujus seculi ab invento Telescopio quotquot usquam apparuere hujusmodi Phænomena vel quæ etiam insequentis seculi posteris apparitura sunt.*

Series momentorum quibus Mercurius Soli conjunctus intra discum ejus conspicitur, per præsens & futurum seculum, cum distantis Planeta à Solis centro.

### A P R I L I.

Ann.	Temp. Conj.			Dist. à centr. ☉.		
	d.	h.				
1615	22	21	38**	7	20	B
1628	25	5	15*	9	35	A
1661	23	4	52*	4	27	B
1674	26	12	29	12	28	A
1707	24	12	6	1	34	B
1720	26	19	43*	15	21	A
1740	21	11	43	15	36	B
1753	24	19	20*	1	19	A
1786	22	18	57*	12	43	B
1799	26	2	34**	4	12	A

OCTOBRI.

( 517 )  
OCTOBR I.

Ann.	Temp. Conj.		Dist. à centr. ☉.		
	d.	h.	'	"	
1605	22	8	29	12 48	A
1618	25	2	3*	4 45	A
1631	27	19	37*	3 18	B
1644	30	13	11	11 21	B
1651	23	13	20	11 26	A
1664	25	6	54*	3 23	A
1677	28	0	28**	4 40	B
1690	30	18	2*	12 43	B
1697	23	18	11*	10 4	A
1710	26	11	45	2 1	A
1723	29	5	19*	6 2	B
1730	22	5	28	16 45	A
1736	30	22	53**	14 5	B
1743	24	23	2**	8 42	A
1756	26	16	36	0 39	A
1769	29	10	10	7 24	B
1776	22	10	19	15 23	A
1782	Nov. 1	3	44*	15 27	B
1789	25	3	53*	7 20	A

Transitus qui signo \* notantur, Londini ex parte visibiles sunt, qui vero signo \*\*, toti conspici possunt.

Notandum vero est Solis Diametrum ad Nodum ♀<sup>ii</sup> Ascendentem Mense Octobri occupare 32'. 34" atq; adeo maximam durationem centralis transitus esse 5<sup>h</sup>. 29' : Mense vero Aprili Diameter Solis fit 31'. 54" ; unde ob tardiores Planetæ motum oritur duratio maxima 8<sup>h</sup>. 1'. Quod si obliquè incidat Mercurius, durationes hæc breviores redduntur proratione distantie à centro Solis : Quoq; perfectior calculus hic reddatur, sequentes Tabellas adjunxi quibus exhibentur dimidiatæ durationes harum Eclipsium ad singula minuta distantie visæ à centro Solis; quæ additæ ac sublatæ à conjunctionis momento in priori Tabula invento, initium ac finem totius Phænomeni designant.

Octobri.

Octobri.

Aprili.

Min. Dist. '	Semi- durat. H. '
0	2 44 $\frac{1}{2}$
1	2 44
2	2 43
3	2 41 $\frac{1}{2}$
4	2 39 $\frac{1}{2}$
5	2 36 $\frac{1}{2}$
6	2 33
7	2 28 $\frac{1}{2}$
8	2 23
9	2 17
10	2 10
11	2 1
12	1 51
13	1 39
14	1
15	1 24
15 $\frac{1}{2}$	0 50
16	0 30

Min. Dist. '	Semi- durat. " '
0	4 0 $\frac{1}{2}$
1	4 0
2	3 58 $\frac{1}{2}$
3	3 56
4	3 53
5	3 48 $\frac{1}{2}$
6	3 43
7	3 36
8	3 28
9	3 18 $\frac{1}{2}$
10	3 7
11	2 54
12	2 38
13	2 19
14	1 55
15	1 21 $\frac{1}{2}$
15 $\frac{1}{2}$	0 56

Observationes omnes hucusq; habitas rite repræsentant hi numeri, nec est quod dubitem de futuris, cum ex omnibus Planetis Mercurius Soli proximus ejus centro adeo vicinus sit, ut aliorum centrorum interventu minime cieatur, nec deviationibus illis quæ à cæterorum systemate oriuntur quibusq; Superiores præsertim Saturnus obnoxii sunt, quod sentiri possit in-  
terturbetur.

Parallaxes consilio omisi, ut perexiguas, quæq; locis diversis diversæ obveniunt generaliori calculo immisceri non debent, quodq; etiam quantæ sint non satis adhuc constat, sed potius ex hujusmodi Observatis tutissime derivari possint: Diametri etiam Mercurii rationem non habui, quia supra fidem parvus per  
paucula

*paucula solum minuta limbo adhære videtur. Ex observatione accuratissimâ deprehendi vix duo minuta elapsa dum totus è Sole egrederetur Octob. 28<sup>vo</sup>. 1677, unde conclusi Diametrum ejus  $\odot$ . 11", ac juxta rationem distantiarum à Terra ad Nodum alterum esse,  $\odot$ . 13"  $\frac{1}{2}$  fere, adeoq; tunc 3'  $\frac{1}{2}$  temporis minuta insumi, dum totus planeta Solis limbum directe pervadit: Oblique vero transiens paulo diutius hæret, secundum ac Secantes angulorum incidentiæ augentur. Æquationes etiam Temporis haud opus est ut æstimemus, quia per plures dies hinc inde in utroq; mense constantes ac quasi invariatiæ persistunt.*

### De Visibili Veneris cum Sole Conjunctione.

**V**enus quamvis syderum omnium speciosissima, more sexus sui, sine mutato cultu ac splendore asscittio in conspectum prodire veretur: Hoc etenim spectaculum inter Astronomica longe nobilissimum, instar Ludorum secularium, integri seculi Mortalibus invident motuum arctæ Leges. Unico vero hoc Observato summa cum certitudine distantiam Solis à Terra determinari posse, quæ ob Parallaxin alias prorsus insensibilem vagis terminis hucusq; definita est, posthac declarabitur. Periodos vero quod attinet, illæ non adeo accurate ac Mercuriales describi possunt, cum Venus semel tantum ob Orbe condito, idq; ab Horroxi nostro, intra Solis discum deprehensa sit: Correctis autem motibus quantum per rudiores Veterum observationes licet, accipe jam summam Calculi.

	S	0	'	"
Longitudo Nodi Ascendentis Veneris a prima	}	1	15	16 00
Stella Arietis				
Sol itaq; ei jungitur in puncto opposito, hoc	}	7	15	16 00
est, per hæc secula, circa finem Novembris				
Distantia Veneris à Sole partium		71997		
Distantia Veneris à Terra		26438		
Inclinatio Orbitæ Veneris ad Eclipticam		3°	23'	

K

Motus.

Motus Veneris in Octo Annis sydereis, supra	}	s	0	.	..
tredecim Revolutiones		0	I	30	28 <sup>i</sup>
Motus Veneris in 235 Annis sydereis supra	}	I	II	29	17 39
381 Revolutiones		0	0	48	8
Motus Veneris in 243 Annis sydereis supra	}	0	0	48	8
395 Revolutiones					

Ex his principiis, inito calculo juxta methodum in Mercurio expositam, proveniunt intervalla temporum ac distantiarum ut sequitur.

Post octo annos Venus revolvitur ad Solem, scilicet sublatis à prioris transitus momento  $2^d. 10^h. 52^m$ . Incedit vero Planeta semitâ  $24'. 41''$ . priore magis Australi.

Post annos 235, additis  $2^d. 10^h. 9'$ , Venus iterum Solem ingredi potest, sed viâ  $11'. 33''$  Borealiori: Quod si præcedens annus Bissextilis fuerit  $3^d. 10^h. 9'$  addendi sunt.

Post annos 243, Venus etiam Solem transire potest, aufereudo tantum  $0^h. 43'$  a prioris tempore, Australius vero incedit  $13'. 8''$ : Quod si præcedens annus Bissextilis fuerit, adde  $23^h. 17'$ .

Et in omnibus his appulsibus Veneris ad Solem, Mense Novembri, Angulus viæ visæ Veneris cum Ecliptica fit  $9^{\circ}. 5'$ , ac motus ejus Horarius intra Solem  $4'. 7''$ ; cumq; semidiameter Solis fit  $16'. 21''$ , provenit maxima duratio transitus centri Veneris  $7^h. 56''$ .

Deinde jungantur Sol & Venus ad Nodum Descendentem Mense Maio; ac juxta numeros eosdem supputantur intervalla eadem. Post octo Annos auferendi sunt  $2^d. 6^h. 55''$ , ac Venus orbitâ  $19'. 58''$  Borealiori pertransibit.

Post annos 235 adde  $2^d. 8^h. 18'$ , vel si prior annus Bissextilis fuerit,  $3^d. 8^h. 18'$  & habebis Venerem Australiorem  $9'. 21''$ .

Deniq; post 243 annos; adde  $0^d. 1^h. 23'$ ; vel si prior annus Bissextilis fuerit  $1^d. 1^h. 23'$  & reperietur Venus iterum Soli conjuncta sed in tramite.  $10'. 37''$  magis Boreali.

In omni ad hunc Nodum transitu intra Solem, angulus viæ visæ Veneris cum Ecliptica fit  $8^{\circ}. 28'$ ; ac Horarius ejus motus  $4'. 00''$ ; ac Solis semidiametro subtendente  $15'. 51''$ , provenit duratio maxima centralis transitus etiam  $7^h. 56'$ ; præcise eadem ac ad Nodum alterum.

Quoad



*Duraciones harum Veneriarum Eclipsium quod attinet, respectu centri eodem modo supputari possunt ac Mercuriales; sed cum Diameter Veneris satis ampla sit, cumq; Parallaxes etiam differentiam valde notabilem quoad tempus ingerere possint, calculus peculiaris pro locis singulis necessario subeundus est.*

*Veneris autem Diameter tanta est, ut dum limbo Solis adhaeret, ferme 20 temporis minuta praeterfluunt; cum scil: Solem directe aggreditur; oblique vero incidens, etiam diutius limbo immoratur. Occupat autem diameter ista, juxta Herroxii observationem 1'. 18", dum ad Nodum Ascend: Soli jungitur; ac 1'. 12" ad Nodum alterum. Praecipuus autem harum conjunctionum usus est, Solis à Terra distantiam sive parallaxin ejus accurate determinare, quam quidem frustra variis methodis tentaverunt Astronomi; dum instrumenta quantumvis subtilia angulorum quaestorum minutiae facile eludunt. At in observando Veneris in Solem ingressu & ab eodem egressu, spatium temporis inter momenta contactuum internorum, ad ipsum temporis minutum secundum, hoc est, ad  $\frac{1}{15}$  minuti secundi sive 4" arcus observati, ope mediocris Telescopii, & Horologii Oscillatorii per 6 vel 8 horas accurate sibi constantis, obtineri potest. Ex duabus autem talibus observationibus in Locis idoneis debite institutis, intra quingentesimam partem certo concludi Solis distantiam proximam occasione commonstrabo.*

*Ne quid obscuri Lectoribus Astronomice minus doctis videretur, Schemata pro utriusq; Planetæ transitu delineavi, Fig. 12, 13. quibus rem oculis subicere conatus sum.*

V	07	1	71	20	8101
M	10	1	72	15	8201
II	12	1	73	10	8301
V	15	1	74	05	8401
J	18	1	75	00	8501
A	21	1	76	00	8601
E	24	1	77	00	8701
A	27	1	78	00	8801
V	30	1	79	00	8901

Some

*Some Observations made on the Spawn of Frogs, and of the production of Todpoles therein, by the Learned and Curious Richard Waller, Esq; Reg. S. Secret.*

**A** Bout the twelfth of *March* 1689. I took some Frog-Spawn out of a Ditch, which I suppose might have been Spawned about 14 days, and kept it in a Gally-Pot of Water, which I shifted every day or two, and kept them in a Window where the Sun shined some part of the Day.

At the first they appeared as Fig. 5. being a round black Globule encompassed with a clear Liquor as I afterwards found, and a Membrane encompassing that Liquor, and that encompassed with a larger Sphere of a more Mucous Liquor.

The second day that I kept them they appeared as Fig. 6. The third day as Fig. 6. The fourth day as Fig. 7.

And about the sixth day several of them were loosed from their Eggs, and on the 7th. and 8th. more of them: when they appeared of the shape of Fig. 8. which in Fig. 9. is represented bigger than the Life, that the posture they lay in may be seen the better.

On the 7th. and 8th. days upon pricking of them with the point of a Needle they would contract themselves; and some of them on the 8th. day would of themselves bend their bodies, but not move out of their place, which was the bottom of the Pot they were kept in.

When they first got through their Egg (which I suppose they did by eating their way) they hung fast upon the outside of it, by that part which I afterwards found to be their Mouth, and when loosed from their hold they sunk

sunk to the bottom of the Water, and could not rise again.

On the 9th. day they were not visibly increased in bulk, only they moved themselves more freely at the bottom of the Vessel.

At about 14 days end they appeared as Fig. 10. at which time they swam about in the Water by moving their Tails, as Fig. 11. and some Rudiments of their fore Legs were visible, which looked forked and like a sprig of a Plant.

At three weeks end their Mouths were to be seen, which they opened and shut, and emitted *Fæces* from the other end.

At a months end the Eyes were to be discerned, at which time they would swim near the top of the Water, and opening their Mouths let out a small bubble of Air, and I suppose take in fresh.

The Liquor which was contained in the innermost Membrane, was more transparent than the other, which was a Mucous Liquor, and like the White of an Egg; the whole was a little heavier *in Specie* than Water, for a single Egg sunk when loosed from the rest, but when they were fastened a great many together, they swam, every three Eggs leaving a little space, which being filled with Air made them specifically lighter than common Water.

*An Account of a Ruminating Man lately living at Bristol, given in to the Royal Society, by the Experienced and Learned Frederick Slare, M. D. & Reg. Soc. S.*

**H**AVING heard of a Person at *Bristol* that did Eat his Meat twice, I was willing to know whether he had really the Faculty of Ruminating, and did presently (for my information) send a Letter to a very intelligent Person in that Town, with a set of Questions; requesting it of him that he would procure me such Answers to them as he could best obtain.

Question I. *How long after Meals does he begin to Chew his Meat over again?*

*Answ.* Within a quarter of an hour if he drink with it; if not, something longer.

Quest. II. *How long does his Chewing last after a full Meal?*

*Answ.* About an hour and half. If he go to Bed presently after Meals he cannot Sleep till the usual Time of Chewing be over.

Quest. III. *What Taste has the Victuals upon the return?*

*Answ.* Somewhat more pleasant than at first.

Quest. IV. *What colour does it return of? Whether white and milky, or how?*

*Answ.* Bread and Meat, and Cheese and Drink, does seem to me to return much of such Colour as they would be of, if they were mixed together in a Mortar.

Quest. V. *Whether this be a late accident?*

*Answ.* He was always so since he can remember.

Quest.

Quest. VI. *What is his Age?*

Ans. About twenty.

Quest. VII. *Whether any of his Relations did so?*

Ans. His Father does so some times, and in small Quantities, but nothing like this.

Quest. VIII. *Whether he has not been sick sometimes, and whether that Faculty continues then or no?*

Ans. If that leave him it signifies sickness, and he is never well till it return.

Quest. IX. *How he was Nursed, and whether he did Suck?*

Ans. His Mother is out of Town, we do not know any thing to the contrary but that she gave him Suck.

Quest. X. *Whether he was ever a Shepherd? Or how bred up?*

Ans. Formerly in the Mines, but now is a Day-Labourer.

Quest. XI. *Whether he Chews Liquids, that is, whether Broath or Spoon-Meat returns to his Mouth as solid Food does?*

Ans. All one as with dryer Meat.

Quest. XII. *Whether he finds any Load extraordinary in his Stomach before Rumination; and what other thing very remarkable you meet with, pray inform?*

Ans. The Victuals does lye heavy in the lower part of his Throat, as it seems to him, until it has passed the second Chewing, afterwards it passes clean away. This he always observes, That if he Eats of variety of Things, that which passes down first comes up first again to be Chewed.

I received an account of such a Person at *Bristol* by Mr. Mellin. who saw this Person, but did not satisfy any of these Queries: for this Reason I sent them to Mr. Day, at that time Mayor of *Bristol*, who has made enquiry into these Particulars, and with his own hand sent me their Answers.

History is very sparing as to many Instances of this kind: *Fabricius ab Aqua pendente* is (I think) the first that mentions one, being a Nobleman of *Padua* that Ruminated in his days, whom he had the luck to out-live, and the leave to Dissect; and what is very strange, he found only one large but very Rugous Ventricle. He also notes a Monk of that place to have had the same Faculty. *Sennertus* takes also notice of one; and so does *Salmuth*: as also *Velshius*, who names one *Damy* a *Welchman* that lived in *London*, but of these they give no Particulars. *Ludovicus*, a *Franckfort* Physitian, who lately lived and Practised there, describes a Person that to him seemed to Ruminat, but this sort of Ruminatation seemed rather a Disease, for this Man did it with aversion, he rather disgorged than Ruminated. Of this kind I have known several in *London* that do not fail to throw up an ill tasted and bitter Mass, half an hour or an hour after feeding, and that to their great disgust: but in true Ruminatation it returns pleasant, and they Chew it the second time with delight. *Pyerus*, who has written at large and very ingeniously about Ruminatation, found two Persons in his Country that were alive when he writ that Book, and had been taken notice of to Ruminat. They were very boorish and foolish Persons, that lived only amongst the Beasts; and he fancies that by frequent Conversation with Calves and Sheep they had learnt to imitate them. As to the Case we have mentioned from *Bristol*, this Person is of mean Parents, but of tollerable Sense and Reason.

*A Letter from that incomparable Botanist Mr. John Ray, giving an account of the Phytographia of Leonard Plukenet, M. D. Lately published. Lond. fol. 1691.*

S I R,

**I**N compliance with your desires I have sent you a short Account of Dr. *Plukenets Phytographia*; not such an one as the Work deserves, but as I am able to draw up: wherein if you find not satisfaction blame your own Judgment for thinking me able to give it.

The Learned and Ingenious Author of these Tables hath therein exhibited to the publick view the Figures and Titles of many hundred Plants; the most part of them, as yet neither described nor figured, some described but not figured, others though already figured, yet not well and exactly. Now a good Figure having this advantage of a verbal Description, that it conveys speedily to the Mind, with ease and pleasure, a clearer and truer *Idea* of the thing delineated, than the Understanding can with much Labour, and in a long time form to it self from a Description, be it never so exact: the pains taken, and cost bestowed in designing and engraving such Plants as have already been only described, or if figured, but lamely and imperfectly, must be acknowledged to have been to very good purpose, and to merit the thanks of those who shall be assisted and eased thereby, that is the greatest part of Herbarists, to whom a Description without a Figure signifies little. The new and *non-descript Species* may give entertainment and diversion to those of the highest form in *Botanics*, who will here meet with many Plants they have not before seen, or it may be heard of. As for the Sculptors they recommend themselves  
to

to the perusal of all sorts, as well for their Beauty and Elegancy, as for their exact similitude to the Vegetables they were taken from or are intended to represent; which are the two only qualities requisite to the perfection of a Cut.

The Titles subjoined to each Table may supply the place of Descriptions, as containing certain Characteristic Notes, sufficient to distinguish the *Species* to which they belong from any others whatsoever: so that they alone without any *Icon*, if diligently heeded and attended to, might serve to lead a Man into a certain knowledge of the Plants.

In this Work the Reader will find many mistakes rectified, and obscurities cleared up, which I shall not stand to enumerate; many *Desiderata* are supplied, of which I shall instance in some few Particulars.

The Figure of that sort of *Artemissa*, of which the *Chinese* make their *Moxa*, so famous for curing the Gout by burning.

Of the Root *Genfing* or *Ninzin* and its Plant, growing in the Kingdom of *Corea*, so much Celebrated in *China* and *Japan* for a *Panacea*.

Of the *Virginian Polyrrhizos* or Snakeweed, so much talked of for the Cure of the Rattle Snake. This hath been already figured, but not exactly.

Of the Tree whose Bark is well known by the name of *Cortex Winteranus*.

Add to these the Figures of that rare *Virginian* Harts-tongue that propagates it self by the tip of the Leaf turning downwards, and when it touches the Ground taking Root; from whence springs up a young Plant, which at last is of its own accord as it were weaned and separated from its Mother, and maintains it self by its own Root.

Of a sort of Kidney-Bean from *Mevis* Island, which they call the Turnep Tree, having an esculent Root.

Of two sorts of Kidney-Beans, which are not trifoliolate, but single-leaved.

Of the top and Flowers of that Plant which *Lobel* inscribes *Verbascum Sylvestre Salvifolium exoticum folio rotundiore* erroneously, giving only the Figure of the Leaves and lower part of it: and *Parkinson* I know not how deceiving himself and imposing upon others, makes a kind of *Cistus*; whereas it appears to be a sort of *Salvia fruticosa*. For the rest I refer the Reader to the Work it self.

J O H N R A Y.

---

E R R A T A.

Pag. 518. l. 19. r. 1<sup>h</sup>. 24'. l. 20. r. 1<sup>h</sup>. 4'.

---

F I N I S.

# PHILOSOPHICAL TRANSACTIONS.

For the Months of *July, August and September,* 1691.

## The CONTENTS.

1. **T**HE *Method the Indians in Virginia and Carolina use to dress Buck and Doe-Skins; as it was communicated to the Royal Society, by the Honourable Sir Robert Southwell Knt. Their President.* (2.) *Observationes Ponderis Testudinis terrestris, cum in Autumno Terram subiret, cum ejusdem ex Terrâ Verno tempore exeuntis pondere comparati, per plures annos repetitæ; Experimento Celeberrimi Domini D. Georgii Ent, Equitis & M.D. & à Doctissimo Domino D. Rob. Pitt. M. D. & R. S. S. communicatæ.* (3.) *Emendationes & Notæ in tria Loca vitiosè edita in Textu vulgato Naturalis Historiæ. C. Plinii, per E. Halley.* (4.) *An Account of the Measure of the Thickness of Gold upon Gilt-Wire, together with a Demonstration of the exceeding Minuteness of the Atoms or constituent Particles of Gold: as it was Read before the Royal Society, by E. Halley.* (5.) *Observationes aliquot rariores de Morboſo Liene, à spectatissimo Domino D. Nehemia Grew, M. D. ac R. S. Socio, cum eadem Societate communicatæ.* (6.) *An Account of a Book, Osteologia Nova, or some New Observations of the Bones, &c. Communicated to the Royal Society in several Discourses read at their Meetings, By the Learned and Accurate Author Clopton Havers, M. D. and R. S. Soc. Lond. 1691, Octavo, for Sam. Smith.*

*The Method the Indians in Virginia and Carolina use to Dress Buck and Doe-Skins; as it was communicated to the Royal Society by the Honourable Sir Robert Southwell, Knt. their President.*

**T**HE *Pelt* being taken off is first streined by Lines, or otherwise, most like the Clothiers Racks, but for no other purpose but to dry them.

The *Brains* of the Deer, whether *Buck* or *Doe*, is taken out and melled; and dawbed on Moss or dried Grass, and then dreyed in the Sun, or by a Fire to preserve them.

When the Hunting time is over, the Women dress the Skins; first, by putting them in a Pond, or Hole of Water, to soak them well. Then they with an old Knife fixed in a Cleft-Stick, force off the Hair, whilst they remain wet. The Hair being taken or forced off, they put as many Skins as they have made so ready, into a Kettle or Earthen Pot, and a proportion of the Deers Brains, before spoken of, into the Kettle with the Skins; and then put them over a Fire till they are more than Blood-warm; which will make them ladder and scour perfectly clean; which done, they with small sticks wrest and twist each Skin as long as they find any Wet to drop from them, letting them remain so wrested some Hours; and then they untwist each Skin, and put them into a sort of a Rack, like a Clothiers Rack (which they fix at every place they come to, with no more Trouble than two small Poles set upright, and two more put a thwart, all fixed with their own Barcks,) and extend them every way by Lines, and as the Skin dries, so they with a dull Hatchet, or a Stick flatted, and brought

brought to a round edge, or a Stone fitted by nature for that purpose, rub them all over to force all the Water and Grease out of them, till they become perfectly dry : which is all they do.

And one Woman will dress eight or ten Skins in a day ; that is, begin and end them. I intimate this because the Men never do it.

Observationes ponderis Testudinis terrestris, cum in Autumno terram subiret, cum ejusdem ex Terrâ Verno tempore exeuntis pondere comparati, per plures annos repetitæ : experimento celeberrimi D. D. Georgii Ent, Equitis, & M. D. & à Doctissimo D. D. Rob. Pitt, M. D. & R. S. S. communicatæ.

**D**IE septimo Octobris, Anno 1651. Testudinem meam appendi, priusquam latibulum adiret, ibidem per totam Hyemem hybernatura, pendebatque exactè libras 4. unciâsque totidem minus drachma, nempe lib. 4. unc. 3. drach. 7.

Die octavo Octobris 1652. Erutam è terra Testudinem ( nam se pridie humaverat ) appendi denno, ponderabatque lib. 4. unc. 6. & drach. 1.

Die 16. Martii 1653. Testudo sponte è latibulo suo prodiiit. Pendebatque lib. 4. atque unc. 4.

Die 4. Octobris 1653. Testudo postquam per aliquot dies jejunasset, subitâsque terram sese abscondisset, inde educta atque appensa ponderabat lib. 4. unc. 5. Oculi ( quos diu clausos habuerat ) tum aperti plurimum madescabant.

Die 18. Martii 1653. Testudo è latebris prodicens & in lance appensa ponderabat lib. 4. unc. 4. & drach. 2.

Die

Die 6. Octob. 1654. Testudo ad hyberna ituriens pende-  
bat lib. 4. unc. 9. & drach. 3..

Die Februar. ultimo 165 $\frac{2}{3}$ . Testudo ex hyemali Cryptâ  
prorepens pependit lib. 4. unc. 7. drach. 6. Amisit itaque  
pristini ponderis unc. 1. drac. 5.

Die 2. Oct. 1655. Testudo hyematum itura, pependit  
lib. 4. unc. 9. prius autem aliquamdiu jejunaverat.

Die 25. Martii 1656. Testudinem è latebris hyber-  
nalibus prodeuntem appendi; eratque lib. 4. unc. 7. & dr. 2.

Die 30. Sept. 1656. Testudo subtus terram ituriens,  
pendebat lib. 4. & unc. 12. drac. 4.

Die 5. Martii 165 $\frac{6}{7}$ . Testudo de subtus terram exiens  
pondo erat lib. 4. unc. 11. dr. 2. ss.

Unde satis liquet quam fixis particulis hæc Animalia,  
quæ sub Terrâ se muniunt adversus frigus Hybernum, con-  
sistent, cum per tot menses tam exigua pars corporis in sudo-  
res aut effluvia abeat, ut an vivant necne, dum hunc in  
modum sepulta jacent, merito ambigatur.

Emendationes & Notæ in tria loca vitiose edita  
in Textu vulgato Naturalis Historiæ C. Plinii,  
per E. Halley.

**D** *Isquisitiones Criticas non hujus loci esse nonnullis forsàn videbitur : attamen cum C. Plinii Historia Naturalis à Mendis quam plurimis, quibus incuriâ scriptorum ubiq; fere scatet, repurgata, hæcenus inter desiderata sit ; cumq; Liber iste inter Veterum Scripta Philosophica longe nobilissimus habeatur, hand abs re erit, nec veritatis studiosis injucundum, uni vel alteri loco ex obscurioribus lucem asferre, ac si fieri possit genuinum Authoris sensum restituere. Etenim licet R. P. Harduinus in eleganti suâ editione Plinii, collatis Codicibus MSS. plurima vitiata correxerit ; nonnulla tamen intacta prætermisit, quædam etiam tentata ad mentem suam se non assequi posse ingenue fatetur. Loca vero quæ à nobis emendata speramus hæc sunt.*

I. Defectus (Solis & Lunæ) ducentis viginti duobus mensibus redire in suos orbes certum est. Plin. Lib. 2. cap. 13. Sic apud omnes libros impressos legitur, sic apud Harduinum, cum tamen revera non detur talis Periodus motuum Lunarium, quocunq; sensu menses hi capiantur. Nam si Menses sint Solares, quorum duodecim Annum conficiunt, 222 Menses sunt Anni octodecim cum dimidio, quibus exactis Luna non revolvitur nec ad Solem, nec ad Nodos suos. Deinde si Menses hi sint Lunares Synodici, sive revolutiones Lunæ ad Solem, quorum singuli sunt 29<sup>d</sup>. 12<sup>h</sup>. 44'. 3", tum Menses 222 constituent annos *XIIIX* sublatis totidem diebus, emensq; hoc temporis spatio post Eclipsin aliquam, Luna nunquam deficit, sed Umbram Terræ illibatam præterit. Egregia autem motuum Lunarium Periodus absolvitur mensibus 223, nempe quâ Luna & ad Solem & ad Nodum eundem satis accurate revolvatur, ac parum absit ab eodem ad Apogæum suum respectu, atq; insuper paucis tantum gradibus ab eodem Cæli puncto distet. Ita ut post intervallum hoc, Eclipses revera rede-

eant in orbem, ac repetito ordine invicem sequuntæ, tam quantitate, tam cæteris circumstantiis per omnia similes sint; nec dubium quin de hac periodo locutus fuerit Plinius, ac legendum esse Ducentis viginti tribus Mensibus.

Hac emendatione coram Societate Regiâ propositâ, Vir undiquaq; doctus ac nuper Societatis Præses ac decus eximium, D. J. Hoskyns Eques Baronettus, solita suâ sagacitate, suspicatus est olim scriptum fuisse numeralibus Romanis CCXXIII, sed in Codice aliquo potiori unde forsaz transcriberentur cæteri, vetustate vel casu periisse ultimum I, quod quidem ita se habere deinde compertum est, cum tam in Codice MS. Chiffletiano, teste Dalecampio, tam in MS. Regiæ Societatis è Bibliothecâ Norfolcianâ satis vetusto, scriptum reperiatur CCXXIII.

Periodus autem ista egregios præstat usus in prædicendo Lunæ motu, tam in Eclipsibus quam alias: Quicquid enim erratum est in calculo aliquo loci Lunæ, etiam post absolutos ducentos viginti tres Menses Lunares, denuo errabitur. Atq; ex observatione aliquâ cum calculo comparatâ, tuto concludere licet Lunæ locum futurum, post exactum hoc intervallum, etiam ubi Numeri Astronomici præstantissimi ultra quadrantem gradus à Cælo aberrant; id quod multoties expertus sum cum accurato consensu. Sed Astronomicis immisceri non ex instituto præsentis est, præsertim cum argumentum hoc peculiarem tractatum jure optimo sibi vindicet, cuiq; etiam scribendo allaborare, si modo vacaverit, mihi in animo est.

Duo vero sunt quæ hac occasione prætermittenda non censeo. Primo, Sphalma illud notabile quod in Notis suis ad hunc Locum admisit R. P. Harduinus Tom. I. Pag. 159. his verbis. Sunt autem Menses 222 Lunares, anni fere Solares octodecim, cum Septem Mensibus & femisse. Totidemq; Mensibus ad eandem Cæli partem regreditur unde digressa est (Luna,) cum Solem interposito suo teris occultavit. Etenim 222 Menses Lunares non conficiunt XIIII Annos Solares integros, ut dictum est, multo mi-

nus, cum septem Mensibus & semisse adjunctis; deinde per peram dicitur Lunam regredi ad eandem Cæli partem unde digressa est, post completam periodum quam supponit; etenim ipse exemplis quæ citat satis comprobavit in opposita Cæli parte contingere Eclipses suas, nempe Octobri & Aprili, ad signa Tauri & Scorpionis. Deniq; ex iisdem exemplis constat, intervallum istud Eclipsium sibi respondentium non  $7\frac{1}{2}$  mensibus, sed  $6\frac{1}{4}$  tantum Annos XIIIX superare. Est autem prædicta periodus non 222 Mensum Lunarium sed 229, eaq; completâ certis conditionibus Luminaria defectum patiuntur, sæpius vero absq; Eclipsi prætervehitur Luna. Unde subest mirari quo pacto vir alias literatus tam paucis verbis, tot absurda ac secum pugnantia simul conglomerare potuerit.

Secundo loco annotare libet hanc Periodum Chaldæis olim Astronomiæ repertoribus Saron dici, qua voce utitur Diodorus Siculus ad designanda veterum Regum tempora; Vox vero ista scriptoribus antiquis æque ac modernis parum cognita ac varie exposita est. Suidas vero, in loco apud Libros impressos vitiato, (quemq; nuper ex MS. Vaticano restituit Vir admodum Reverendus Pearsonius Episcopus Cestriensis in doctissimâ suâ Symboli Apostolici Expositione) rectius saltem probabilius cæteris rem tradit his verbis, Σάροι μέτρον ἔστι ἀριθμὸς ὡς καὶ χάλδαϊοι οἱ γὰρ οὐκ ἴσασιν ἐνιαυτὸς βουβ' κατὰ τὴν χάλδαϊων ψήφον εἰσὶν ὁ αἶψ' ποιεῖ μῆνας σελλωιακῶν σὺβ', οἳ οὖν γίνονται ἢ ἐνιαυτοὶ ἔ μὲν ἔξ. hoc est, Sari mensura & numerus apud Chaldæos, etenim 120 Sari constituunt annos 2222 juxta Chaldæorum calculum, nempe Saros constat ex 222 mensibus Lunaribus, qui sunt 18 Anni cum sex mensibus. Desunt autem in impressis Codicibus verba χ' πλὴν χάλδαϊων ψήφον. εἰσὶν ὁ αἶψ' ποιεῖ μῆνας σελλωιακῶν σὺβ'. Unde turbato sensu locus iste inexplicatus mansit. Vide Pearsonii Expos. Symb. Apost. Edit. Lond. 1683, Fol. 59. Quod vero hic scribatur σὺβ' pro σὺγ' fortassis ex eo fluxit, quod ex Plinio, etiam Suidâ vivente corrupto, desumi poterat iste numerus. A Chaldaicâ vero voce ܣܪܘ significante capit,

inchoavit, vox ista Saros derivari videtur; quasi sit principium renovatae periodi Eclipsium. Sed hæc Linguarum Orientalium peritioribus relinquo.

II. Jecur maxime vetustatis patiens centenis durare annis obsidionum exempla prodidere, *Plin. lib. 11. cap. 37, ubi de visceribus tractatur*: sic legitur in impressis, sic in MS. Lugdunensi, idq; manifestâ mendâ: Nullo enim modo concipi potest jecoris per centum annos durationem ex obsidionibus probari posse. Sed locus hic collatis plurimum MSS.lectionibus variis, apud omnes vitiatus reperitur, teste Harduino qui præter Lugdunensem hæc citat.

In Vaticanis N<sup>o</sup>. 1950, 1952, Legitur hoc syrion tum exempla prodidere.

In Reg. 1. Colb 1, 2, & Parisino. hoc syrion cum explenda prodidere.

In Reg. 2. obsidione cum explenda prodidere.

In Colb. 3. obsidione cum exempla prodidere.

His adde MS. Norfolcianum prædictum, ubi invenitur hoc syrion cum exempla prodidere.

Ex quibus omnibus sensus non liquet, ac post plurima conamina irrita, etiam Harduinus vulgatas editiones sequitur, cum illi non constaret quo pacto emendari deberent.

Ad hujus tamen obscuri loci illustrationem nos operam dedisse non pavitet, cum scilicet intra duorum verborum ambiguitatem rem clausisse videamur. Primo autem considerandum venit, quæ de Jecoris duratione dicta hic sunt, vel ad Jecur humanum vivens; vel ad Jecur aliquo modo coctum vel conditum, ac in usum ventris per longum tempus repositum pertinere: neque tertium excogitari posse. Itaq; si de Jecore vivente sermo sit, non nisi ex valde Senibus exempla Jecorum post centum annos integrorum adduci possunt, ac si hoc modo sumatur, legendum esse hoc seniorum exempla prodidere. At si de Jecore cocto & exiccato dicatur, non nisi ex Jecore in Conditoriis post centum annos reperto probari potest: cumq; Conditoria subterranea & operta, frugibus alijsq; rebus per longum tempus conservan-

dis

dis idonea, à Varrone, Columella & Curtio, ac quod magis est, à Plinio ipso lib. 18. cap. 30. Siri appellentur, legi oportet Hoc firorum exempla prodidere. Utroq; modo integer & probabilis est sensus; ac juxta MSS. plurimos habetur hoc firiotum vel sirioncum, quod quidem multo propius ad verba hoc seniorum, vel hoc firorum accedere videtur, quam vulgatum istud obsidionum, proculdubio ex iisdem literis, in Codice quodam primario, vel male scriptis vel vetustate obtritis corruptum.

Hic vero obiter notare licet hos decem MSS. ab eodem primario Codice olim transcriptos fuisse, vel mediate vel immediate, cujus in hoc loco vitium, quocunq; modo ortum, in prolem suam, ut ita dicam, promanavit. Unde patet quali & quam severo examini, ne dicam interneconi, libri omnes subjecti fuerint, cum nec Plinius ipse per orbem Romanum celeberrimus ac toties transcriptus, nisi unico exemplari casu conservato, Barbarorum vel ipsis Barbaris astutius literaturæ infestorum manus effugeret.

III. Syriation & vomicas vulvæ curavit illa. Plin. lib. 20. cap. 14, quo de Herbarum quarundam virtutibus agitur: hoc vero in loco de Menthæ viribus medicinalibus tractatur: ac enarrato ejus usu ad sistendam Lactis coagulationem, deinde Hippocratis verba refert, quod Semen genitale denseri vel incrassescere cohibeat, vel etiam dissolvat; quo dicto, statim sequuntur hæc Verba Syriation &c. Hippocrates autem, quem hic sequitur Plinius, quiq; in Catalogo Authorum pro Libro XX reperitur, hæc habet, Μίνδν δερμίνει καὶ ἐρέεται, καὶ ἐμέτους ἴσποι: καὶ ὡς πολλάκις ἐοδὴν ἴς, ἢ σπώρον αὐτῆ πίκει ὡσεὶ ῥέειν, καὶ ἐπιτίθειν κωλύει. de Dieta lib. 2. cap. 26. Mentha Calfacit & urinam ciet & vomitus sistit; ac si quis sæpe comedat, semen genitale ejus colliquefacit ut diffuat & arrigere prohibet. Quæcunq; vero arrigere prohibent ad compescendum Satyriasin morbum proprie adhibentur, itaq; legendum videtur Satyriasin & vomicas Vulvæ curavit illa. Atq; hæc nostra suspicio duplici modo confirmari videtur, primo quod Syriation

Syriation & Satyriafin iisdem fere literis scribantur neq; multum transpositis: deinde quod particula ista & Copulativa potius videatur, ac Syriation morbi nomen in Accusandi casu innuat; quam quod pro etiam Intendendi Adverbium ponatur, ac Syriation sit nomen Medici cujusdam obscuri. Voce vero Vomica hic peculiariter utitur Plinius, non pro Apostemate, sed pro fluore quodam Uteri, id quod ex alio Plinii dicto patet. Est lapis in Venis cujus Vomica liquoris æterni Argentum vivum dicitur, venenum rerum omnium. *Lib. 33. cap. 6.* Ubi Vomica pro fluore è Lapide manante dicitur. Quod autem Mentha has etiam vires habeat audiamus Raium nostrum Botanicorum præstantissimum. *Hist. Plant. pag. 532.* Mentha Menses & album Mulierum profluvium efficaciter compescit. An vero de alio quodam Mulierum affectu hæc Plinii verba capienda sint ad Medicos referendum est.

---

*An account of the Measure of the thickness of Gold upon Gilt-Wire, together with a demonstration of the exceeding minuteness of the Atoms or constituent Particles of Gold; as it was read before the R. Society, by E. HALLEY.*

**W**HAT are the Constituent parts of Matter, and how there comes to be so great a diversity in the weight of Bodies to all appearance equally solid and dense, (such as are Gold and Glass, (whose specific Gravities are nearly as 7 to 1) seems a very hard question to those that shall rightly consider it: For from undoubted experiment, Gravity is in all Bodies proportionable to the quantity of Matter in each, and there is no such thing as a propension of some more, others less, towards the Earths Center; since the Impediment of the

the

of the Air being removed, all Bodies descend, be they never so loose or compact in texture, with equal velocity. It follows therefore, That there is 7 times as much matter in Gold as in a peice of Glass of the same Magnitude; and consequently, that at least six parts of seven in the bulk of Glass, must be Pore or Vacuity: This some favourers of the Atomical Philosophy have endeavoured to Solve, by supposing the primary or constituent Atoms of Gold to be much larger than those of other Bodies, and consequently the Pores fewer; whereas in other Bodies, the great multitude of the intersperced Vacuities does diminish their Weights.

Being desirous to examine this Notion of the Magnitude of Atoms of Gold, I bethought my self of the Extreme Ductility of that Metal, which is seen in the beating of it into Leaf, and above all in the drawing fine Gilt-Wire; by means whereof, I believed I might most exactly obtain the true thickness of the Coat of Gold that appears even with the Microscope, so well to represent Gold itself, that not the least point of Silver appears through it. In order to this, I inform'd my self among the Wire-Drawers, what Gold they us'd to their Silver, and they told me, That the very best double Gilt-Wire, was made out of Cylidrick Ingots 4 Inches in circumference, and 28 Inches long, which weigh 16 Pounds Troy; on these they bestow 4 Ounces of Gold, that is, to every 48 Ounces of Silver one of Gold: and that two Yards of the super-fine Wire weighs a Grain. Hence at first sight it appear'd, that the length of 98 Yards is in weight 49 Grains, and that a single Grain of Gold covers the said 98 Yards, and that the 10000 th. part of a Grain is above  $\frac{1}{3}$  of an Inch long; which yet may be actually divided into 10, and so the 100000 th. part of a Grain of Gold be visible without a Microscope. But being desirous to compute the thickness of the Skin of Gold: by means of the specifick Gravities

Gravities of the Metals, *viz.* Silver  $10\frac{1}{3}$ , and Gold  $18\frac{2}{3}$ , I found the Diameter of such Wire the  $\frac{1}{386}$  part of an Inch, and its Circumference the  $\frac{1}{121}$  part; but the Gold in thickness not to exceed the  $\frac{1}{13450}$  part of an Inch; whence it may be concluded, that the Cube of the hundredth part of an Inch would contain above 243300000, (or the Cube of 1345) of such Atoms. And it may likewise be marvelled at, that Gold being stretcht to so great a degree as is here demonstrated, should yet shew itself of so even and united a Texture, as not to let the white Colour of the Silver under it appear through any the least Pores; which Argues that even in this exceeding thinness, very many of those Atoms may still lie one over the other: Which is a Consideration may merit the Thoughts of this Honourable Society, as tending to examine that renowned Atomical Doctrine, which has of late of much obtained among the Learned.

Obser-

Observationes aliquot rariores de Morboſo Liene,  
à Spectatiſſimo Domino D. Nebemia Grew,  
M. D. ac R. S. Socio cum eadem Societate  
communicatæ.

**D**omini Thomæ Sedgwick Mercatoris Londinenſis  
Filia, decimo quarto ſuæ ætatis anno, ad Operum acu-  
piſtorum Magiſtram ſe erudiendam contulit. In  
quibus aded miræ fuit indolis, ut iis ſolis totos dies, eoſque  
ferè continuos, per biennium inſumeret. Hinc Melancholi-  
cum Temperamentum connatum in morboſum tranſiit: cui  
Pallor, Inappetentia, Menſum defectus, atque Tuffis co-  
mitabantur. Et poſt tres annos, gravativus Dolor, in ſi-  
niſtro inſimoque Latere, qui ad extremum uſque diem per-  
ſiſtit. Anno autem ætatis vicesimo ineennte, ex Febre obiit.

In aperto Cadavere, Pulmones, Jecur, reliquaque Viſcera  
excepto ſolo Liene, ſana inveni. Hoc verò mirum in mo-  
dum auctum & tumefactum; nempe craſſum ſupra duos  
digitos; quatuor latum; longum prope decem. Ita ut, cùm  
Lien Humanum, quoties ſe rectè habet, vix quinque uncias  
pendeat; in hac Virgine, quinque & viginti ſuperabat.  
Et cùm hoc Viſcus, ſicubi ægrotet, Tumoribus ſchirroſis &  
ſubnigris plerumque indureſcat; hæc è contra, tota ejus  
ſubſtantia putreſcens, quendam emittebat fætorum; molliſ-  
que aded fuit ac digitis palpantibus diſſolubilis, ut videretur  
quafi grumofus ſanguis; atque altera pars à prehensâ alterâ,  
etiam ſuo pondere diſrumperetur. Nihilominus, tam exte-  
riùs quàm intus, rubicundo floruit colore, neque ullo Apo-  
ſtemate, aut materia verè purulentâ inſciebatur.

Ex ſolitariis Inſtantiis, non eſt Sapienſis δογματικῶν.  
Liceat tamen ut pauliſper inquirendo philoſophemur.

N

In

*In hoc Casu, ista Tria sunt consideranda, viz. Vita genus, Ætas, Ætatisque Periodus.*

*Primo enim à tam diuturna exercendi desuetudine, vix potuit non evenire inæqualis Alimenti distributio. Quemadmodum itaque Ossa, & sæpe Viscera, ex inepta Nutritione, supra modum augmentur in Rhachitide: pariter & hîc Lien, ex eodem Nutritionis vitio, videtur ampliorem molem accepisse.*

*Præcipuè, cum secundo, hæc vite consuetudine usa est illa Virgo, non in proVectiori etate, sed florente adhuc adolescentiâ. Exercitia enim necessaria sunt, etiam ad debitam nutritionem: multo magis ad Partium æquale Incrementum.*

*Tertio, & in illa ipsa etatis periodo, quâ Menses primo effluere solent. Quibus inde suppressis, vel multum immixtis, iste sanguis, quem desidiosa Natura omisit eliminare per consuetas vias, ex parte in Lienem, quasi quoddam diverticulum, rejiciebatur.*

*Corollarium. Virginibus, nimia Exercitiorum intermissio, inprimis circa finem secundi, aut principium tertii etatis Septenarii, pessima.*

*An Account of a Book. Osteologia Nova, or some Observations of the Bones, &c: Communicated to the Royal Society, in several Discourses, Read at their Meetings, by the Learned and Accurate Author, Clopton Havers, M. D. and R. S. Soc. Lond. 1691, Octavo, for Sam. Smith.*

**T**HE Author offering to give some Account of the manner, in which the Bones are first formed, supposes, that they, as all the other parts of the Body, are formed in the Egg before the Female is impregnated, and that the Seed of the Male does only put those Particles, which

which are the first Principles of the Spirits and Humors, into motion, by which motion they begin a Circulation, and being expanded they dilate the containing parts, whose Dilatation both causes an Encrease in the Dimensions of the Animal, and makes them more capable of the Accession of new Particles to nourish and augment them.

Coming to describe the Nature and Structure of the Parts, which are the Subject of the Discourse, he begins with the *Periostium*, or Membrane which invests the Bones, which consists of two sorts of Fibres, one of which lying next to the Bone it self, is derived from the *Dura Mater*, the other from the Tendons of the Muscles. The use of this Membrane is to cover the Bones; To convey Spirits into them for their Sense, and to assist in their Nutrition, to which end it has Fibres inserted into them; To limit their Growth; To keep some of them conjoyn'd; To joyn the Bones and their Cartilages together; to fasten the Heads and Tendons of the Muscles to the Bones; and lastly, for the safety and security of the Bones against Injuries, as it serves to make them sensible, and so gives the Animal a quick apprehension of any Mischief that threatens those parts, and directs us in our application of Remedies when they are injured.

The Bones, tho they are at first Gelatinous, and afterwards Cartilaginous, are when they come to their true and proper nature, solid and hard, consisting of terrestrial and saline Particles. These Particles, being in their several Series united at their Extremities, form Strings, and these Strings being united make distinct Plates, which lying one over another make the whole Thickness of the Bone. In and between these Plates he observes two sorts of Pores, some which run through every Plate, others which are formed between them for the Dispensation of the Medullary Oil to the Substance of the Bone. The Superficies of the Bones is unequal,

being rendered so by some superficial Cavities, and by passages which penetrate into them, the first of which are for enlarging their Surface, and strengthening the Adhesion of their Membrane to them; the other for the ingress of Blood Vessels into their Substance or Cavities. The Cavities of the Bones are in some large, in others small and numerous, whose Partitions are formed of Plates propagated wholly from those Plates, which make the sides of the Bones in such as have long Cavities; and in them which are spongy, from Plates which run up the whole length of the Bone in that manner. And in some Bones there are *Fasciculi* of Strings which run off from the Plates in the Sides, and make a sort of *Cancelli*, or Net-work in the Cavity.

In the Bones, there are Blood-Vessels, which serve for their Nourishment, which are many; the Arteries entering at one end, and the Veins coming out in vast numbers, either at the contrary extremity, or in some intermediate parts: And there are both Veins and Arteries belonging to the Marrow.

In the Teeth he observes a twofold Substance, one of a stony Nature, which is the Cortical or exterior part of so much of the Teeth as stands out of the Gums; the other truly Bone, consisting of *Laminæ* or Plates, as the other Bones do.

In the second Discourse he gives an Account of the manner of Accretion, and Nutrition in general, and then particularly in the Bones. The Matter, which gives an increase to the Animal, is originally from the Chyle, the Particles of which designed for Nourishment being elaborated in the Mass of Blood, and so reduced nearer to the nature of a *Succus nutritivus*, and disposed for a Separation, are discerned from the sanguineous Mass, by Glands seated on the Sides of the Arteries all over the Body. And here the Author takes occasion to speak of Glandular Secretion; to explain which he  
observes

observes, first that all motion in its proper tendency is direct, and that the Glandules are so seated, as to favour the motion of any Particles that strike against them in a right Line, more than the Veins; and having Pores adapted to the Figure of the Particles which they separate, the Particles do endeavour in their motion to proceed into those Glandules, and being entertained by them, are separated, and distinguished from the rest of the Mass of Blood, and so assume the form of that Liquor we find separated by every Gland: And to prevent the Regurgitation of the separated Matter out of the Glandules into the Mass of Blood again, (because the Ducts, which convey it to the Receptacles, do not run so as to favour the direct motion of the Particles,) he supposes some contrivance like Valves in the Pores by which the Particles enter into the Glandules.

How the Situation of the nutritious Glandules agrees with his Assertion, that the Glandules are so seated as to favour the motion of a Particle in a right Line, more than the Veins, is shown by observing the gradual contraction of the arterial Channel.

He then goes on with the affair of Accretion, and the account is in short this, that the Nutritious Particles, being separated by the Glandules plac'd in the sides of the Arteries, are carried into those small nervous Pipes, or Interstices of the Fibres where the Spirits move, so that they fall in the way of the Spirits motion. The Spirits he supposes to have a twofold motion, one direct, the other rotatory turning upon their Axis. Whilst the Animal is capable of Accretion, and the Particles of which the solid parts consist are not entirely united at their extremities, but are capable of receding one from another, both laterally and at their extremities; the Spirits act upon the nutritious Particles, which are of a viscous nature, by their rotatory motion, by which they carry them to the sides of the Fibres and bony Strings, driving  
some

some against the sides of their parts and forcing them out laterally ; others into the Interstices between their extremities, (thereby elongating every Series of them ; ) where they are apposed, and fixed, and thus the parts increase both in their thickness, and longitude. But after the Particles are united at their extremities, and no longer capable of making room to lodge the nutritious parts out of the way of the Spirits direct motion ; then the Spirits come to act upon the nutritious Matter by that motion, and to drive it so thorough the nervous Channels that it has not the liberty of stopping, and adhering, and so the Accretion of the Animal Ceases.

Nutrition he makes to be no reparation of the loss of the substance of the Solid parts ordinarily, but only a continual succession and supply of Spirits, and of all those fluid parts, which fill the containing parts and preserve them distended.

The Rickets being a Distemper in which the Accretion of the Bones is concerned, he does suppose that the incurvation of the Bones is neither from a preternatural shortness of the Muscles, nor an unequal supply of Spirits, and nourishment of the several parts of the Bones : but from a different temper in the several parts of them, that on one side they continue in their Affinity to the Nature of the Cartilage, whilst on the other they approach nearer to the temper of a perfect Bone ; so that the Particles are in one place more apt to recede and to give way for the accession of new Nourishment : and consequently there is a greater increase than in the other. From which unequal Accretion the Bone will be incurvated, and the Concave of their Arch will be on that side which is least augmented, and the Convex on the other.

For Venereal Nodes in the Bones ; he supposes that the venose Matter does eat some little holes in the *Laminae*, and so makes room for the reception of some of the nutritious Matter, on one side of the Spirits motion : and then

then the Spirits by their rotatory motion will determine some of it to those little holes; so that if any of those preternatural *Foramina* reach to the Superficies of the Bone, some part of the nutritious Juice will be thrown out upon the surface of the Bone, where indurating into a bony substance it produces gummatous inequalities.

The third Discourse concerns the Marrow, which has blood Vessels, both Veins and Arteries. The Organs by which the Medullary Oil is separated, are small Vesicles or Glandules, which are conglomerated into distinct Lobules contained in several Membranes or Baggs, which lie contained in one common Membrane investing the whole Marrow: all which both Vesicles, Baggs and Membrane are propagated from the exterior Coat of the Arteries. The passage of the Medullary Oil from all parts of the Marrow to the Bone is not by Ducts, but by Pores formed in the Vesicles, by which it passes from one to another, till it arrives at the sides or extreme parts of the Bone.

The Medullary Oil, which is supplied to the Interstices of the Joynts, passes into them by passages penetrating through the Bone into these Cavities, and formed for this end.

The use of the Medullary Oil is either common to all the Bones, or more proper to the Joynts. To all the Bones it is serviceable, and necessary to preserve their temper, and keep them from being brittle. In the Articulations, First, It lubricates the extremities of the Bones, and so makes them more apt to be moved. Secondly, It preserves the ends of the articulated Bones from an inordinate incalescence. Thirdly, It prevents the Attrition of those parts of the Bones, which are rubbed one against another. It is likewise beneficial to the Ligaments of the Joynts in preserving them from dryness and rigidity, and lubricating those parts of them, which slide upon the Bone. Those Cartilages also which are joyn'd to any of the Bones it preserves flexible. In

In the fourth Discourse we have an account of a particular sort of Glands, which he calls the mucilaginous Glands seated in the Joynts. These are of two sorts; some are small, and in a manner miliary Glands, being Glandules placed all upon the same Surface of the Membrane, which lies over the Articulations. The other sort are conglomerate, or many Glandules collected and planted one upon another, so as to make a bulk, and considerable Glands. In some of the Joynts there are several of them, in some there is a single Gland. For the Structure of these large Glands, they consist of small Vesicles, which are not gathered into several Lobules or Bags of Glandules, but are disposed upon several Membranes lying one over another, of which Membranes there are several in every one of these Glands, which appear evidently in some that are Hydropical.

They have their Blood Vessels, as other Glands, but their Veins have a particular flexure in their course for retarding the return of the Blood from the Glands, that the mucilaginous Liquor, which is not separated with the greatest expedition, may have time to penetrate the secretory Pores of the Glandules.

The large mucilaginous Glands are variously seated, some in a *Sinus* formed in the Joynt, others stand near or over against the Interstice between the articulated Bones: but in general they are so placed as to be squeezed gently, and lightly prest in the inflexion or extension of the Joynt, so as to separate a quantity of Mucilage proportionate to the motion of the part, and the present occasion, and yet without any injury.

We have also some description of the common Membrane of the Muscles, how it is every where set thick with the small mucilaginous Glands; and about some Joynts which are often moved, and where the Tendons run backward and forward more considerably, it has some larger or conglomerate Glands.

The

The design of all these Glands is to separate a mucilaginous kind of Liquor, that serves principally to lubricate the Joynts, to make them so slippery as to be moved with the greatest facility imaginable. It serves likewise to preserve the ends of the articulated Bones from Attrition, and an immoderate incalescence. But all these things it performs in Conjunction with the Medullary Oil. Of which two Ingredients is made a Composition admirably fitted for those ends: For the Mucilage adds to the lubricity of the Oil, and the Oil preserves the Mucilage from growing too thick and viscous.

The Author observing the same sort of Glands to lie between the Muscles and Tendons, supposes that there is the same mixture of an oily and mucilaginous Substance, the one being that Fat which is found between the Muscles, and is supplied by the adipose Glands; the other being separated by the mucilaginous Glandules, of which the common Membrane of the Muscles is every where full. This mixture in the interstices of the Muscles lubricates them and their Tendons, and preserves them from shrinking, and from growing dry and rigid.

For the Generation of this Mucilage he supposes that Nature has designed one large *Viscus*, and that this is the Office of the Spleen; the Glandules of which he makes to have two secretory Pores, by one of which some Acid, and by the other some Austere Particles are separated; which meeting in the small Cavities of the Glandules, they are converted into a mucilaginous and gummous Substance, having observed that the Spirit of Vitriol mixt with a Decoction of Galls, will produce a Gum.

In the next place follows an account of some Experiments made with the Mucilage, the most of which come to this; that all Acids do coagulate it, as all Austeres, and Austere Acids: but with this difference that the *Coagulum* or Curd made with Acids only is tenderer than that

O

which

which is produced by an Austere only, or an Austere Acid.

These Experiments being made and described in order to explain the Nature and Causes of a Rheumatism, and the Gout, these Distempers are next treated of.

The Matter or Humour producing a Rheumatism is made to have a different Nature in several Patients; in some it is Acid, in some Saline, and in others Acrions. This Matter whilst it lies in the Mass of Blood, temperd with the other parts, scarce gives any sensible effect: but the mucilaginous Glands between the Muscles, (as we see other Glands of the Body often do,) serving sometimes for the Depuration of the Sanguineous Mass, by separating from it incongruous and morbifick Particles, this Matter so separated comes to be more strong and sincere, so as to have a sensible effect upon the Fibres, pricking and irritating of them, and if the Matter be an Acid or Austere, it affects the Mucilage it self, so as to coagulate it in the Interstices of the Muscles, which produces that Rheumatism, which is fixt, and where the Blood is very sify.

As there is a difference in the Matter, which produces the Distemper, so it is to be treated with different means. Where the Matter is thin and acrious; with temperate and cooling Medicines, together with such gentle Diaphoreticks, as have themselves no Acrimony. Where the Humour is salt; with diluting and aqueous-things together with some Diureticks. And when the Mucilage is coagulated with an Acid above other things, the most proper Medicines seem to be such as dissolve a *Coagulum*, such are *Oleum Tartari per deliquium*, Spirit of Salt Armoniack, and Spirit of Harts-Horn.

In the Gout the humour likewise is of a different Nature; sometimes Acid, or Saline, and sometimes Acrions. This Matter is separated in the manner of a *Crisis* by the mucilaginous Glands of the Joynts, where it al-

ways

ways affects the sensible parts about them; and if it be Acid makes a Coagulation, or inspissates the Mucilage, and then the Gout sticks some considerable time. The generation of the *Tophaceous* Matter in the nodose Gout is accounted for, from the Experiments made with Acid-Austere Liquors mixed with the Mucilage; so that where the Gout is nodose, the Mucilage is first coagulated by some Acid-Austere Matter, and the *Coagulum* made by such a Matter is not so easily dissolved, as when it is made by an Acid only. This *Coagulum* therefore being imprisoned, and the more gross and earthy parts being incapable of an evaporation or being otherwise spent, are concentrated and indurated by the evaporation or flowing off of the moist Particles, and so produce a hard, and chalkey Substance.

The last Discourse is of the Cartilages, which approach near to the Nature of Bones, but differ from them in their Formation, and in their flexibility: This flexibility is from the Figure and order of their parts, which are such that the Particles (as they must slide one way or other in the inflexion of a Body) may move without interrupting the continuity of the whole, even when they recede from one another, unless they are forced too far. That recoyling, which is found in these and other flexible Bodies that have a rigidity, arises from a pressure made by the spring of the Air, either implanted and shut up in the interstices of the Particles, as when the Particles are driven nearer to one another, and those Interstices are contracted: or by the Elastick power of the external Air, when the Particles of the Body recede from one another, and drive up the spring of that Air.

The Cartilages have a Membrane every way like to the *Periostium*, and is a continuation of it, where they are joyned to any Bones. Blood Vessels they likewise have in great numbers.

The use of the Cartilages in general is to give a strength to some parts, which did stand in need of such Bodies as both were flexible and had a rigidity. Those of the Ribs are designed to make them capable of an Elongation, that so they may protrude the *Sternum* one way, and drive back the *Vertebres* of the Breast the other, whereby there is an addition made to the capacity of the Breast. These Gristles serve likewise in the contraction of the Breast. For having their natural Figure altered in the elevation of the Ribs, and the ampliati-  
 on of the Cavity of the *Thorax*, they do naturally endeavour to regain their first Figure, and to return into their proper posture, by which endeavour they help something towards the depression of the Ribs, and the contracting the Cavity of the Breast.

---

F I N I S.

---

L O N D O N :

Printed and are to be sold by *Samuel Smith*, at the Princes Arms in *S. Paul's Church-Yard*. 1691.

# PHILOSOPHICAL TRANSACTIONS.

October 19. 1692.

## The CONTENTS.

1. **A**N Account of the several Species of Infinite Quantity, and of the Proportions they bear one to the other, as it was read before the Royal Society, by E. Halley.
2. A Discourse concerning the Musical Notes of the Trumpet and Trumpet-Marine, and of the Defects of the same, by the Honourable Francis Roberts Esq; R. S. S.
3. An Account of the Cause of the Change of the Variation of the Magnetical Needle, with an Hypothesis of the Structure of the Internal parts of the Earth: as it was proposed to the Royal Society, in one of their late Meetings, by E. Halley.

*An Account of the several Species of Infinite Quantity, and of the Proportions they bear one to the other, as it was read before the Royal Society, by E. Halley.*

**T**HAT all Magnitudes infinitely great, or such as exceed any assignable Quantity, are equal among themselves, though it be vulgarly received for a Maxim, is not yet so common as it is erroneous; and the reason of the Mistake seems to be, That the Mind of Man; coming to contemplate the Extensions of what exceeds the bounds of its Capacity, and of which the very Idea does include a negation of Limits; it comes to pass that we acquiesce generally, and it suffices to say such a Quantity is infinite.

But if we come more nearly to examine this Notion, we shall find, that there are really besides infinite *Length* and infinite *Area*, no less than Three several sorts of infinite Solidity: all of which are *Quantitates sui generis*, having no more relation or proportion the one to the other, than a Line to a Plane, or a Plane to a Solid, or a Finite to an Infinite: but that among themselves each of those Species of Infinites are in given Proportions; is what I now intend to make plain, if possible.

But first, infinite *Length* or a Line infinitely long is to be considered either as beginning at a point, and so infinitely extended one way, or else both ways from the same Point; in which case the one, which is a beginning Infinity, is the one half of the whole, which is the sum of the beginning and ceasing Infinity, or as I may say of Infinity *a parte ante* and *a parte post*, which is analogous to Eternity in time or Duration, in which there is always as much to follow as is past from any point

point or moment of Time: Nor doth the Addition or Subduction of finite Length or Space of time alter the case either in Infinity or Eternity, since both the one or the other cannot be any part of the whole.

As to Infinite *Surface* or *Area*, any right Line, infinitely extended both ways on an infinite Plane, does divide that infinite Plane into equal parts, the one to the right and the other to the left of the said Line; but if from any point in such a Plane two right Lines be infinitely extended so as to make an Angle, the infinite Area, intercepted between those infinite right Lines, is to the whole infinite Plane, as the Arch of a Circle, on the point of concurrence of those Lines as a Centre, intercepted between the said Lines is to the Circumference of the Circle; or as the Degrees of the Angle to the 360 Degrees of a Circle. For example, two right Lines meeting at a right Angle do include, on an infinite Plane, a quarter part of the whole infinite Area of such a Plane.

But if so be two parallel infinite Lines be supposed drawn on such an infinite Plain, the Area intercepted between them will be likewise infinite; but at the same time will be infinitely less than that Space which is intercepted between two infinite Lines that are inclined, tho with never so small an Angle, for that in the one case the given finite Distance of the parallel Lines diminishes the Infinity in one degree of Dimension; whereas in a Sector, there is Infinity in both Dimensions: and consequently the Quantities are the one infinitely greater than the other, and there is no Proportion between them.

From the same Consideration arise the Three several Species of infinite Space or Solidity, as has been said, for a Parallelepiped or a Cylinder infinitely long is greater than any finite Magnitude how great soever, and all such Solids supposed to be formed on given Bases,

are as those Bases, in proportion to one another. But if two of these Three Dimensions are wanting, as in the space intercepted between two parallel Planes infinitely extended and at a finite distance; or with infinite Length and Breadth with a finite Thickness: all such Solids shall be as the given finite Distances one to another; but these Quantities, tho infinitely greater than the other, are yet infinitely less than any of those wherein all the three Dimensions are infinite. Such are the Spaces intercepted between two inclined Planes infinitely extended; the Space intercepted by the Surface of a Cone or the sides of a Pyramid likewise infinitely continued, &c. of all which notwithstanding, the Proportions one to another, and to the  $\tau\omicron\ \pi\acute{\alpha}\nu$  or vast Abyss of infinite space (wherein is the *Locum* of all things that are or can be; or to the solid of infinite Length, Breadth and Thickness taken all manner of ways) are easily assignable. For the space between two Planes is to the whole, as the Angle of those Planes to the 360 Degrees of the Circle. As for Cones and Pyramids they are as the spherical Surface, intercepted by them, is to the Surface of the Sphere, and therefore Cones are as the Versed sines of half their Angles, to the Diameter of the Circle: These three sorts of infinite Quantity are analogous to a Line, Surface and Solid, and after the same manner cannot be compared, or have no proportion the one to the other.

Besides these, there are several other Species of infinite Quantity, arising from the contemplation of Curves and their Asymptotes, which by reason of the difficulty of the Subject cannot be made so plain to most Readers; but what has been already said may be sufficient to convince what we undertook to explain.

*A Discourse concerning the Musical Notes of the Trumpet, and Trumpet-Marine, and of the defects of the same, by the Honourable Francis Roberts, Esq; R. S. S.*

**T**HE Trumpet so famous in all Ages for its use in War, the lowdness and nobleness of its sound peculiarly suiting it to that purpose, is nevertheless to be reckon'd among the imperfect Musical Instruments. For though it has a large compass, the greater part of the intermediate Notes are wanting, and some of them imperfect: The extent of this Instrument cannot be strictly determined, it reaches as high as the strength of the breath can force it, but by considering its Notes within the ordinary compass of the Scale of Musick (from double *C fa-ut* to *C sol-fa* in *alt*) the nature of the higher Notes will plainly appear. These are all set down in the Table (Fig. 1.) only take notice that the Prickt Notes are imperfect, not being exactly in Tune, but a little flatter or sharper than the places where they stand, according as *f* or *s* is set over them.

Here we may make two inquiries.

1. Whence it comes to pass that the Trumpet will perform no other Notes (in that compass) but only those in the Table, which are usually called by Musicians Trumpet Notes.

2. What is the reason that the 7th, 11th, 13th, and 14th. Notes are out of Tune, and the others exactly in Tune.

In this matter we may receive some light from the Trumpet-Marine, an Instrument though as unlike as possible to the Trumpet in its frame (one being a Wind-Instrument, the other a Monochord) yet has a wonderful agreement with it in its effect.

The

The sound is so like as not to be easily distinguished by the nicest Ear, and as it performs the very same Notes, so it has the same defects as a Trumpet, for if the String be stop'd in any part, but such as produces a Trumpet Note, it yields a harsh and uncouth (not a Musical) sound.

Let us therefore proceed to our first inquiry, and examine what is the reason that the Trumper-Marine will perform no other but the Trumpet Notes.

It is a known Experiment of two Unison Strings, that striking one of them moves the other, which probably proceeds from hence, that the impulses of the Air which are made by one String, do more easily set another in motion which lies in a disposition to have its vibration *Synchronous* to them, than a third whose motion would be cross.

We may improve this a little farther, by observing that a String will move not only at the striking of a Unison, but an 8th. or 12th, though after a different manner.

If a unison is struck, it makes one intire vibration in the whole String, as in Fig. *A*, and the motion is most sensible in the middle at *m*, for there the vibrations take the greatest scope.

If an 8th. is struck, it makes two vibrations, as in Fig. *B*, and then the point *m* is in a manner quiescent, and the most sensible motion at *n, n*.

If a 12th. be struck, then it makes three vibrations, as in Fig. *C*, and the greatest motion at *q, m, q*, and hardly to be perceived at *p, p*. All which may be plainly experimented by putting a little piece of paper upon the several parts of the String to make the motion more conspicuous.

So that in short this Experiment holds when any Note is struck which is a unison to some *aliquot part* of the String, as in the former Examples, an 8th. is unison to half the String, and a 12th. to a third part of it.

In this case (the vibrations of the equal parts of a String being *Synchronous*) there is no contrariety in their motion to hinder each other, whereas it is otherwise if a Note is unison to *f*, in the Fig. *D*, that does not divide the String into equal parts, for then the vibrations of the remainder *r* not suting with those of the other parts, immediately make a confusion in the whole.

Now in the Trumpet-Marine you do not stop close as in other Instruments, but touch the String gently with your Thumb, whereby there is a mutual concurrence of the upper and lower part of the String to produce the sound. This is sufficiently evident from that, if any thing touches the String below the stop, the sound will be as effectually spoyled as if it were laid upon that part which is immediatly struck with the Bow.

From hence therefore we may collect, that the Trum-  
pet-Marine will yield no Musical sound but when the stop makes the upper part of the String an *aliquot* of the remainder, and consequently of the whole: otherwise as we just now remark'd of Fig. *D*, the vibrations of the parts will cross one another, and make a sound sutable to their motion, altogeth'er confus'd.

Now that these *aliquot parts* are the very stops which produce the Trumpet Notes shall be plainly shown in treating of the second enquiry, *viz.* What is the reason that the 7th. 11th. 13th. and 14th. Notes are out of Tune, and the rest exactly in Tune.

All Writers of the Mathematical part of Musick agree

That by shortning a String	$\left\{ \begin{array}{l} \text{half} \\ \text{a third part} \\ \text{a fourth} \\ \text{a fifth} \\ \text{a sixth} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{the sound} \\ \text{is rais'd} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{an eighth} \\ \text{a fifth} \\ \text{a fourth} \\ \text{a sharp third} \\ \text{a flat third.} \end{array} \right\}$

From

From this Foundation all the other Notes are derived. The flat and sharp sixth are to be the flat and sharp third to the fourth; and the seventh the like to the fifth: the second to be a fifth-to the fourth below, &c. By this Rule let us examine what Notes a Monochord fretted in its aliquot parts will produce.

Suppose the Monochord *F* to consist of 720 parts, and its Tone double *C fa-ut* the first Note in the Table; then half of it will be 360, and a third part 240, &c.

Now I say, fretting, (or stopping with the Thumb) at 360 must produce *C fa ut*, because 360 being half 720, the sound will rise an eighth from double *C fa-ut*.

Again 360 being *C fa-ut*, 240 must make *G sol-re-ut* the third Note in the Table, because 240 being just a third part less than 360, the sound will rise a fifth from that Note. After the same manner proceeding step by step it will be evident that,

180	} which is less than	240	} by just	} a 4th. a 5th. a 6th. half a 3d. a 5th. a 3d. a 5th. half	} produces	} <i>C sol-fa-ut</i> the 4th. <i>E lami</i> 5th. <i>G sol-re-ut</i> 6th. <i>C sol-fa</i> 8th. <i>D la-sol</i> 9th. <i>E lami</i> 10th. <i>G sol-re-ut</i> 12th. <i>B fabimi</i> 15th. <i>C sol-fa</i> 16th.	} Note in the Table.
144		180					
120		144					
90		180					
80		120					
72		90					
60		90					
48		60					
45	90						

By the same Reason,

100	} which is less than	120	} by just	} a 6th. a 4th. a 5th. half	} produces	} <i>B fabimi</i> flat, <i>F fa-ut</i> , <i>A lamire</i> , <i>B fabimi</i> flat.
67½		90				
54		67½				
50		100				

And Consequently,

102 <sup>2</sup> / <sub>7</sub>	} the 7th. 11th. 13th. 14th.	} Note in the Ta- ble is a little	} flatter sharper flatter flatter	} then	} <i>B fabimi</i> flat, <i>F fa-ut</i> , <i>A lamire</i> , <i>B fabimi</i> flat.
65 <sup>1</sup> / <sub>2</sub>					
55 <sup>2</sup> / <sub>3</sub>					
51 <sup>1</sup> / <sub>7</sub>					

Which answers the second Inquiry.

Now

Now to apply this (in a few words) to the Trumpet, where the Notes are produced only by the different force of the breath; it is reasonable to imagine that the strongest blast raises the sound by breaking the Air within the Tube into the shortest vibrations, but that no Musical sound will arise unless they are futed to some aliquot part, and so by reduplication exactly measure out the whole length of the Instrument, as in Fig. C, for otherwise a remainder will cause the same inconvenience in this case, as in Fig. D. To which if we add that a Pipe, being shortned according to the Proportions we even now discours'd of in a String, raises the sound in the same degrees, it renders the case of the Trumpet just the same with the Monochord.

For a Corollary to this Discourse, we may observe that the distances of the Trumpet Notes ascending, continually decreased in proportion of  $\frac{1}{2} \frac{2}{3} \frac{3}{4} \frac{4}{5}$  in *infinitum*, For,

The { second } Note in the { first } by {  $\frac{1}{2}$  } of the String,  
 { third } Table, differs { second } by {  $\frac{1}{3}$  } *&c.*  
 { fourth } from the { third } {  $\frac{1}{4}$  }

*An Account of the cause of the Change of the Variation of the Magnetical Needle. with an Hypothesis of the Structure of the Internal parts of the Earth: as it was proposed to the Royal Society in one of their late Meetings. By Edm. Halley.*

Some years since I published in these Transactions, (Numb. 148.) a Theory of the Variation of the Magnetical Compass, wherein having collected as many Observations as at that time I could procure, and having  
 Q carefully

carefully compared them together, I came at length to this general conclusion, *That the Globe of the Earth might be supposed to be one great Magnet, having four Magnetical Poles or Points of Attraction, near each Pole of the Equator two: and that in those parts of the World which lie near adjacent to any one those Magnetical Poles, the Needle is chiefly governed thereby; the nearest Pole being alwaies predominant over the more remote.* And I there have endeavoured to state and limit the present position of those Poles in the Surface of our Globe, which the Reader pleasing to consult will save us the pains of repeating. But after all, though that Discourse was favourably received both at home and abroad, as seeming to render a tollerable account of the observed Variations, yet I found two difficulties not easie to surmount, the one was that no Magnet I had ever seen or heard of, had more than two opposite Poles; whereas the Earth had visibly four, and perhaps more. And secondly, it was plain that these Poles were not, at least all of them, fixt in the Earth, but shifted from place to place, as appeared by the great changes in the Needles direction within this last Century of years, not only at *London*, (where this great Discovery was first made,) but almost all over the Globe of Earth; whereas it is not known or observed that the Poles of a Load-Stone ever shifted their place in the Stone, nor (considering the compact hardness of that substance,) can it easily be supposed: Though the Matter of Fact be too notorious and universal, not to be accounted for.

These difficulties had wholly made me despond, and I had long since given over an inquiry I had so little hopes of; when in accidental discourse, and least expecting it, I stumbled on the following Hypothesis; in delivering whereof, if I shall seem to advance any thing that looks like Extravagant, or Romantick, the Reader is desired to suspend his censure, till he have considered

considered the force and number of the many Arguments which concurr to make good so new and so bold a Supposition.

Though it be sufficiently known and allowed that the Needles Variation changes, it will be necessary however to give a few instances, whereby it may appear that this change is gradual and universal, and the effect of a great and permanent motion. For which take the following Examples.

At *London* in the year 1580. the Variation was observed by Mr. *Burrows* to be  $11^{\circ}. 15'$  East. In *Anno* 1627. the same was found by Mr. *Gunter* to be but  $6^{\circ}. 6'$  East. In the year 1634. Mr. *Gellibrand* found it  $4^{\circ}. 5'$  East. In 1657. Mr. *Bond* observed that there was no Variation at *London*. *Anno* 1672. my self observed it  $2^{\circ}. 30'$  to the West; and this present year 1692. I again found it  $6^{\circ}. 00'$  West. So that in 112 years the direction of the Needle has changed no less than 17 degrees.

At *Paris*. *Orontius Finaeus* about the year 1550. did account it about 8 or 9 degrees East Variation. *Anno* 1640. it was found 3 degrees East. *Anno* 1666, there was no Variation there, and *Anno* 1681. I found it to be  $2^{\circ}. 30'$  to the West.

At *Cap d' Agulhas*, the most southerly Promontory of *Africa*, about the year 1600. the Needle pointed due North and South without Variation, whence the *Portuguese* gave it its name. *Anno* 1622. there was 2 degrees West Variation. *Anno* 1675. it was  $8^{\circ}. 00'$  West; and this year 1691. it was curiously observed not less than 11 degrees West.

At *St. Helena*, about the year 1600. the Needle declined 8 degrees to the East. *Anno* 1623. it was but  $6^{\circ}. 00'$  East. *Anno* 1677. when I was there, I observed it accurately on shore to be  $0 d. 40'$  East; and now this year it was found about  $1 d.$  to the the West ward of the North.

At *Cape Comorine* in *India*, in the Year 1620. there was  $14^{\circ} 20'$  West Variation; in the Year 1680. there was  $8^{\circ} 48'$ , but now lately in the Year 1688. it was no more than  $7^{\circ} 30'$ , so that here the Needle has returned to the East about seven degrees in seventy Years.

In all the other Examples the Needle has gradually moved towards the West, and the places are too far asunder to be influenced by the removal of any Magnetical matter, which may by accident be transplac'd within the Bowels or on the Surface of the Earth. If more Examples are desired, the Reader may be furnished with them in the *Portugueze Routier* of *Aleixo de Motta* (written about the year 1600,) and in the Voyage of *Beaulieu*, both published in Mr. *Thevenot's* first Collection of curious Voyages, printed at *Paris*, anno 1663. which he is to compare with the Journals of our late *East India* Voyagers, and I am assured that it will be thereby evident, that the Direction of the Needle is in no place fixt and constant, tho in some it change faster than in others. And where for a long time it has continued as it were unaltered, it is there to be understood that the Needle has its greatest deflection, and is become Stationary in order to return, like the Sun in the Tropick. This at present is in the *Indian* Sea, about the Island *Mauritius*, where is the highest West Variation, and in a Tract tending from thence into the N. N. W. towards the *Red Sea* and *Egypt*. And in all Places to the Westward of this Tract, all over *Africa* and the Seas adjoining, the West Variation will be found to have encreas'd; and to the Eastwards thereof, as in the example of *Cape Comorine*, to have decreased, viz, all over the *East Indies* and the Islands near it.

After the like manner in that Space of East Variation which, beginning near *St. Helena*, is found all over the South

South *America*, and which at present is highest about the Mouth of *Rio de la Plata*, it has been observed that in the Eastern parts thereof, the Variation of the Needle gradually decreases; but whether on the contrary it increases in those places which lie more Westerly than that tract wherein the highest East Variation is found; or how it may be in the vast *Pacifick* Sea, we have not experience enough to ascertain, only we may by Analogy infer, that both the East and West Variations therein do gradually increase and decrease after the same Rule.

These *Phænomena* being well understood and duly considered do sufficiently evince, That the whole magnetical System is by one or perhaps more Motions translated, whether Eastwards or Westwards I shall anon discuss; that this moving thing is very great, as extending its effects from Pole to Pole; and that the Motion thereof is not *per saltum*, but a gradual and regular Motion.

Now considering the structure of our *Terraqueous* Globe, it cannot be well supposed that a very great part thereof can move within it, without notably changing its Centre of Gravity and the Equilibre of its parts, which would produce very wonderful Effects in changing the Axis of Diurnal Rotation, and occasion strange alteration in the Sea's Surface, by Inundations and Recesses thereof, such as History never yet mentioned. Besides, the solid parts of the Earth are not to be granted permeable by any other than fluid Substances, of which we know none that are any ways Magnetical. So that the only way to render this Motion intelligible and possible, is, to suppose it to turn about the Centre of the Globe, having its Centre of Gravity fixt and immovable in the same common Centre of the Earth: And there is yet required that this moving internal Substance be loose and detached from the external parts of the Earth, whereon we live; for otherwise were it affix'd thereto,

thereto; the whole must necessarily move together.

So then the External Parts of the Globe may well be reckoned as the Shell, and the Internal as a *Nucleus* or inner Globe included within ours, with a fluid medium between. Which having the same common Centre and Axis of diurnal Rotation, may turn about with our Earth each 24 hours; only this outer Sphere having its turbinating Motion some small matter either swifter or slower than the internal Ball. And a very minute difference in length of time, by many repetitions becoming sensible; the Internal parts will by degrees recede from the External, and not keeping pace with one another will appear gradually to move either Eastwards or Westwards by the difference of their Motions.

Now supposing such an Internal Sphere having such a Motion, we shall solve the two great difficulties we encountred in my former Hypothesis. For if this exterior Shell of Earth be a Magnet having its Poles at a distance from the Poles of Diurnal Rotation; and if the Internal *Nucleus* be likewise a Magnet, having its Poles in two other places distant also from the Axis; and these latter by a gradual and slow Motion change their place in respect of the External; we may then give a reasonable account of the four Magnetical Poles I presume to have demonstrated in No. 148. of these Transactions; as likewise of the changes of the Needles Variations, which till now hath been unattempted.

The Period of this Motion being wonderful great; and there being hardly an hundred Years since these Variations have been duly observed, it will be very hard to bring this Hypothesis to a Calculus, especially since, tho' the Variations do increase and decrease regularly in the same place, yet in differing places, at no great distance, there are found such casual Changes thereof

thereof as can no ways be accounted for by a regular Hypothesis; as depending upon the unequal and irregular distribution of the Magnetical matter within the substance of the External shell or coat of the Earth, which deflect the Needle from the position it would acquire from the effect of the general Magnetism of the whole. Of this the Variations at *London* and *Paris* give a notable instance, for the Needle has been constantly about  $1^{\circ} \frac{1}{2}$  more Easterly at *Paris* than at *London*; tho' it be certain that according to the general effect the difference ought to be the contrary way. Notwithstanding which the Variations in both places do change alike.

Hence, and from some other of like nature, I conclude, That the two Poles of the external Globe are fixt in the Earth, and that if the Needle were wholly governed by them, the Variations thereof would be always the same, with some little Irregularities upon the account I but just now mentioned: But the internal Sphere having such a gradual translation of its Poles, does influence the Needle and direct it variously according to the result of the attractive or directive power of each Pole; and consequently there must be a period of the Revolution of this internal Ball, after which the Variations will return again as before. But if it shall in future ages be observed otherwise, we must then conclude that there are more of these Internal Spheres, and more Magnetical Poles than Four, which at present we have not a sufficient number of Observations to determine; and particularly in that vast *Mar del Zar*, which occupies so great a part of the whole Surface of the Earth.

If then two of the Poles be fixt and two moveable; it remains to ascertain which they are that keep their place: and tho' I could wish we had the experience of another Century of years to found our Conclusions upon, yet I think we may safely determine, *That our*  
*European*

*European North Pole* (which in No. 148. I supposed near the Meridian of the Lands End of *England*, and about seven degrees therefrom) is that that is moveable of the two Northern Poles, and that that has chiefly influenced the Variations in these parts of the World: For in *Hudson's Bay*, which is under the Direction of the *American Pole*, the change is not observed to be near so fast as in these parts of *Europe*, tho' that Pole be much farther removed from the Axis.

As to the *South Poles*, I take the *Asian Pole*, which I place about the Meridian of the Island *Celebes* to be the fixt, and consequently the *American Pole* to move; from the like observation of the slow decrease of the Variation on the Coast of *Java*, and near the Meridian of the *Asian Pole*; tho' I must confess to have no account of the effects of the other beyond *Magellan's Streights*:

If this be allowed me, 'tis plain that the fixt Poles are the Poles of this External Shell or *Cortex* of the *Earth*, and the other two the Poles of a *Magnetical Nucleus* included and moveable within the other. It likewise follows, that this Motion is Westwards, and by consequence that the aforesaid *Nucleus* has not precisely attained the same degree of Velocity with the exterior parts in their Diurnal Revolution: but so very nearly equals it that in 365 Revolves the difference is scarce sensible. This I conceive to arise from the Impulse whereby this diurnal Motion was impress'd on the *Earth*, being given to the external parts, and from thence in time communicated to the internal; but not so as perfectly to equal the Velocity of the first Motion impress'd on, and still conserv'd by the superficial parts of the *Globe*.

As to the Quantity of this Motion it is almost impossible to define it, both from the Nature of this kind of Observation, which cannot be very accurately performed

formed, as also from the small time these Variations have been observed, and their change discovered. It appears by all Circumstances, that its period is of many Centuries of Years, and as far as may be collected from the Change of the Place, where there was no Variation by reason of the Equilibre of the two Southern Magnetical Poles, viz. from *Cape d'Agulhas* to the Meridian of *St. Helena* (which is about  $23^{\text{e}}$  in about 90 years) and of the place where the Westerly Variation is in its *ακμή* or greatest Deflection, being about half so much, viz. from the Isle of *Diego Roiz* to the South West parts of *Madagascar*. We may with some Reason conjecture, that the *American Pole* has moved Westwards 46 degrees in that time, and that the whole Period thereof is performed in 700 Years, or thereabouts; so that the nice Determination of this and of several other particulars in the Magnetick System is reserved for remote Posterity; all that we can hope to do is to leave behind us Observations that may be considered in, and to propose Hypotheses which after Ages may examine, amend or refute. Only here I must take leave to recommend to all Masters of Ships and all others, Lovers of natural Truths, that they use their utmost Diligence to make, or procure to be made, Observations of these Variations in all parts of the World, as well in the North as South Latitude (after the laudable custom of our *East-India* Commanders) and that they please to communicate them to the *Royal Society*, in order to leave as compleat a History as may be to those that are hereafter to compare all together, and to compleat and perfect this abstruse Theory.

And by the way it will not be amiss to amend a received Error in the Practice of observing the Variation, which is, to take it by the Amplitude of the Rising and Setting Sun, when his Centre appears in the visible Horizon; whereas he ought to be observed when his under

Limb is still above the Horizon about  $\frac{2}{3}$  of his Diameter, or 20 Minutes, upon the score of the Refraction, and the height of the Eye of the Observer above the Surface of the Sea: Or else they are to work the Amplitudes as they do the Azimuth, reckoning the Sun's distance from the Zenith  $90^{\circ} 36'$ : This, tho it be of little consequence near the Equinoctial, will make a great error in high Latitudes, where the Sun rises and sets obliquely.

But to return to our Hypothesis, In order to explain the change of the Variations, we have adventured to make the Earth hollow and to place another Globe within it: and I doubt not but this will find Opposers enough. I know 'twill be objected, That there is no Instance in Nature of the like thing; That if there was such a middle Globe it would not keep its place in the Centre, but be apt to deviate there-from, and might possibly chock against the concave Shell, to the ruine or at least endammaging thereof; That the Water of the Sea would perpetually leak through, unless we suppose the Cavity full of Water; That were it possible yet it does not appear of what use such an inward Sphere can be of, being shut up in eternal Darkness, and therefore unfit for the Production of Animals or Plants; with many more Objections, according to the Fate of all such new Propositions.

To these, and all others that I can foresee, I briefly answer. That the Ring environing the Globe of *Saturn* is a notable Instance of this kind, as having the same common Centre, and moving along with the Planet, without sensibly approaching him on one side more than the other. And if this Ring were turned on one of its Diameters, it would then describe such a concave Sphere as I suppose our External one to be. And since the Ring in any position given, would in the same manner keep the Centre of *Saturn* in its own, it follows that such a  
 concave.

concave Sphere may move with another included in it, having the same common Centre. Nor can it well be supposed otherwise, considering the Nature of Gravity, for should these Globes be adjusted once to the same common Centre, the Gravity of the parts of the Concave would press equally towards the Centre of the inner Ball, which Equality must necessarily continue till some external force disturb it, which is not easie to imagine in our case. This perhaps I might more intelligibly express, by saying that the inner Globe being posited in the Centre of the exterior, must necessarily ascend which way soever it move; that is, it must overcome the force of Gravity pressing towards the common Centre, by an impulse it must receive from some outward Agent; but all outward efforts being sufficiently fenced against by the Shell that surrounds it, it follows, that this *Nucleus* being once fixt in the common Centre, must always there remain.

As to the leaking of the Water through this Shell, when once a passage shall be found for it to run through, I must confess it is an Objection seemingly of weight; but when we consider how tightly great Beds of Chalk or Clay, and much more Stone do hold water, and even Caves arch'd with Sand; no man can doubt but the Wisdom of the Creator has provided for the Macrocosm by many more ways than I can either imagine or express, especially since we see the admirable and innumerable Contrivances wherewith each worthless Individual is furnisht both to defend it self and propagate its Species. What Curiosity in the Structure, what Accuracy in the Mixture and Composition of the parts ought not we to expect in the Fabrick of this Globe, made to be the lasting Habitation of so many various Species of Animals, in each of which there want not many Instances that manifest the boundless Power and Goodness of their Divine Author; and can

we then think it a hard supposition that the Internal parts of this Bubble of Earth should be replete with such Saline and Vitriolick Particles as may contribute to petrification, and dispose the transfuding Water to shoot and coagulate into Stone, so as continually to fortifie, and if need were to consolidate any breach or flaw in the Concave Surface of the Shell.

And this perhaps may not without reason be supposed to be the final Cause of the admixture of the Magnetical Matter in the Mass of the Terrestrial parts of our Globe, viz. To make good and maintain the Concave Arch of this Shell: for by what the excellent Mr. *Newton* has shewn in his *Principia Philosophiæ*, it will follow that according to the general Principle of Gravity, visible throughout the whole Universe, all those Particles that by length of time or otherwise shall molder away or become loose on the Concave Surface of the External Sphere, would fall in, and with great force descend on the Internal, unless those Particles were of another sort of Matter capable by their stronger tendency to each other, to suspend the force of Gravity; but we know no other substances capable of supporting each other by their mutual Attraction but the Magnetical, and these we see miraculously to perform that Office, even where the power of Gravity has its full effect, much more within the Globe where it is weaker. Why then may we not suppose these said Arches to be lined throughout with a Magnetical Matter, or rather to be one great Concave Magnet, whose two Poles are the Poles we have before observed to be fixt in the Surface of our Globe.

Another Argument favouring this Hypothesis is drawn from a Proposition of the same Mr. *Newton*, where he determines the force wherewith the *Moon* moves the *Sea* in producing the *Tides*: his words are, *Densitas Lunæ est ad densitatem Terræ ut 680 ad 387 seu 9 ad 5 quamproxime. Est igitur corpus Lunæ densius ac magis terestre*  
quam

*quam Terra nostra*, p. 466. Now if the Moon be more solid than the Earth as 9 to 5, why may we not reasonably suppose the Moon, being a small Body and a Secondary Planet, to be solid Earth, Water, and Stone, and this Globe to consist of the same Materials, only four ninths thereof to be Cavity, within and between the internal Spheres: which I would render not improbable.

To those that shall enquire of what use these included Globes can be, it must be allowed, that they can be of very little service to the Inhabitants of this outward World, nor can the Sun be serviceable to them, either with his Light or Heat. But since it is now taken for granted that the Earth is one of the Planets, and they all are with reason supposed Habitable, though we are not able to define by what sort of Animals; and since we see all the parts of the Creation abound with Animate Beings, as the Air with Birds and Flies, the Water with the numerous varieties of Fish, and the very Earth with Reptiles of so many sorts; all whose ways of living would be to us incredible did not daily Experience teach us. Why then should we think it strange that the prodigious Mass of Matter, whereof this Globe does consist, should be capable of some other improvement than barely to serve to support its Surface? Why may not we rather suppose that the exceeding small quantity of solid Matter in respect of the fluid Ether, is so disposed by the Almighty Wisdom as to yield as great a Surface for the use of living Creatures as can consist with the conveniency and security of the whole. We our selves, in Cities where we are pressed for room, commonly build many Stories one over the other, and thereby accommodate a much greater multitude of Inhabitants.

But still it will be said that without Light there can be no living, and therefore all this *apparatus* of our inward Globes must be useless: to this I answer that there are many ways of producing Light which we are wholly ignorant

ignorant of ; the Medium it self may be alwaies luminous after the manner of our *Ignes fatui*. The Concave Arches may in several places shine with such a substance as invests the Surface of the Sun ; nor can we, without a boldness unbecoming a Philosopher, adventure to assert the impossibility of peculiar Luminaries below, of which we have no sort of *Idea*. I am sure the Poets *Virgil* and *Claudian* have gone before me in this Thought, inlightning their *Elysian Fields* with Sun and Stars proper to those infernal, or rather internal, Regions. *Virg. Æneid. 6.*

*Largior hic compos æther & lumine vestit  
Purpureo ; Solemque suum sua Sidera norunt.*

And *Claudian* lib. 2. *De Raptu Proserpine.*

*Amissum ne crede diem, sunt altera nobis  
Sidera, sunt orbés alii, lumenque videbis  
Purius, Elysumque magis mirabere Solem.*

And though this be not to be esteemed as an Argument, yet I may take the liberty I see others do, to quote the Poets when it makes for my purpose.

Lastly, To explain yet farther what I mean, I have adventured to adjoyn the following Scheme, wherein the Earth is represented by the outward Circle, and the three inward Circles are made nearly proportionable to the Magnitudes of the Planets *Venus*, *Mars* and *Mercury*, all which may be included within this Globe of Earth, and all the Arches more than sufficiently strong to bear their weight. The Concave of each Arch, which is shaded differently from the rest; I suppose to be made up of Magnetical Matter ; and the whole to turn about the same common Axis *p, p.* only with this difference, that the Outer Sphere still moves somewhat faster than the

the

the Inner. Thus the Diameter of the Earth being about eight thousand *English* Miles, I allow five hundred Miles for the thickness of its Shell, and another space of five hundred Miles for a Medium between, capable of an immense Atmosphere for the Use of the Globe of *Venus*: *Venus* again I give a Shell of the same thickness, and leave as great a space between her Concave and *Mars*; so likewise from *Mars* to *Mercury*, which latter Ball we will suppose solid, and about two thousand Miles Diameter. Thus I have shewed a possibility of a much more ample Creation, than has hitherto been imagined; and if this seem strange to those that are unacquainted with the Magnetical System, it is hoped that all such will endeavour first to inform themselves of the Matter of Fact, and then try if they can find out a more simple Hypothesis, at least a less absurd, even in their own Opinions. And whereas I have adventured to make these Subterraneous Orbs capable of being inhabited, 'twas done designedly for the sake of those who will be apt to ask *cui bono*, and with whom Arguments drawn from *Final Causes* prevail much. If this short Essay shall find a kind acceptance, I shall be encouraged to enquire farther, and to Polish this rough Draft of a Notion till hitherto not so much as started in the World, and of which we could have no Intimation from any other of the *Phænomena* of Nature.

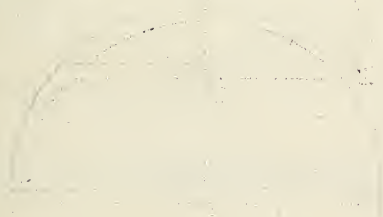
Since this was written, a Discovery I have made in the Celestial Motions, seems to render a farther account of the Use of the Cavity of the Earth, *viz.* To diminish the Specifick Gravity thereof in respect of the Moon: for I think I can demonstrate that the Opposition of the Ether to the Motions of the Planets in long time becomes sensible: and consequently the greater Body must receive a less Opposition than the smaller, unless the Specifick Gravity of the smaller do proportionably exceed that of the greater, in which case only they can

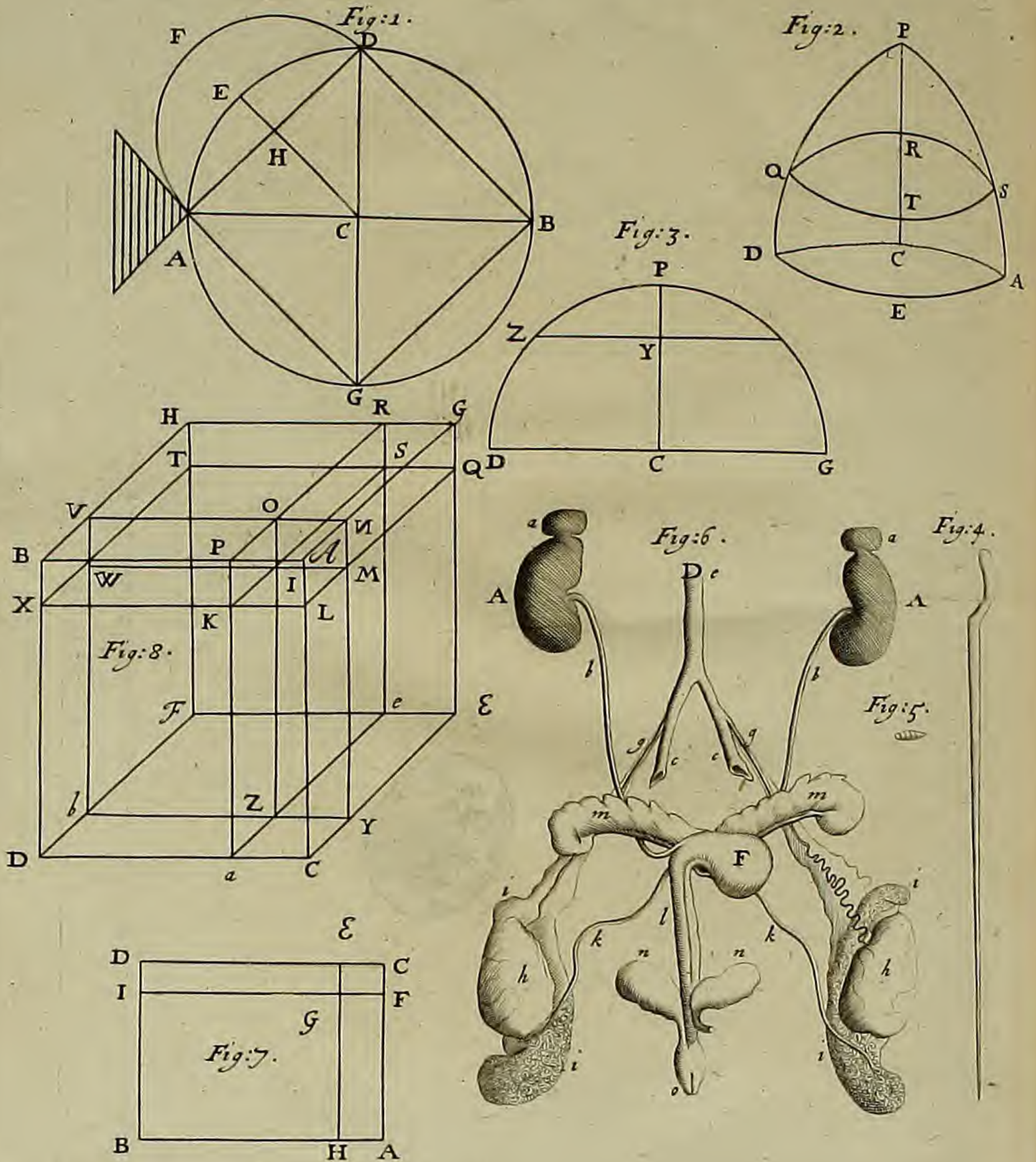
can move together; so that the Cavity I assign in the Earth, may well serve to adjust its weight to that of the Moon. For otherwise the Earth would leave the Moon behind it, and she become another Primary Planet. But this I design to explain by a Discourse apart more at large.

---

*F I N I S.*

---





---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of January, 1693.*

---

## The CONTENTS.

1. **T**HE Preface. 2. *A Paper of the Honourable Robert Boyle, late Fellow of the Royal Society, deposited with the Secretaries of the R. S. A<sup>o</sup>. 1680. containing a Method of preparing the Phosphorus of Humane Urine.* 3. *A Solution of the Florentine Problem touching the Figure of a Cupola, whose Windows being cut out, the Remainder is Quadrable. By the Reverend John Wallis, S. T. D.* 4. *The Extract of two Letters from Mr. Anth. Leeuwenhoek of Delft about the Testicles of a Rat, and the Ammalcules therein contained; with some Observations of Small Animals found in Oysters, and in the Sap of Vines.* 5. *Some Observations in the dissection of a Rat, with a Figure of the Genital parts thereof. By Mr. Ric Waller, S. R. Secr.* 5. *An Estimate of the Degrees of the Mortality of Mankind drawn from curious Tables of the Births and Funerals at the City of Breslaw, with an Attempt to ascertain the*

A

Price

*Price of Annuities upon Lives.* By Mr. Edmond Halley,  
R. S. S.

*An Account of* BOOKS.

1. THE WISDOM OF GOD *manifested in the Works of the Creation: In Two Parts. The Second Edition, very much enlarged.* By John Ray, S. R. S. in 8°. 1692.

2. *Three Physico-Theological Discourses, concerning*  
1. *The Primitive Chaos and Creation of the World.*  
2. *The General Deluge, its Causes and Effects.* 3. *The Dissolution of the World, and future Conflagration, in 8°. 1693. Both Printed for S. Smith.*

3. *Leonardi Plukenetii Phytographia, five stirpium illustriorum Icones. Pars Tertia. Lond. In Folio. 1693. Printed for the Author, and Sold by S. Smith.*

T H E

# P R E F A C E.

**S**O many and so large Steps having been made towards the Discovery of Nature by the indefatigable Industry of this last Age, it may seem as if the Subject were almost exhausted, and Nature her self wearied with the Courtships of so many Pretenders : But if on the other side, we consider the vast, not to say boundless Extent of the Universe, and that the Discovery of one Phænomenon leads to, as well as entices to the Search after another ; together with how easie a thing it is, even to impose on our selves groundless Opinions instead of Real Knowledge ; we must own the Work at least great enough for the Age of the World, and sooner doubt our own Resolutions and Abilities, than fear the Failure of fit Subjects to entertain our Thoughts.

Real Knowledge is a nice thing ; and as no Man can be said to be Master of that which he cannot teach to another, so neither can the Mind it self, at least as to Physical matters, be allowed to apprehend that whereof it has not in some sence a Mechanical Conception ; for this Knowledge entring wholly by the Senses, whose Objects only are Bodies, whereof their Organs have the Perception, but from the Magnitude, Figure, Situation and Motion of them, which are all mechanically to be consider'd, or we come short of a Satisfactory Information, it follows, that Number, Weight and Measure must be

*applied to annalize the Problems of Nature by which they were compounded.*

*This has been the Employment of the Experimenting part of Mankind, and the Design of that Glorious Institution of the Royal Society ; whose Youthful Vigour carried them warmly on in the pursuit of Nature, then at a farther distance off ; catcht and grasp'd the Proteus thro' all its Changes. And since Publications of this Nature have been thought no small Advancement to that great Design, because it collects and preserves several small Tracts, which otherwise might possibly be lost, the Publisher has yielded to the Sollicitation of some Friends to undertake this Work with an Engagement to the Learned, of communicating (as constantly as hath ever been at any time practised) whatever of a Philosophical Nature shall come to his hands, clearing the Royal Society, (which is no way concerned therein) from all the Miscarriages he may possible commit ; and promises himself he shall never fail of Materials from the Ingenious, since he proposes neither the mean end of private Advantage, nor thinks himself capable of the Baseness, to stifle any Persons Discovery till another may pretend to it ; being resolved immediately to insert in the next Transaction what ingenious Communications shall be so desired, that the true Author be not defrauded of his due Merit and Glory.*

I. *A Paper of the Honourable Robert Boyle's, deposited with the Secretaries of the Royal Society, Octob. 14. 1680. and opened since his Death; being an Account of his making the Phosphorus, &c.*

Sept. 30. 1680. **T** Here was taken a considerable quantity of *Man's Urine*, (because the Liquor yields but a small proportion of the desired *Quintessence*) and of this a good part at least, had been for a pretty while digested before it was used. Then this Liquor was distilled with a moderate Heat, till the *Spirituos* and *Saline* parts were drawn off; after which the *Superfluous* Moisture also was abstracted (or evaporated away) till the remaining Substance was brought to the consistence of a somewhat thick *Syrup*, or a thin *Extract*. This done, it was well incorporated with thrice its Weight of fine *White Sand*; and the Mixture being put into a strong *Stone-Retort*, to which a large *Receiver* (in good part fill'd with Water) was so joyn'd, that the Nose of the Retort did almost touch the Water: Then the two Vessels being carefully luted together, a naked Fire was gradually administred for Five or Six Hours, that all that was either *Phlegmatick* or *Volatile* might come over first. When this was done, the Fire was encreased, and at length for Five or or Six Hours made as strong and intense as the Furnace (which was not bad) was capable of giving: (which Violence of Fire is a Circumstance not to be omitted in this Operation.) By this means there came over good store of white Fumes, almost like those that appear in the Distillation of the Oyl of *Vitriol*; and when

when those Fumes were pass'd, and the *Receiver* grew clear, they were after a while succeeded by another sort that seem'd in the *Receiver* to give a faint blewish Light, almost like that of little burning Matches dipt in Sulphur. And last of all, the Fire being very vehement, there pass'd over another Substance, that was judg'd more ponderous than the former, because it fell through the Water to the bottom of the *Receiver*; whence being taken out, (and partly even whilst it stay'd there, it) appeared by several Effects, and other *Phænomena*, to be such a kind of Substance as we desired and expected.

II. *Problema Florentinum, de mira Templi Testudine Quadrabili. A Doctissimo Dno. Johanne Wallis, S. T. D. Solutum.*

**L**ibet hic subungere, Problema quoddam (interventu Clarissimi Viri D. *Guilielmi Bridgman*) ad me transmissum, de mira cujusdam Templi Testudine Quadrabili, meamque ejusdem Solutionem, cum subjuncto Scholio eam explicante.

D. *Guilielmi Bridgman* ad me Epistola, erat (Latine reddita) ad hunc sensum;

*Reverendo Viro, D. Wallis S. T. D. Geometriæ Professori, Oxonii.*

*Augusti 30. 1692.*

*Inclusam churtulam (Reverende Vir) Florentia mihi missam, ut ad te deferatur (de qua sententiam tuam expectant*

tunt) cum his accipies. Cui si tibi visum fuerit responsi  
aliquid reponere, id ego curabo Florentiam remittendum.

Tuus ad officia,

Guilielmus Bridgeman.

Inclusa chartula, hæc erat.

Die 4. April. 1692.

“ ANIGMA GEOMETRICUM  
“ DE MIRO OPIFICIO TESTUDINIS  
“ QUADRABILIS HEMISPHERICÆ  
“ A  
“ D. PIO LISCI PUSILLO GEOMETRA

“ Propositum.

“ Cujus Divinatio, à secretis Artibus Illustrium Ana-  
“ lystarum vigentis ævi expectatur, quod, in Geometriæ  
“ pura historia tantummodo versatus, ad tam recondita  
“ videatur invalidus.

“ I Nter venerabilia eruditæ olim Græciæ monumen-  
“ ta, extat adhuc, perpetuo equidem duraturum,  
“ Templum augustissimum, ichnographia Circulari,  
“ ALMÆ GEOMETRIÆ dicatum, quod, à Testudine  
“ intus perfecte hemisphærica, operitur: sed in hac,  
“ fenestrarum quatuor æquales areæ (circum, & supra  
“ basim hemisphæaræ ipsius dispositarum) tali configura-  
“ tione, amplitudine, tantaque industria, ac ingenii acu-  
“ mine sunt extractæ, ut, his detractis, superstes curva  
“ Testudinis superficies, pretioso opere musivo ornata,  
“ Tetragonismi verè Geometrici est capax.

“ Quæritur modo, quæ sit, qua methodo, quave  
“ arte, pars illa hemisphæricæ superficiæ curvæ quadra-  
“ bilis,

“ bilis, tenſæ ad inſtar Carbafi, vel turgidi Veli nautici,  
 “ ab Architecto illo Geometra fuerit aſſecuta ? & cui de-  
 “ mum plano geometricè quadrabili ſit æqualis.

“ **P**Ræſentis Ænigmatis enodatio (quod ſpectat ad  
 “ hujus admirabilis Fornicis, tum Constructio-  
 “ nem expeditiſſimam, tum Quadraturam) SERENIS-  
 “ SIMO FERDINANDO MAGNO PRINCIPI ETRU-  
 “ RIÆ, Scientiarum, & nobiliorum Artium CULTO-  
 “ RI, ac PATRONO GENEROSISSIMO, ab eodem  
 “ Ænigmatiſta collata jam eſt ; qui quidem ſimul non  
 “ dubitat quin hoc ipſum Ænigma à ſingulis, literario in  
 “ Orbe degentibus hodie, præclariffimis Analyſtis, ſit  
 “ ſtatim divinaturum, proprias quadrationes impertien-  
 “ do ſingularis Teſtudinis hujus tetragonifmicæ ac hemi-  
 “ ſpæra diſſectæ : ſed ipſorum ſolummodo peracutas  
 “ indagines, multiplicesque induſtrias ad hoc unum, i-  
 “ demque Geometricum collimantes, impatientur expe-  
 “ ctat, ut hinc, qui temere contumelias in Geometriam  
 “ jacere audent, ſilere diſcant ; vel potius maxima cum  
 “ voce exclament. OH UNICA VERORUM SCIS-  
 “ CITABILIIUM SCIENTIA à DIVINA in Hominem  
 “ MENTE infuſa, ut hæc, imperviis, mutabilibus, fallaci-  
 “ busque contemptis, æterna iſta, quæ ſemper, & uni-  
 “ cuique ſunt eadem, tantum appetat, nilque aliud un-  
 “ quam magis innocuum ſcire perquirat.

Cui ſic reſponſum eſt.

*Clariffimo*

Clarissimo Viro, D. Guilielmo Pontio, Anglice  
Bridgeman, Johannes Wallis. S.

Oxonix, Sept. 2. 1692.

**A** Ccepi, Vir Clarissime, nudius tertius (noſtu decubitus) Literas tuas pridie datas Londini (Auguſti 30. ſera nocte;) quibus heri non vacabat, alias occupato, reſpondere: Eiſque incluſam Chartulam, typis impreſſam, cui aſcriptus eſt dies 4 April. 1692. Quam au Florentia te accepiffe mihi mittendam. Cui reſpoſum meum expetis, quod Florentiam te remiſſurum polliceris.

Continet ea Chartula Ænigma Geometricum, quod (verborum involucris exemptum) hoc innuere judico Problema; Ab Hemisphærii curva ſuperficie, Segmenta quatuor inter ſe æqualia ſic amputare, ut reliquum ſit Tetragonismi capax.

Simulque videtur innuere, In veteris Græciæ monumentis etiamnum extare quidpiam quo illud fiat.

Hoc eſſe exiſtimo Hippocratis Chii Quadraturam Lunulæ.

Quippe cum Archimedes demonſtravit, Curvam Hemisphærii ſuperficiem æqualem duobus Circulis ejuſdem Spæræ maximis, (id eſt quatuor Semicirculis;) Docuitque Hippocrates Chius Lunulam quadrare quandam: Si ſingulis Hemisphærici huiuſce Fornicis quadrantibus, tantundem eximatur, quanto deficit à Semicirculo ea Lunula; Reliquum æquabitur Quadrato, quod Circulo Sphæræ maximo (cui hic inſiſtit Fornix Hemisphæricus) in ſcribatur.

Sic habes, Vir Clarissime, tum Ænigmatis Enodationem, tum Solutionem Problematis.

*Si tamen, præter Ænigmaticam Problematidis involu-  
tionem, subsit aliquid (de Templo) Historicum: putave-  
rim ego, S. Sophiæ (quod est Constantinopoli) Templum  
hic insinuatam.*

### SCOLIUM.

Fig. 1. Per Hippocrates Chii Quadraturam Lunulæ (1<sup>o</sup> Phy-  
sicorum Aristotelis, & Simplicii in eum locum Commen-  
tariis, indicatam,) Si semicirculo ABD, in duos qua-  
drantes ACD BCD deviso, aptetur AD subtensa qua-  
drantalibus arcus, radio CE bisecta in H: & centro H:  
scribatur semicirculus ADF: Erit (propter quadratum  
rectæ AD subduplum quadrati rectæ AB) semicirculus  
ADF subduplus semicirculi ABD; adeoque quadrantibus  
ACD æqualis. Et (dempto utrinque communi seg-  
mento ADE) residua Lunula AEDF residuo Triangu-  
lo ADC æqualis. Talesque quatuor Lunulæ, talibus  
quatuor Triangulis; hoc est, Quadrato t<sup>o</sup> circulo in-  
scripto ADBG.

Porro; per Archimedis demonstrata; Æquatur Sphæ-  
ræ superficies, quatuor Circulis in ea Sphæra Maximis.  
Adeoque Hemisphærii superficies curva, talibus quatuor  
Semicirculis: talisque superficiem Hemisphæricæ Qua-  
drans, uni semicirculo.

Fig. 2. Circulus ADBG esto jam Basis Hemisphæricæ super-  
ficiem curvæ: cujus polus P, axis CP, plano basis per-  
pendicularis, ejusque quadrans unus DPA; qui plano  
EPC per axem transeunte bisecetur.

Ponantur item (ob commodiorem calculum) Circuli  
radius  $R$ , diameter  $D=2R$ , peripheria  $P$ , expositus ar-  
cus  $a$ ,

Positoque

Positoque quadrantali arcu  $DEA = a = \frac{1}{4}P$ ; est semicirculus  $ABD = aR = \frac{1}{4}RP$ ; triangulum  $ADC = \frac{1}{4}R^2 = \frac{1}{4}RD$ ; reliquumque semicirculi (dempto hoc triangulo)  $\frac{1}{4}RP - \frac{1}{4}RD$ ; cui æquale auferendum est ex  $DPA$  (quadrante superficiæ hemisphæricæ curvæ, æquali semicirculo  $ABD$ ) quo residuum æquetur exposito triangulo  $ADC$ .

Quod quum variis modis fieri possit; per ea quæ nos dudum docuimus Anno 1659. (ad calcem Tractatus de *Cycloide*, tum Editi, pag. 122. inferenda ad § 68.) iterumque Anno 1670 (in Tractatus de *Motu* capite V, prop. 24.) de *Figura Plana, æquali cuiusvis in superficie Sphæricæ figuræ, circulis quibusvis (sive maximis, sive minoribus) terminatæ*. Sic fiat simplicissime;

Cum superficiæ Sphæricæ segmenta, parallelis planis abscissa, sint Axis segmentis proportionalia (quod de exposita quadrantalis Cunei superficie  $DPA$  pariter valet:) Si sumatur, in axe  $CP$ , ut semicirculus  $\frac{1}{4}RP$ , ad semicirculum dempto triangulo  $\frac{1}{4}RP - \frac{1}{4}RD$ ; hoc est, ut  $P$  ad  $P - D$ ; sic  $CP$  ad  $CY$ : (sive, quod tantundem est, ut  $P$  ad  $D$ , sic  $CP$  ad  $PY$ ;) planum per  $YZ$  basi parallelum, abscindet hujus superficiæ curvæ portionem polo adjacentem, æqualem triangulo  $ADC$ . Quod cum, in reliquis superficiæ curvæ quadrantibus, pariter fiat: æquabitur totum Abscissum (Polo adjacens) toti quadrato basi inscripto: Et sic tensum ut oportuit. Quod erat faciendum.

Fig. 2.

Vel sic brevius. Est Hemisphærii superficies curva (utpote duobus circulis maximis æqualis)  $= RP$ . Quadratum circulo maximo inscriptum,  $= 2RR = RD$ . Illudque ad hoc, ut  $P$  ad  $D$ . Adeoque (propter segmenta superficiæ parallelis planis abscissa, segmentis axis proportionalia) sumptis  $CP$  ad  $PY$  ut  $P$  ad  $D$ , erit tum tota superficies  $= RP$ , tum portio ad Polum, plano  $ZY$

abscissa, =  $RD$  quadrato basi inscripto. Quod erat faciendum.

Si dicatur ; Processum hic esse ex præsumpti Circuli Quadratura, aut ratione quam habet circuli Perimeter ad Diametrum : Id omnino verum est. Sed non est objiciendum. Quia non postulat *Ænigma* propositum, ut Hemisphæricæ superficiæ portiones *Abscissæ*, (quas *Fenestras* vocat) sed ut portio *Superstes*, sit Tetragonismi capax. Et quidem si utrumque postularet, postularet Circuli quadraturam absolute Geometricam : quod haberi non posse satis constat.

Opificium quod spectat ; super basem planam, extra basem Hemisphærii positam, sed ipsi contiguam ; cuius duo latera in angulum coeant ad  $A$ , intra protractas  $DA$   $GA$  rectas, (quo *Fenestrarum* quas vocat utrinque adjacentium liber prospectus pateat, non impeditus,) extruatur Moles satis firma ; ita quidam ut, assurgente structura, promineat ejus Acies, angulo suffulta, circuli arcum efficiens qualis est  $DZ$ , ad altitudinem  $Y$  assurgens. Et similiter ad reliquos angulos  $DBG$ . Atque his demum structuris (quasi totidem Columnis) ad eam altitudinem provectis, imponatur Testudo, sic intus excavata ut possit Hemisphærica superficies. Adeoque totum opus imperatum absolvitur.

Fig. 2.

#### ALITER.

Idem fiet si, pro Quadrato basi inscripto, exponatur Quadratum quodvis  $QQ$ , (quod minus sit quam Hemisphærica superficies curva.) Quippe si sumatur, ut  $RP$  (hemisphærica superficies curva) ad  $QQ$  (expositum Quadratum,) sic  $CP$  (axis hemisphærii) ad  $PT$  (axis portionem polo adjacentem ; ) planum  $ZT$  (basi parallelum) abscindet portionem superficiæ sphæricæ Tetragonismi capacem : Utpote æqualem exposito quadrato  $QQ$ .

ALITER

## A L I T E R.

Idem sic aliter absolvi potest ; sed majore sollicitudine.

Cum sit (ut jam ostensum est) Hemisphæricæ superficiei curvæ Quadrans DPA, æqualis Semicirculo ABD; ejusque segmenta planis basi parallelis abscissa, segmentis Axis proportionalia: Sumatur in DP quadrantali arcu, arcus PQ graduum 60; (quod mihi *Caswellus* suggerit.) Fig. 22.  
 Polo P descriptus Circulus QTS bifecabit Axem (propter sinum versum grad. 60. =  $\frac{1}{2}R$ ;) adeoque quadrantem hemisphæricæ superficiei curvæ DPA dirimet in duo segmenta inter se æqualia. Quorum alterum, DQTSA quadrilinium, æquat quadrantem circularem BCD; reliquumque Trilineum PQTS æquat quadrantem ACD. Unde si porro auferatur QRST bilineum, æquale segmento circuli ADE: reliquum trilineum PQRS, æquabat ADC triangulum. Taliaque quatuor, in quatuor Quadrantibus Hemisphærii, æquabunt Quadratum basi inscriptum. Habebitur autem illud Bilineum per ea quæ nos dudum docuimus locis modo citatis.

Idem universalius sic fiet:

Sumpto Q ubivis in arcu DZ (ne major sit DQ quam DZ;) Et, Quanto deficit quadrilinium DQTSA à toto auferendo, tantundem suppleat Bilineum QRST: Reliquum æquabit ADC triangulum.

Et quidem, si sumatur Q in D (quo evanescat Quadrilinium) sumendum erit Bilineum æquale toti auferendo. Sin sumatur Q in Z. (ut Bilineo non sit opus) æquabitur Quadrilinium toti auferendo.

Eademque omnia (de Quadrilинеo & Bilineo quæ simul compleant totum auferendum) pariter accommodanda erunt (mutatis mutandis) si, pro Quadrato basi inscripto,

inſcripto, ſubſtituatur  $Q$   $Q$  quadratum quodvis ; quod tota ſuperficie curva hemiſphærica non ſit majus.

Sed quum proceſſus hic (de bilineo ſumendo) ſit paulo operoſior ; ſufficit ſimplicioſiorem præxin adhibuiſſe.

### MONITUM.

Postquam hæc ſcripta fuerant, erantque ſub prelo, reſcivi tandem huic idem Problemati reſponſum dediſſe Cl. Virum D. *Leibnitz*, illudque in *Actis Lipſicis* comparere pro Mense *Junio* 1692. Quod fecit ut prelum ſufflaminandum curaverim per aliquot ſeptimanas donec illud conſpicerem ; quod ægre tandem obtinui (nam apud Bibliopolas noſtros liber non eſtabat) exeunte *Decembri* noſtro. Videoque Cl. Virum juxta mecum ſentire, non eſſe *Problema Determinatum*, ſed mille modis (nedum infinitis) ſolubile. Methodum ejus non repeto. Quam ibi quærat Lectôr, ut utramque ſi libet conferat. Citat ille ſuam *Geometriam Incomparabilium, & Analyſin Infinitorum*, in *Actis Eruditorum* exſtantes ; ſed quas ego nondum vidi ( nam eorum libri ſero ad nos perveniunt) nec tamen inde minus æſtimo ; ſed tanto Viro dignas præſumo. Et quidem, ſi tempori vidiſſem, potuiſſem cum *Newtoni & Gregorii* methodis (his forte non abſimiles) noſtris inferuiſſe. Sed, cum alibi exſtent, id minus erit opus. Eſt ejus Solutio Problematis (ſatis ingenioſa) ex comparatis ſuperficiebus Sphærica & Cylindrica, atque Ungularum Doctrina (quas & nos alibi tractavimus) petita ; & ſecundum *Indiviſibilium* methodum demonſtrata ; (aliis interim adhibitis lineis quam Circularibus ; ) eodem die præſtita (ut in re non admodum difficili) quo acceperit Problema. Nec in Problemate requiri exiſtimat (uti nec ego) ut partes *Abſciſſæ* ſed ſaltem ut pars *Reſidua* ſit Quadrabilis.

IV. *The Abstract of two Letters sent some time since by Mr. Anth. Van. Leeuwenhoeek to Dr. Gale and Dr. Hooke.*

HAVING examined the *Testicles* of a *Rat*, and the *Liquor* press'd out of the *Seminal Vessels* thereof, I found a great number of *Amalcules* long and serpent-like, as is represented *Fig. 4.* which shews one of them dead. The *Liquor* it self in which they floated was transparent and oily, full of irregular Parts, besides the *Amalcules*, some whereof lay turned up round, and seem'd not to be full grown or living; and I conceived the irregular Particles were the Beginnings or Rudiments of these *Animalcules* which were generated in the *Thred-like Vessels* of the *Testicles*. I suppose the manner of their *Generation* differs from that of the *Eels* I have formerly observed in *Vinegar*, which carry their *Young* in their *Body*, whereas I believe these are produced from an *Egg*. And possibly they may have their beginning with the *Generation* of the *Animal*, and come to perfection together with it, remaining in the *Seed* in the *Testicles* in *Fieri*, till the *Animal* it self is fit for *Copulation*; as in *Man* till about *Fourteen Years*, and then first have *Life* and *Perfection*.

The particular *Coat* of these *Thred-like Vessels* is exceeding thin; and the *Amalcules* therein contained so very minute, that 10000 of them equal not one *Thred*; whence may be computed the vast number one *Testicle* is capable of containing. These *Threds* are more conspicuous in the *Testicle* of a *Rat* than any *Animal*.

Endeavouring to examine the *Seed* of *Muscles* in *March* when they spawn, I was somewhat prevented; only in the *Liquor* contained in their *Shells*, I found

many

many small living Animals; and the *Muscle* it self had two thin Films, consisting of long slender *Threads*, with little knobby parts thereon, something like the Beards or Fins of *Oysters*, but were more easily separable from the Fish: These Strings were thick beset with Hairs continually moving; and through the *Threads* themselves I saw a great number of small *Animals*.

In the Liquor in *Oysters* I found several sorts of *Amalcules*, but in their Beards or Gills none, possibly because the *Oysters* were dead.

Examining the *Sap* that bleeds from *Vines*, I found therein several *Amalcules* of different sizes, such as I had formerly observed in Water. And I suppose that the Sun may have raised the very small *Eggs* of these *Amalcules*, and let them fall in Dew or Rain on the out-sides of *Vines* which stopt by the Leathers that fasten them to the Wall, are there hatch'd and carried down with the trickling *Sap*, which I am confirmed in, by reason after Rain I found of these *Amalcules* in the Water so stopt by the Leathers; and at other times I have found no *Amalcules* in the *Sap* of *Vines*.

I have sometimes found in this *Sap* an *Aurelia*, such as *Fig. 5.* but a Million of times smaller than a course Sand. Some of these I brought home, but those in the Air dried up to nothing, and some that I kept in Water were lost.

#### V. *Some Observations in the Dissection of a Ratt, communicated by Mr. R. W. S.R.S.*

THE *Fore-Foot* of a *Rat* resemble those of the *Castor*. The *Hair* is also some Fine, some Course; as in that *Animal*. The *Tail scaly*, with Hairs between every

every Scale, like the *Castors*, which shews these two *Animals* to be something a-kin; and indeed the *Water-Rat* comes very near to the *Beaver*, and makes it's Holes in the bank-sides of Ponds after the same manner.

The *Penis* in the *Rat* has a particular Passage near the *Navel*, as in *Squirrels*; and not at the *Anus*, as in the *Castor*.

The *Liver* is full of little Specks as big as Pins Heads, which are the little *Glands* thereof.

There was no *Gall-Bladder*, but a *Ductus Felleus*; possibly the *Bladder* was inclosed in the *Parenchyma* of the *Liver*, as it is in some *Animals*.

The *Cæcum* was much larger than the *Stomach*, and in shape like that of the *Castor*.

The *Testicles* lay not behind, but in the *Groins* on the *Os Pubis*. These were like a *Bottom* or *Skein* of *Thred* rumbled up together, which was visible through the *Coats* of the *Testicle*. This *Thred* continued of near the same *Size* in the *Epididymides*, only towards the *Deferentia* it grew larger, as is seen in the *Figure*. It was tender, and not easie to be unravel'd, so that I could not draw out above *Three Quarters* of a *Yard*.

The *Prostatæ* lay under the *Spermatic Arteries*.

The *Kidneys* were whitish with their *Succenturiati*, as in the *Figure* annext. At the *Neck* of the *Bladder* were inserted the *Vesiculæ Seminales*, transparent and fill'd with the *Semen*.

Toward the *End* of the *Penis*, which had a *Bony Gristle*, were two large *Glands*, emptying themselves near the *End* of the *Penis*, and contained a *Substance* like *Cream*, as in the *Dormouse*, observed by *Swammerdam*.

Figure the 6th represents,

<i>A A</i> , The Kidneys.	}	<i>F</i> , The Bladder.
<i>a a</i> , The <i>Renes Succenturiati</i> .		<i>g g</i> , The Spermatick Vessels, Veins and Arteries.
<i>b b</i> , The <i>Ureters</i> .		<i>h h</i> , The <i>Testes</i> , with the Branches of the Veins and Arteries.
<i>c c</i> , The Crural Veins and Arteries.		<i>i i</i> , The <i>Epididymides</i> .
<i>D</i> , <i>Arteria Magna</i> .		<i>k k</i> , The <i>Deferentia</i> .
<i>e</i> , <i>Vena Cava</i> .		<i>l</i> , The <i>Penis</i> .
		<i>m m</i> , <i>Vesciculæ Seminales</i> .
		<i>n n</i> , Two Glands, from whence a thick Juyce might be press'd out.
		<i>o</i> , The <i>Balanus</i> .

*An Estimate of the Degrees of the Mortality of Mankind, drawn from curious Tables of the Births and Funerals at the City of Breslaw; with an Attempt to ascertain the Price of Annuities upon Lives. By Mr. E. Halley, R.S.S.*

**T**HE Contemplation of the *Mortality of Mankind*, has besides the *Moral*, its *Physical* and *Political* Uses, both which have been some years since most judiciously considered by the curious *Sir William Petty*, in his *Natural* and *Political* Observations on the Bills of *Mortality of London*, owned by *Captain John Graunt*. And since in a like Treatise on the Bills of *Mortality of Dublin*.

*Dublin.* But the Deduction from those Bills of *Mortality* seemed even to their Authors to be defective: First, In that the *Number* of the People was wanting. Secondly, That the *Ages* of the People dying was not to be had. And Lastly, That both *London* and *Dublin* by reason of the great and casual Accession of *Strangers* who die therein, (as appeared in both, by the great Excess of the *Funerals* above the *Births*) rendered them incapable of being Standards for this purpose; which requires, if it were possible, that the People we treat of should not at all be changed, but die where they were born, without any Adventitious Increase from Abroad, or Decay by Migration elsewhere.

This *Defect* seems in a great measure to be satisfied by the late curious Tables of the Bills of *Mortality* at the City of *Breslaw*, lately communicated to this Honourable Society by Mr. *Justell*, wherein both the *Ages* and *Sexes* of all that die are monthly delivered, and compared with the number of the *Births*, for Five Years last past, *viz.* 1687, 88, 89, 90, 91, seeming to be done with all the Exactness and Sincerity possible.

This City of *Breslaw* is the Capital City of the Province of *Silesia*; or, as the *Germans* call it, *Schlesia*, and is situated on the Western Bank of the River *Oder*, anciently called *Viadrus*; near the Confines of *Germany* and *Poland*, and very nigh the Latitude of *London*. It is very far from the Sea, and as much a *Mediterranean* Place as can be desired, whence the Confluence of *Strangers* is but small, and the Manufacture of Linnen employs chiefly the poor People of the place, as well as of the Country round about; whence comes that sort of Linnen we usually call your *Sclesie Linnen*; which is the chief, if not the only Merchandize of the place. For these Reasons the People of this City seem most pro-

per for a *Standard*; and the rather, for that the *Births* do, a small matter, exceed the *Funerals*. The only thing wanting is the Number of the whole People, which in some measure I have endeavoured to supply by comparison of the *Mortality* of the People of all Ages, which I shall from the said Bills trace out with all the Acuracy possible.

It appears that in the Five Years mentioned, *viz.* from 87 to 91 inclusive, there were *born* 6193 Persons, and *buried* 5869; that is, born *per Annum* 1238, and *buried* 1174; whence an *Encrease* of the People may be argued of 64 *per Annum*, or of about a 20th part, which may perhaps be ballanced by the Levies for the *Emperor's* Service in his Wars. But this being contingent, and the Births certain, I will suppose the People of *Breslaw* to be encreased by 1238 *Births* annually. Of these it appears by the same Tables, that 348 do die *yearly* in the *first Year* of their *Age*, and that but 890 do arrive at a full *Years Age*; and likewise, that 198 do die in the *Five Years* between 1 and 6 compleat, taken at a *Medium*; so that but 692 of the Persons *born* do survive *Six* whole *Years*. From this *Age* the Infants being arrived at some degree of Firmness, grow less and less *Mortal*; and it appears that of the whole People of *Breslaw* there die *yearly*, as in the following Table, wherein the upper Line shews the *Age*, and the next under it the *Number* of Persons of that *Age dying yearly*.

7 . 8 9 . . 14 . 18 . 21 . 27 . 28 . . 35 .  
 11 . 11 . 6 .  $5\frac{1}{2}$  . 2 .  $3\frac{1}{2}$  5 6  $4\frac{1}{2}$   $6\frac{1}{2}$  9 . 8 . 7 . 7 .

36 . 42 . 45 49 54 . 55 . 56 . . 63  
 8 .  $9\frac{1}{2}$  8 . 9 . 7 . 7 . 10 11 . 9 . 9 . 10 . 12

70 71 . 72 . 77 81 84 . 90 91 .  
 $9\frac{1}{2}$  14 9 . 11  $9\frac{1}{2}$  6 . 7 . 3 . 4 . 2 . 1 . 1 . 1 .

98 . 99 . 100 .  
 0 .  $\frac{1}{5}$  .  $\frac{3}{5}$

And where no *Figure* is placed over, it is to be understood of those that die between the Ages of the preceding and consequent *Column*.

From this Table it is evident, that from the Age of 9 to about 25 there does not die above 6 *per Annum* of each *Age*, which is much about one *per Cent.* of those that are of those *Ages*: And whereas in the 14, 15, 16, 17 *Tears* there appear to die much fewer, as 2 and  $3\frac{1}{2}$ , yet that seems rather to be attributed to Chance, as are the other Irregularities in the Series of *Ages*, which would rectifie themselves, were the number of *Years* much more considerable, as 20 instead of 5. And by our own Experience in *Christ-Church Hospital*, I am informed there die of the *Young Lads*, much about one *per Cent. per Annum*, they being of the foresaid *Ages*. From 25 to 50 there seem to die from 7 to 8 and 9 *per Annum* of each *Age*; and after that to 70, they growing more *crasie*, though the number be much diminished, yet the *Mortality encreases*, and there are found to die 10 or 11 of each *Age per Annum*: From thence the number of the *Living* being grown very small, they gradu-

gradually decline till there be none left to *die*; as may be seen at one View in the Table.

From these Considerations I have formed the *adjoin'd Table*, whose Uses are manifold, and give a more just *Idea* of the *State* and *Condition* of *Mankind*, than any thing yet extant that I know of. It exhibits the *Number* of *People* in the City of *Breslaw* of all *Ages*, from the *Birth* to extream *Old Age*, and thereby shews the *Chances* of *Mortality* at all *Ages*, and likewise how to make a certain Estimate of the value of *Annuities* for *Lives*, which hitherto has been only done by an imaginary *Valuation*: Also the *Chances* that there are that a *Person* of any *Age* propos'd does live to any other *Age* given; with many more, as I shall hereafter shew. This *Table* does shew the *number* of *Persons* that are living in the *Age* current annex'd thereto, as follows:

Age.	Per-	Age.	Per-	Age.	Per-	Age.	Per-	Age.	Per-	Age.	Per-	Age.	Per-
Curt.	sons.	Curt.	sons.	Curt.	sons.	Curt.	sons.	Curt.	sons.	Curt.	sons.	Curt.	sons.
1	1000	8	680	15	628	22	585	29	539	36	481	7	5547
2	855	9	670	16	622	23	579	30	531	37	472	14	4584
3	798	10	661	17	616	24	573	31	523	38	463	21	4270
4	760	11	653	18	610	25	567	32	515	39	454	28	3964
5	732	12	646	19	604	26	560	33	507	40	445	35	3604
6	710	13	640	20	598	27	553	34	499	41	436	42	3178
7	692	14	634	21	592	28	546	35	490	42	427	49	2709
												56	2194
												63	1694
												70	1204
43	417	50	346	57	272	64	202	71	131	78	58	77	692
44	407	51	335	58	262	65	192	72	120	79	49	84	253
45	397	52	324	59	252	66	182	73	109	80	41	100	107
46	387	53	313	60	242	67	172	74	98	81	34		
47	377	54	302	61	232	68	162	75	88	82	28		
48	367	55	292	62	222	69	152	76	78	83	23		
49	357	56	282	63	212	70	142	77	68	84	20		
													34000
													Sum Total.

Thus it appears, that the whole *People* of *Breslaw* does consist of 34000 *Souls*, being the *Sum Total* of the *Persons* of all *Ages* in the *Table*: The first use hereof

is

is to shew the Proportion of *Men* able to bear *Arms* in any *Multitude*, which are those between 18 and 56, rather than 16 and 60; the one being generally too weak to bear the *Fatigues* of *War* and the Weight of *Arms*, and the other too crasie and infirm from *Age*, notwithstanding particular Instances to the contrary. Under 18 from the *Table*, are found in this City 11997 Persons, and 3950 above 56, which together make 15947. So that the Residue to 34000 being 18053 are Persons between those *Ages*. At least one half thereof are Males, or 9027 : So that the whole Force this City can raise of *Fencible Men*, as the *Scotch* call them, is about 9000, or  $\frac{2}{3}$ , or somewhat more than a quarter of the *Number* of *Souls*, which may perhaps pass for a Rule for all other places.

The *Second Use* of this *Table* is to shew the differing degrees of *Mortality*, or rather *Vitality* in all *Ages*; for if the number of Persons of any *Age* remaining after one year, be divided by the difference between that and the number of the *Age* proposed, it shews the *odds* that there is, that a Person of that *Age* does not die in a *Year*. As for Instance, a Person of 25 *Years* of *Age* has the odds of 560 to 7 or 80 to 1, that he does not die in a *Year* : Because that of 567, living of 25 years of *Age*, there do die no more than 7 in a *Year*, leaving 560 of 26 *Years* old.

So likewise for the *odds*, that any Person does not die before he attain any proposed *Age*: Take the *number* of the remaining Persons of the *Age* proposed, and divide it by the difference between it and the number of those of the *Age* of the Party proposed; and that shews the *odds* there is between the Chances of the Party's living or dying. As for Instance; What is the *odds* that a Man of 40 lives 7 *Years* : Take the number of Persons of 47 years, which in the *Table* is 377, and

sub-

subtract it from the number of Persons of 40 years, which is 445, and the *difference* is 68 : Which shews that the *Persons dying* in that 7 years are 68, and that it is 377 to 68 or  $5\frac{1}{2}$  to 1, that a Man of 40 does live 7 Years. And the like for any other *number* of *Years*.

*Use III.* But if it be enquired at what number of *Years*, it is an even Lay that a Person of any *Age* shall die, this Table readily performs it : For if the *number* of Persons *living* of the *Age* proposed be *halved*, it will be found by the *Table* at what Year the said *number* is reduced to half by *Mortality* ; and that is the *Age*, to which it is an even Wager, that a Person of the *Age* proposed shall arrive before he *die*. As for Instance ; A Person of 30 Years of *Age* is proposed, the number of that *Age* is 531, the half thereof is 265, which number I find to be between 57 and 58 Years ; so that a Man of 30 may reasonably expect to live between 27 and 28 Years.

*Use IV.* By what has been said, the *Price* of *Insurance* upon *Lives* ought to be regulated, and the *difference* is discovered between the *price* of ensuring the *Life* of a *Man* of 20 and 50, for Example : it being 100 to 1 that a Man of 20 dies not in a year, and but 38 to 1 for a Man of 50 Years of *Age*.

*Use V.* On this depends the Valuation of *Annuities* upon *Lives* ; for it is plain that the *Purchaser* ought to pay for only such a part of the value of the *Annuity*, as he has Chances that he is living ; and this ought to be computed yearly, and the Sum of all those yearly Values being added together, will amount to the value of the *Annuity* for the *Life* of the Person proposed. Now the present value of Money payable after a term of years, at any given rate of Interest, either may be had from Tables already computed ; or almost as compendiously,  
by

by the Table of Logarithms : For the Arithmetical Complement of the Logarithm of Unity and its yearly Interest ( that is, of 1, 06 for Six per Cent. being 9, 974694.) being multiplied by the number of years proposed, gives the present value of One Pound payable after the end of so many years. Then by the foregoing Proposition, it will be as the number of Persons living after that term of years, to the number dead ; so are the Odds that any one Person is Alive or Dead. And by consequence, as the Sum of both or the number of Persons living of the Age first proposed, to the number remaining after so many years, (both given by the Table) so the present value of the yearly Sum payable after the term proposed, to the Sum which ought to be paid for the Chance the person has to enjoy such an Annuity after so many Years. And this being repeated for every year of the persons Life, the Sum of all the present Values of those Chances is the true Value of the Annuity. This will without doubt appear to be a most laborious Calculation, but it being one of the principal Uses of this Speculation, and having found some *Compendia* for the Work, I took the pains to compute the following Table, being the short Result of a not ordinary number of Arithmetical Operations ; It shews the Value of Annuities for every Fifth Year of Age, to the Seventieth, as follows.

Age.	Years Purchase.	Age.	Years Purchase.	Age.	Years Purchase.
1	10,28	25	12,27	50	9,21
5	13,40	30	11,72	55	8,51
10	13,44	35	11,12	60	7,60
15	13,33	40	10,57	65	6,54
20	12,78	45	9,91	70	5,32

This shews the great Advantage of putting Money into the present *Fund* lately granted to their Majesties, giving 14 *per Cent. per Annum*, or at the rate of 7 years purchase for a Life; when young Lives, at the usual rate of Interest, are worth above 13 years Purchase. It shews likewise the Advantage of young Lives over those in Years; a Life of Ten Years being almost worth 13½ years purchase, whereas one of 36 is worth but 11.

*Use V.* Two Lives are likewise valuable by the same Rule; for the number of Chances of each single Life, found in the Table, being multiplied together, become the Chances of the Two Lives. And after any certain Term of Years, the Product of the two remaining Sums is the Chances that both the Persons are living. The Product of the two Differences, being the numbers of the Dead of both Ages, are the Chances that both the Persons are dead. And the two Products of the remaining Sums of the one Age multiplied by those dead of the other, shew the Chances that there are that each Party survives the other: Whence is derived the Rule to estimate the value of the Remainder of one Life after another. Now as the Product of the Two Numbers in the Table for the Two Ages proposed, is to the difference between that Product and the Product of the two numbers of Persons deceased in any space of time, so is the value of a Sum of Money to be paid after so much time, to the value thereof under the Contingency of Mortality. And as the aforesaid Product of the two Numbers answering to the Ages proposed, to the Product of the Deceased of one Age multiplied by those remaining alive of the other; So the Value of a Sum of Money to be paid after any time proposed, to the value of the Chances that the one Party has that he survives the other whose number of Deceased you made use of, in the second Term of the proportion. This perhaps may

may be better understood, by putting  $N$  for the number of the younger Age, and  $n$  for that of the Elder ;  $T, y$  the deceased of both Ages respectively, and  $R, r$  for the Remainders; and  $R + T = N$  and  $r + y = n$ . Then shall  $Nn$  be the whole number of Chances;  $Nn - Ty$  be the Chances that one of the two Persons is living,  $Ty$  the Chances that they are both dead ;  $Ry$  the Chances that the elder Person is dead and the younger living ; and  $rT$  the Chances that the elder is living and the younger dead. Thus two Persons of 18 and 35 are proposed, and after 8 years these Chances are required. The Numbers for 18 and 35 are 610 and 490, and there are 50 of the First Age dead in 8 years, and 73 of the Elder Age. There are in all  $610 \times 490$  or 298900 Chances ; of these there are  $50 \times 73$  or 3650 that they are both dead. And as 298900, to 298900 - 3650, or 295250 : So is the present value of a Sum of Money to be paid after 8 years, to the present value of a Sum to be paid if either of the two live. And as  $560 \times 73$ , so are the Chances that the Elder is dead, leaving the Younger ; and as  $417 \times 50$ , so are the Chances that the Younger is dead, leaving the Elder. Wherefore as  $610 \times 490$  to  $560 \times 73$ , so is the present value of a Sum to be paid at eight years end, to the Sum to be paid for the Chance of the Youngers Survivance ; and as  $610 \times 490$  to  $417 \times 50$ , so is the same present value to the Sum to be paid for the Chance of the Elders Survivance.

This possibly may be yet better explained by expounding these Products by Rectangular Parallelograms, as in *Fig. 7.* wherein  $AB$  or  $CD$  represents the number of persons of the younger Age, and  $DE, BH$  those remaining alive after a certain term of years; whence  $CE$  will answer the number of those dead in that time : So  $AC, BD$  may represent the number

of the Elder Age ;  $AF, BI$  the Survivors after the same term; and  $CF, DI$ , those of that Age that are dead at that time. Then shall the whole Parallelogram  $ABCD$  be  $Nn$ , or the Product of the two Numbers of persons, representing such a number of Persons of the two Ages given ; and by what was said before, after the Term proposed the Rectangle  $HD$  shall be as the number of Persons of the younger Age that survive, and the Rectangle  $AE$  as the number of those that die. So likewise the Rectangles  $AI, FD$  shall be as the Numbers, living and dead, of the other Age. Hence the Rectangle  $HI$  shall be as an equal number of both Ages surviving. The Rectangle  $FE$  being the Product of the deceased, or  $Yy$ , an equal number of both dead. The Rectangle  $GD$  or  $Ry$ , a number living of the younger Age, and dead of the Elder : And the Rectangle  $AG$  or  $rY$  a number living of the Elder Age, but dead of the younger. This being understood, it is obvious, that as the whole Rectangle  $AD$  or  $Nn$  is to the *Gnomon*  $FABDEG$  or  $Nn - Yy$ , so is the whole number of Persons or Chances, to the number of Chances that one of the two Persons is living : And as  $AD$  or  $Nn$  is to  $FE$  or  $Yy$ , so are all the Chances, to the Chances that both are dead ; whereby may be computed the value of the Reversion after both Lives. And as  $AD$  to  $GD$  or  $Ry$ , so the whole number of Chances, to the Chances that the younger is living and the other dead ; whereby may be cast up what value ought to be paid for the Reversion of one Life after another, as in the case of providing for Clergy-mens Widows and others by such Reversions. And as  $AD$  to  $AG$  or  $rY$ , so are all the Chances, to those that the Elder survives the younger. I have been the more particular, and perhaps tedious, in this matter, because it is the Key to the Case of Three Lives, which of it self would not have been so easie to comprehend.

VII. If Three Lives are proposed, to find the value of an Annuity during the continuance of any of those three Lives. The Rule is, *As the Product of the continual multiplication of the Three Numbers, in the Table, answering to the Ages proposed, is to the difference of that Product and of the Product of the Three Numbers of the deceased of those Ages, in any given term of Years ; So is the present value of a Sum of Money to be paid certainly after-so many Years, to the present value of the same*

same Sum to be paid, provided one of those three Persons be living at the Expiration of that term. Which proportion being yearly repeated, the Sum of all those present values will be the value of an Annuity granted for three such Lives. But to explain this, together with all the Cases of Survivance in three Lives: Let  $N$  be the Number in the Table for the Younger Age,  $n$  for the Second, and  $v$  for the Elder Age; let  $X$  be those dead of the Younger Age in the term proposed,  $y$  those dead of the Second Age, and  $u$  those of the Elder Age; and let  $R$  be the Remainder of the younger Age,  $r$  that of the middle Age, and  $\rho$  the Remainder of the Elder Age. Then shall  $R + X$  be equal to  $N$ ,  $r + y$  to  $n$ , and  $\rho + u$  to  $v$ , and the continual Product of the three Numbers  $N n v$  shall be equal to the continual Product of  $R + X$   $\times$   $r + y$   $\times$   $\rho + u$ , which being the whole number of Chances for three Lives is compounded of the eight Products following. (1)  $R r \rho$ , which is the number of Chances that all three of the Persons are living. (2)  $r \rho X$ , which is the number of Chances that the two Elder Persons are living; and the younger dead. (3)  $R \rho y$  the number of Chances that the middle Age is dead, and the younger and Elder living. (4)  $R r u$  being the Chances that the two younger are living, and the elder dead. (5)  $\rho Y y$  the Chances that the two younger are dead, and the elder living. (6)  $r Y u$  the Chances that the younger and elder are dead, and the middle Age living. (7)  $R y u$ , which are the Chances that the younger is living, and the two other dead. And Lastly and Eightly,  $Y y u$ , which are the Chances that all three are dead. Which latter subtracted from the whole number of Chances  $N n v$ , leaves  $N n v - Y y u$  the Sum of all the other Seven Products; in all of which one or more of the three Persons are surviving.

To make this yet more evident, I have added *Fig. 8.* wherein these Eight several Products are at one view exhibited. Let the rectangled Parallelepipedon  $AB C D E F G H$  be constituted of the sides  $AB, GH, \&c.$  proportional to  $N$  the number of the younger Age;  $AC, BD, \&c.$  proportional to  $n$ ; and  $AG, CE, \&c.$  proportional to the number of the Elder, or  $v$ . And the whole Parallelepipedon shall be as the Product  $N n v$ , or our whole number of Chances. Let  $BP$  be as  $R$ , and  $AP$  as  $X$ ; let  $CL$  be as  $r$ , and  $Ln$  as  $y$ ; and  $GN$  as  $\rho$ , and  $NA$  as  $u$ ; and let the Plain  $P R e a$  be made parallel to the plain

plain  $ACGE$ ; the plain  $NVbY$  parallel to  $ABCD$ ; and the plain  $LXTQ$  parallel to the plain  $ABGH$ . And our first Product  $Rr\epsilon$  shall be as the Solid  $STWIFZeb$ . The Second, or  $r\epsilon Y$  will be as the Solid  $ETZeQSMI$ . The Third,  $R\epsilon y$ , as the Solid  $RHOVVIST$ . And the Fourth,  $Rrv$ , as the Solid  $ZabDWXIK$ . Fifthly,  $\epsilon Yy$ , as the Solid  $GQRSIMNO$ . Sixthly,  $rYv$ , as  $IKLMGYZA$ . Seventhly,  $Ryv$ , as the Solid  $IKPOBXVW$ . And Lastly,  $AIKLMNOP$  will be as the Product of the 3 numbers of persons dead, or  $Yyv$ . I shall not apply this in all the cases thereof for brevity sake; only to shew in one how all the rest may be performed, let it be demanded what is the value of the Reversion of the younger Life after the two elder proposed. The proportion is as the whole number of Chances, or  $Nrv$  to the Product  $Ryv$ , so is the certain present value of the Sum payable after any term proposed, to the value due to such Chances as the younger person has to bury both the elder, by the term proposed; which therefore he is to pay for. Here it is to be noted, that the first term of all these Proportions is the same throughout, *viz.*  $Nrv$ . The Second changing yearly according to the Decrease of  $R, r, \epsilon$ , and Increase of  $Y, y, v$ . And the third are successively the present values of Money payable after one, two, three, &c. years, according to the rate of Interest agreed on. These numbers, which are in all cases of Annuities of necessary use, I have put into the following Table, they being the Decimal values of One Pound payable after the number of years in the Margent, at the rate of 6 per Cent.

Years

Years.	Present va- lue of 1 l.	Years.	Present va- lue of 1 l.	Years.	Present va- lue of 1 l.
1	0,9434	19	0,3305	37	0,1158
2	0,8900	20	0,3118	38	0,1092
3	0,8396	21	0,2941	39	0,1031
4	0,7921	22	0,2775	40	0,0972
5	0,7473	23	0,2618	45	0,0726
6	0,7050	24	0,2470	50	0,0543
7	0,6650	25	0,2330	55	0,0406
8	0,6274	26	0,2198	60	0,0303
9	0,5919	27	0,2074	65	0,0227
10	0,5584	28	0,1956	70	0,0169
11	0,5268	29	0,1845	75	0,0126
12	0,4970	30	0,1741	80	0,0094
13	0,4688	31	0,1643	85	0,0071
14	0,4423	32	0,1550	90	0,0053
15	0,4173	33	0,1462	95	0,0039
16	0,3936	34	0,1379	100	0,0029
17	0,3714	35	0,1301		
18	0,3503	36	0,1227		

It were needless to advertise, that the great trouble of working so many Proportions will be very much alleviated by using Logarithms; and that instead of using  $Nn - \gamma\gamma$  for the Second Term of the Proportion in finding the value of Three Lives, it may suffice to use only  $\gamma\gamma$ , and then deducting the Fourth Term so found out of the Third, the Remainder shall be the present value sought; or all these Fourth Terms being added together, and deducted out of the value of the certain Annuity for so many Years, will leave the value of the contingent Annuity upon the Chance of Mortality of all those three Lives. For Example; Let there be Three Lives of 10, 30, and 40 years of Age proposed, and the Proportions will be thus:

As 661 in 531 in 445 or 156190995, or  $Nn$   
to 8 in 8 in 9, or 576, or  $\gamma\gamma$  for the first year, so 0,9434. to 0,00002348  
to 15 in 16 in 18, or 4320, for the second year, so 0,8900. to 0,00002462  
to 21 in 24 in 28, or 14112 for the third year, so 0,8396. to 0,00008128  
to 27 in 32 in 38, for the fourth year, so 0,7921. to 0,00016650  
to 33 in 41 in 48, for the fifth year, so 0,7473. to 0,00031071  
to 39 in 50 in 58, for the sixth year, so 0,7050 to 0,00051051

And

And so forth to the 60th year, when we suppose the elder Life of Forty certainly to be expired; from whence till Seventy we must compute for the First and Second only, and from thence to Ninety for the single youngest Life. Then the Sum Total of all these Fourth Proportionals being taken out of the value of a certain Annuity for 90 Years, being 16,58 years Purchase, shall leave the just value to be paid for an Annuity during the whole term of the Lives of three Persons of the Ages proposed. And note, that it will not be necessary to compute for every year singly, but that in most cases every 4th or 5th year may suffice, interpoling for the intermediate years *secundum artem*.

It may be objected, that the different *Salubrity* of places does hinder this Proposal from being *universal*; nor can it be denied. But by the number that die, being 1174. *per Annum* in 34000, it does appear that about a 30th part die yearly, as Sir *William Petty* has computed for *London*; and the number that die in Infancy, is a good Argument that the Air is but indifferently salubrious. So that by what I can learn, there cannot perhaps be one better place proposed for a Standard. At least 'tis desired that in imitation hereof the Curious in other Cities would attempt something of the same nature, than which nothing perhaps can be more useful.

The

*The WISDOM of GOD manifested in the Works of the Creation; in Two Parts.* By John Ray, Fellow of the Royal Society. *The Second Edition very much enlarged.* London, Printed for Samuel Smith: in 8°. 1692.

THE Design of our Author in this Treatise, is manifest by the Title it self, which he endeavours to make good from several Heads, as first, from the *Multitude of the Creatures*, coelestial and terrestrial, and from the possibility, that the fixt Stars may be so many Suns, attended with the like Train as we find our Center, the Ruler of our Motions, is accompanied with. Hence he proceeds to guess at the number of *Terrestrial Bodies*, animate and inanimate: Of *Beasts* known and described about 150; of *Birds* about 500; and of *Fishes* the like number; *Insects* are more numerous; of *Butterflies* and *Beetles* 300; and if *Caterpillars* are reckon'd as a distinct Species, that number is doubled, and the *Fly-kind* at least equals both the other: *Creeping Insects* very numerous. In short, if as he conjectures the British *Insects* amount to 2000. the total sum of those of the whole Earth may be 20000, if they hold the same proportion as the British and Foreign *Plants* do. Of *Plants*, he thinks, there are not fewer in the World than 18000: And lastly, of *Fossiles, Stones*, and the like, he gives no guess at their number, but concludes it very great.

Next he proceeds to censure the *Aristotelian, Epicurean, and Cartesian Hypotheses*, as incapable of explaining the *Phænomena* of Nature; and for the formation of the Bodies of Animals, he has recourse to the *Sensitive Soul*, if it be immaterial; but if material, to a *Plastick Nature*. And here he treats in short of the Souls of *Brutes*. At the 48th Page he seems to incline to the *Atomical Hypothesis*, as to the ranging inanimate Bodies, and explaining some of their Operations. Our Author then enters into a more particular Account of some of the Creatures as the Sun, Moon, &c. and holds the *gravitating Principle* to be the Band that keeps the Universe in order, though he attempts not to explain what it is, or how caused. He proceeds to the Uses of the four Elements, as *Fire, Air, Water, and Earth*, hinting at the life of the *Fœtus in utero*, pag 65. and from the motion of the Water gives the reason why most Water-Plants grow flat, their edges more easily cutting the Stream, than if they were round. He then touches upon the *Mettors*, as Rain, Wind, &c. and next of inanimate Bodies; where, as to formed Stones he determines not the business of *Petrification*, enlarging upon the use of the *Loadstone*. He proceeds to *Metals*.

As to *Plants*, he refers their Constancy in continuing their Species to a *Plastick* Nature, as well as their Stature, Figure, and the like, and ends with the uses of the several parts thereof.

Treating of *Animals*, he thinks it probable, that the *Females* as well of *Beasts* as *Birds*, have in them, from their first formation, the Seeds of all the young they shall ever produce; and sets it down as a manifest Argument of Divine Providence, that *Birds* are not viviparous, so as that they have no hindrance in their flying and way of living: Observing further the strange Memory and Order *Birds* have in feeding their Young, not omitting or forgetting one, but feeding them all gradually; with several other curious Remarks of the building of their Nests, Brooding, &c. and by the way treating of the Juice afforded by the *Glands* of the *Stomach*, he hints at the notable Vertue of the insipid *Saliva*, in its killing *Quicksilver*, fermenting Dough, taking away *Warts*, &c. He admires the Curiosity and Contrivance of the *Honeycomb*, and particularly the *Tree-Bee*, which Insect he describes, with the manner of its generation. He proceeds to *Quadrupedes*, and concludes th's Head with the fitness of the Parts of several *Animals*, for their particular Natures and ways of living, viz. in the *Mole*, *Antbear*, *Chamalion*, *Woodpecker*, and *Swallow*; observing that the reason why *Swallows* fly low before Rain may be from the *Insects*, which they prey upon, which being sensible of the Vapors of the superiour Regions of the Air, descend nearer to the Earth at such times. Next, that the Parts of *Birds* are all fitted for flying, as those of *Fish* are for swimming; observing, that though no Land-Fowl have short Necks and long Legs, yet the contrary is seen in many whole-footed Water-fowl, Nature providing them with a long Neck, that they may fish therewith at the bottom of the Water.

Next our Author answers an Objection too long to be here inserted; and having touch'd upon some other Heads, as the Discoveries made by *Dr. Hooke*, and *Mr. Lewenboek*, by the *Microscope*, in minute *Animals* and their parts, he proceeds to some Practical Inferences, and having selected two particular Pieces to insist more largely upon, viz. The whole Body of the *Earth*; as to which, he remarks its Spherical Figure fitted for Motion and Strength, and shews its diurnal and annual motions no way dissonant to the *Scriptures*. Coming to the outward face thereof, he instances in the admirable use of some *Plants*, and concludes this first Part with the necessity of *Mountains*, for the production of Springs and Minerals, the Conveniencies for Habitation, delightful Prospects, production of variety of *Plants*, entertainment and maintenance of several *Beasts*, *Birds*, and *Insects*, with the hindering the evagation of Vapours to the North and South, from the hot-Countries, where they are most needful.

In the *Second Part* of this Work our Author prosecutes the same subject from the consideration of *Man*, and that from eight general Observations, 1<sup>st</sup>, Of his *Erect Posture*, which he shews to be natural from the length of the Legs, and strength of their Muscles, position of the Face, &c. 2<sup>dly</sup>, In that nothing is wanting, or redundant. 3<sup>dly</sup>, The Parts are most conveniently placed for use and ornament. 4<sup>ly</sup>, The Provision made for the Security of the Principals, as the Heart, Brain, and Lungs. 5<sup>ly</sup>, The most useful parts being provided against Accidents, by their being in pairs; and the many Conveniencies they have to get rid of what offends them. 6<sup>ly</sup>, The

Con-

Consistency observed in the principal parts, which cannot proceed from Chance, whereas there is a great variety in the less necessary, as in the Ramifications of the Veins, Arteries, and Nerves, wherein Nature seems to sport her self. 7ly, Pleasure annexed to those actions that support the *individuum*, as Eating, Drinking, and those that continue the Species. 8ly, The *Multitude of Intentions* to be regarded in the forming of our Bodies for the various motions and operations thereof. Coming to particulars, he observés the great *Variety* in the *Faces* of Men, and the *Capacity* of the Head from its Spherical Figure, to contain a large Brain: In the next place he enlarges on the *Eye*, and its several parts endeavouring at a reason why Objects seem not inverted, though they are so painted on the *Retina*, which seems to need a farther Explication. He observes from *Nuck's* Experiment on a Dogs-Eye, that the Aqueous Humor is repairable, as being most subject to Casualties. As to the *Ear*, he observes, that if the external Ear (which by degrees contracts and draws the sound inwards) be cut off, the Hearing has been much impaired, if not quite spoiled; and takes notice of the alteration of its Figure from the distance of the Sound he refers for a more particular Explication of this part, and its use to *Montieur Du Verney's* Treatise of the Ear. Next as to the *Teeth*, having recapitulated *Mr. Boyle's* Seven Observations of them, he adds, That the *Molars* are placed nearest to the Center of Motion, where there is the greater strength required. And lastly, The motion of the *Jaws* is transverse, as most proper for chewing. Treating of the *Tongue*, he notes with *Des Cartes*, that Brutes have no cogitation since none of them can be brought to signify their Conceptions by artificial Signs, either Words or Gestures, the Signs which they use being motions of some of the Passions. Having touched at the use of the *Saliva*, for digestion of the Food, he observes the *Annular Formation* of the *Windpipe*, whose Rings are not entire, lest it should press too hard upon the Gullet. Treating of the *Heart*, he allows it not to be conservatory of the vital Flame; the Lungs serving rather for the accension and maintaining of that Flame, but shews its admirable contrivance from its Muscles, Valves, and the like, to be a proper *Machine* to continue the *circulation* of the Blood, assisted much by the quadruple Coat of the *Arteries*, especially its third or muscular one, first discovered by *Dr. Willis*, effecting a Constriction, or kind of *Peristaltick* Motion. Having treated of the Structure and Uses of the *Hand*, and of the *Vertebrae* of the Back-bone, he observés the Provision that is made for the more easie *motion* of all the *Joynts*, and prevention of heating and fretting, by an oily and a mucilaginous Juice. There are several other Remarks on the *Thorax*, *Belly*, *Bladder*, *Liver*, *Kidneys*, and the like, which I omit; and coming to the *Bones* and *Muscles*, he affirms, that there seems to be therein more *Geometry* than in all the artificial Engines in the World. Which he leaves to the *Mathematicians* to handle, as has been attempted by *Borelli* and others.

Our Author waves the consideration of the *Formation* of the *Fetus*, and supposes Impregnation to proceed from some *contagious Vapour*, or *subtile Effluvium* of the Male Seed. Which he believes have a great stroke in generation, in that the Mule and other Creatures most resemble the Male Parent. Taking occasion here to speak of *Spontaneous Generation*, he affirms, that there is no such thing in Nature; but that all, nay, the most contemptible *Insect*, is

generated by the Animal Parents of the same *Species*. The same he confirms as to *Plants*, by an Experiment of *Malpighius*, who covered Earth taken from a deep place with Silk many times doubled, which though it admitted the Air and Water, yet produced not any Plant; and concludes, that a *spontaneous Generation* of Animals and Plants will be found, upon due examination, to be nothing less than a *Creation* of them. He enforces this Opinion by the Suffrages of the most Experienc'd in this matter, as *Swammerdam*, *Malpighi*, *Lister*, &c. For this he brings several Arguments, and answers the most material Objections, and as for the raining of *Frogs* and other *Insects*, he believes it with the same Faith, as that *Spanish Gennets* are begotten by the Winds, since each Story is attested, as he says, by good Authors, and he that can swallow this, hath, he thinks, made a fair-step towards believing it may rain *Calves* too, since it is reported that one fell out of the Clouds in *Avicenna's* time. Here he takes notice of the long *Venerale Embrace* of the *Frogs*, for at least a whole month indiesently. As to *Insects* produced in Animal Bodies, he concludes them not *spontaneous*, from their exact agreement, and perpetual similitude, in the shape and figure of their Bodies, and concludes, that the Eggs which produce them are taken in with the Food of the Animal in which they are found.

In the next place he gives several *Miscellaneous* Observations of the Structure, Actions, and Uses of some Parts of Animals, omitted in the precedent Discourses; as, That God effects the same thing by different means instanced in the Varieties of Digestions in the Stomachs of several Animals, and the like. By the way he says, that *Swine* wallow in the Mire, and *Poultry* bask themselves in the Dust, not to cool themselves, but to destroy and choak the *Lice* and other importunate *Insects*. Our Author has other Observables touching *Respiration*, the *Foramen Ovale* in amphibious Animals, the *Epiglottis*, which part the Elephant has not, neither needs it, there being no Communication betwixt his Luags and Oesophagus. Some Instances of the Sagacity of the *Tortoise*; of theirs and the *Armadillo's* Armour, which latter contract's it self into a round Ball, by the means of a notable Muscle on each side, consisting of many *Fibres*, decussating each other like the letter X. Next he hints at the Uses of the *Fat* and the nictating Membrane in the Eyes of Beasts, and Birds, transcribing a large account of this part out of the *Parisian Anatomy* of Animals. Next of the sudden growth of *Flesh-Flyes*, which he finds necessary for their production; with some Particularities touching other Animals. He conjectures, that *Cartilagineous Fish* raise and sink themselves to any Depth, by the Water which they take in and let out again at pleasure, by the help of Muscles for that purpose, at two holes in the lower part of their Belly.

Speaking of *Plants*, he says, it is the descending Juice which is taken in by the Leaves that nourishes both the Fruit and Plant. There are several other particulars worth the Reader's perusal, and after all he concludes with many practical Inferences and Deductions from the whole.

The whole Treatise, though it be of a Philosophical Nature, seems to be of great use for such as make popular Discourses; and as it is not far above the Capacity of the *Meaner*, so there are several Passages that will at least give hints and assistance to the greatest *Theologues*.

*Three Physico-Theological Discourses, concerning, 1. The Primitive Chaos, and Creation of the World. 2. The General Deluge, its Causes and Effects. 3. The Dissolution of the World. By John Ray, S. R. S. The Second Edition. Lond. printed for Samuel Smith, 80. 1693.*

**I**N the first Discourse concerning the *Chaos*, (the Notion whereof our Author asserts in his Preface to be divinely revealed) he produces the Testimonies of several Heathen Writers, to prove the production of all things out of It, (which they looked upon self-existent, and unproduced, as he thinks, erroneously) which Opinion he shews consentaneous to *Moses*, there being a gradual formation of things related, which were all produced, as he supposes, out of præ-existing Seeds, which he says were first created by God. As to the separation of the *Land* and *Water*, which at first covered the face of the Earth: He proposes, that it might be effected by the same Causes which raise Mountains now, *viz: Subterraneous-Fires* and *Flatus's*, such as *Ovid* in the 15th Metamorph: describes near the City *Tiværen*; and a later Instance near *Puzzuolo*, of a new Mountain; which last he describes from his own observation. He mentions several other Hills raised, and now oft-shaken by Earthquakes and Subterraneous Fires as the *Andes*, *Alps*, &c. Taking notice of an extraordinary one, which in the time of *Valentinian* shook the whole World, with some Passages out of *Strabo* and others, he shews from a Passage out of *Julius Ethnicus*, and *Father Kircher*, that there may be a Communication from one burning Mountain to another, though at a great distance, by Vaults under the Sea; the bottom whereof, except where it is Rocky, he by the way asserts to be very even. Of *Submarine Plants* he observes, there are none at great depths for want of Air. This depth usually answers the height of the adjoining Hills and Land. He treats of the use and necessity of Mountains. Coming in the next place to the *Creation of Animals*, he proposes some Questions, as, Whether *God* made at first the Seeds only of all Animals, and scatter'd them over the Earth, or made the first sett of *Animals* in perfection, giving each *Species* a power to generate? then, Whether he made a great many of a sort, or only two, a Male and a Female? And from these another Question arises, Whether the *Ovaries* of the first Animals, actually included in them the whole number, to be produced by that *Species* to the end of the World? Which he enclines to, and seems to make the Female the chief Agent in Generation; each Egg containing an *Animalcule*, the Arguments for and against this *Hypothesis* make up the Remainder of this Discourse: Though he confesses himself not fully satisfied, as to all Doubts that may be raised, but ends with his Reasons for dissenting from *Lewenhoek*, that all Animals proceed from an *Animalcule* in the Male *Sperme*.

The Author takes the same method in the *Second Discourse* of the *General Deluge*, bringing first the Testimonies of the ancient Heathen Writers concerning it, endeavouring to shew, that by *Deucalions* they understood *Noah's* Flood, which they also make universal, though he owns there was in *Thessaly* such a particular Flood as they call *Deucalion's*, about 700 years after *Noah's*, and that of *Ogyges* in *Attica*, about 230 years before *Deucalions*. Proceeding to treat of the Causes of this general Flood, rejecting that of the Airs being turned into Water, alledged by *Kircher* in *Arca Noe*, he pitches upon those two mentioned in *Genesis*, the breaking up the Fountains of the great deep, and opening the Windows of Heaven, by the last of which he supposes a great quantity of Water may be afforded, taking the Waters above the *Firmament* to be Waters lodged above the inferior Regions of the Air. By the Fountains of the Deep, he understands the subterraneous Waters. As to the Expende of the Sea-water by Vapour, he concludes the Receipts of the *Mediterranean* to fall short of its expence. He questions whether there be any under-Currents in the Sea, and proceeding to his present Subject of the breaking up the Fountains, he by the way differs from *Dr. Plot*, in his *Nat. Hist. of Staffordshire*, That the Valleys are as much below the Surface of the Sea as the Mountains are above it, since the Rivers run down from those Valleys into the Sea; and seems dissatisfied with the Opinion of an inferior circulation of Water, as not sufficiently demonstrated how it can be performed. Having observed that the Hills and Dry Land is so equally dispersed over the World, as to counterbalance each other, so that the Centers of Motion, Gravity, and Magnitude concur in one, he discourses occasionally of the original of Springs, all which he holds to be partly from Vapors condensed into Dews, and partly from Rain and Snow; giving his Thoughts upon *Mr. Halley's* late Hypothesis; coming at last to what he thinks the most probable Cause of the Flood, viz. The Changing the Center of the Earth at that time, and setting it nearer the middle of our Continent, whereupon the *Atlantic* and *Pacific* Oceans pressing upon the subterraneous Abyss, by that means forced the Water upwards and compell'd it to run out at the wide mouths made at the breaking up of the Fountains of the Deep. These Waters thus poured out upon the Earth, the declivity being changed by the Removal of the Center, could not flow to the Sea again, but stagnate upon the Earth; and after the Earth returning to its old Center, these Waters return'd also to their former Receptacles. He adds another Hypothesis, That the Divine Power might at that time so depress the Surface of the Ocean, as to force the Waters of the Abyss through the fore-mentioned Channels, &c. An Hypothesis like the former of these you will at the end of a Treatise, *de Potentia Restitutiva*, or of Springs publish'd by *Dr. Hooke*, anno 1678. pag. 50. Where, by the removal of the Center toward the Antipodes, he explains the appearance of several Islands in our Seas, by the Receipt of the Water; which formerly were not observed, &c. In the next place our Author speaking of the Effects of the Deluge, has a particular Chapter of formed Stones, Sea-shells, and the like Bodies found at distances from the shore, and brings the Arguments at large on both sides, for and against their being originally Shells, Bones, &c. to which being long, we refer: In which he owns himself not to be yet satisfied on either side: He adds the draughts of some of the most different kinds of these Bodies, and leaving the matter undetermin'd,

determin'd, proceeds to give some account of the Changes that have happen'd to the Earth since the general De'uge, as, the breaking off of some *Islands* formerly joyn'd to the *Continent*, some Places gain'd from the Sea, others cover'd by it. Other Changes happening to the Earth, by the sinking of *Mountains*, Changes by *Earthquakes*, where he touches upon that lately happening in *Jamaica*, and that in *England* in *Sept.* last, of which he observes the considerable Circumstances out of a Letter from Dr. *Robinson*, and as to *Earthquakes* in *England*, that they have been very short, and finish'd at one Explosion, an Argument that the Cavities wherein the enflam'd matter is contained are here very narrow. Other Changes have been caus'd in the Earth by *extraordinary Floods*, from long and continual Rains, others by boisterous *Winds*, and the like, which with some Remarks, that the Earth does not proceed so fast towards the levelling and general Inundation, as the force of these Causes seem to require: Concludes this second Discourse.

The Third Discourse being more *Theological*, and less related to the design of these *Traacts*, I shall be the more brief in the account thereof, and waving the beginning thereof, shall only observe, that our Author, in order to prove his Assertion of a general *Dissolution by Fire*, besides Scripture-proofs, and the Opinions of the *Primitive Fathers*, brings several from the *ancient Philosophers*, whose Opinions were, that the Dissolution of the World should be by *Water* and *Fire*, alternately at certain Periods; the Gods themselves not being free from these *Catastrophes*. Coming in the next place to the Question, Whether there be any thing in *Nature* that may probably cause or argue a *future Dissolution*? He grants to the *Peripateticks*, that supposing the ordinary Course of *God* with Second Causes, the World might endure for ever, there being no such Decay in *Nature* as might argue the contrary. Proceeding to Particulars, he examines the four probable Causes of such a Dissolution; first, as to the possibility of the *Water*, in process of time, overflowing the *Earth*; from the Sceptle of *Craich*, in the *Peak* of *Derbyshire*, (formerly not to be seen at a certain distance, but now visible, by the sinking of an interposed Hill, which the Rains have gradually lessened and wash'd down; with some other Observations of the like Nature) he argues, that the Waters may at last level the whole Earth, and bring a total *Subversion* thereof; to which purpose is inserted a large Quotation out of *Josiphus Blancanus*. For a second cause he alledges the *Extinction of the Sun*, instancing in some Observations of unusual defects and paleness of the *Sun* for a considerable time, and thinks it not impossible but the *Macula Solares* may so far prevail, as wholly to rob us of his necessary Influence. For a third Cause he brings the *Eruption of the Central Fire*, the possibility whereof he argues, particularly from *new Stars* appearing and disappearing, which *Phenomenon* he thinks may be so solved. A fourth Cause may be the *dryness and inflammability* of the Earth in the *Torrid Zone*, where by the way he explains what *Fire* is, and in the end rejects this Cause as insufficient. Coming to that Question, How this Dissolution will be effected; he answers, By *Fire*, and concludes it will be after a miraculous way, suddenly, &c. He determines not the Time, but allows it possibly at a great distance, and thinks it likely, that it will be a *Renovation*, and not an utter *Annihilation*, which he proves from several old Writers. And so much for the Philosophical part of this *Treatise*.

Leonardi Plukenetii *PHYTOGRAPHIA* seu *Plantæ*  
*quamplurimæ novæ & Literis huc usque incognitæ ex*  
*variis & remotissimis Provinciis ipsiq; Indis allatæ*  
*Nomine & Iconibus. TABULIS ÆNEIS 130*  
*Fig. ferè 800 magnâ cum Industriâ & insigni sanè in*  
*successores beneficio Illustratæ. Fol. Londini, 1692.*  
*P A R S I I I.*

**T**HE Curious in *Botany* must needs own themselves highly obliged, as well to the Industry as Sincerity of the most Ingenious Author, since what he formerly promis'd touching this Subject he now amply performs in this *Third Part*, enriching the World with a new Set of *Phytographick Tables*, which he humbly dedicates to His present Majesty, wherein he exhibits to publick view the Figures and Descriptive Titles of near 800 Plants, all different from what he published the foregoing year, and the greatest part of them hitherto either not describ'd, or not figur'd.

In this Work the judicious Reader may observe, that as there are really New and Non-describ'd *Species*, that will afford Entertainment and Diversion to the profounder Enquirers, and such as are in the upper Form of *Botany*; so there are others would be thought as such, to the unnatural encrease of the Faculty, whereby the Superficiary Proficients would for ever be deterr'd from attempting to grasp at such an Immensity, did not the studied Care of our elaborate Author, in his stated References and Synonymes, contract their Number, and reduce the Account of *Botany* to its just and natural Limits. A single Instance hereof (among many others) you have in the *Uvisera litorea*, &c. from *America*, or the Sea-side Grape, by those of *Barbados*, in *Tab. 235.* which although by many esteem'd as a new Plant, is really no other than the *Raisinier* of *Monf. Rochfort*, or *Oulien* of the *Charibbeans Histoire des Antilles*. The same with *Obè* of the Dutch *Prodromus*, and the *Sideroxylum folio sabrotundo* ejus'd. The *Arbor Insule Tabago materia ligno Brasiliano simili, de Laet*. The *Papyracea arbor, Guajabara Barbaris. Hispanis Uvero. Jo. Bauh. Copey in Insulâ Hispaniolâ Casp. Bauh. Pinac. and populus rotundifolia Americana, Parkinson*; as any may perceive by the Synonymous Titles, subjoin'd to the forementioned Table. So that here are no less than eight seemingly several and distinct Plants, united into one and the same thing; and were this Method duly observ'd in the whole course of *Phytology*, the History of Vegetables would not appear so bulky and unbounded, but any ingenious person might in some reasonable time take a full view of all its Heights and Depths, and utmost Extent, without the danger of Dizziness or Afrightment.

In these most excellent *Tables* you will find the *Hallucinations* and *Mistakes* of several Authors rectified, their *Obscurities* cleared up, and many other useful *Illustrations*, which I shall forbear to enumerate in this place; only of some of their particular *Rarities* we shall give the Reader a *Specimen*.

Besides the *Mexican Abies*, and that elegant *Southernwood* from *Portugal*, there is a whole Set of curious *Acacia's*, most of them *Thorny*, yet some without *Thorns*, from *Java*, *Maderaspatan*, *Ceylon*, *Africa* and the *West-Indies*. The *Acacia Africana spinis candicantibus horrida*, &c. in *Tab. 123*, is the true *Egyptian Acacia* that the incomparable Botanist *Fabius Columna* raised of Seed at *Naples*, a Figure whereof he has given us with his learned Notes upon *Reccus*, pag. 866.

The *Acacia Abrua foliis*, &c. of the same *Table*, our Author thinks may be the same with the *Frutex Palestinus* of *Belonius*, which was supposed by him to be the Tree producing *Myrrhe*. *Obs. lib. 2. cap. 8*.

An *Acer foliis trifidis & quinquifidis Virginianum*, which by the Author is supposed to be the *Arbor Saccharifera Canadensium Indorum apud Cl. Rajum*. *Hist. Pl. 1701*. A pretty *Myrtifoliata Alnus* in the *Appendix* from *Bermudos*, in use among the *Tanners*. Several sorts of *Maiden-Hair* from *Narbon*, *Africa*, *Brasil*, *Barbados*, *Bermudos*, and some other *Islands* of the *Charibbees*. Four stately kinds of *Aloes* from the *Cape*. Various sorts of *Amarantoides* from *Maderaspatan*, one with sharp *Prickles* along the *Stalk*, and a *Thorny* sort of *Alkanet* from the same place. There are no less than six sorts of *Anona*, with a critical distinction of them each from other. The *Benjamin-Tree*, with its *Branch* and *Flowers*, from the *Continent* of *Virginia*. The *Cubeb-Tree*, or supposed to be so from *Fort St. George*, as also from *Bengal*. A *Balsam-Tree*, from *Barbados*, call'd by the *Planters Spanish-Ash*. As also a *Spanish-Oak*, from the same *Island*. A *filiquiferous Tree*, with the *Leaves* of *Beech*.

The Tree called *Mancinella*, being remarkable for its *venomous Qualities*, together with its *Fruit*: From this Tree a *Juice* is drawn so *venomous*, that you cannot touch it, but the *Skin* rises with *great Pain*, and becomes as black as though a hot *Iron* were applied to it. The *Arbor Staetifua putata*, or a Tree that drops *liquid Myrrhe*, from *America*. The *Poyson-Wyth* of *Barbados*, which is a kind of *Bryony*. Three distinct kinds of the *Tree Pimiento's*, from the *Islands* of *Jamaica* and the *Barbados*. The *Flowering Beech* of *Virginia*, and the *Silver Chestnut*, which differs from the *Chinquapin* of the same place, and may be the *Leucoma* of Authors.

A new Family of the *Cenchramide's*, from *Barbados*; the *Fruit* of one of these may well be suspected that of the *Bdellium* in *Lobels Icons*, call'd *Balsam-Apple* by our *Planters* in *Barbados*. A *Cedar* of the same *Island* with the *Leaves* of an *Ash*. *Sundry* sorts of *Cherries* from *America*, *Arabia*, and the *Cape*. A wonderful *Cereus*, that creeps upon the *Ground* like a *Serpent*, from *America*. An elegant sort of *Christophoriana*, with the *Leaves* of *Malabathrum*,

called *Nettle-Tree* by those of *Barbados*. *Chrysanthema*, various kinds, both *American*, *East-Indian*, *African*, and *Persian*. A wild *Cinamon* of *Barbados*, with unvein'd Leaves. Two wonderful *Cistus's*, from *Virginia*, and one from *Ceylon*. Several strange *Celutra's*, from the *East-Indies*, *Java*, *Maderaspatan*, *Egypt*, and *Veracruce* in *America*. As many *Convolvuli*, from *America*, *Jamaica*, *Virginia*, the *Cape of Good-Hope*, *Ceylon*, and *Maderaspatan*.

The *Cordis Indi folio & facie frutescens Portoricensis Paradis. Batav. Prod.* whereunto belongs the *Quaubmeatl* or *Zarzaparilla*, 2, & 3. *Nov. Hispan. Terent. apud Rece. p. 289.* as our Author has reason to suspect. That other *Cordis Inai folio & facie, &c.* from *Curassao*; to which he refers the *Aquitzeiti* of *New Spain*, *apud Rece. p. 354.* an elegant Tree called *Coralwood*. Strange *Cucumbers* from *Malabar*, *Maderaspatan*, and from *America*. Several *Caliball-Trees* from the *East-Indies* and *America*. A Berry bearing *Doddar*, from the *Island of Barbados*, perhaps the same with *Acatsjavalli Hort. Malabar, par. 7.* And *Pearl-Tree* of *Surinam*, which is a kind of *Euonymus*.

The true *Ficus Indice arcuata*, and the *Bearded Fig-Tree*, from *Barbados*, both of the *Arbor de Raiz* kind, propagating themselves by stringy Fibres emitted from their Branches, which touching the ground, take Root, and produce new Trees. Several sorts of *Ferns*, some Natives of *England*, but never till now figur'd; three from *Africa*, two from *Virginia*, and one from the *Academick Garden of Padua*, as also in the *Appendix*; four more from the *Island of Bermudos*.

The *Manna Tree* or *Ash* of *Aleppo*, several most noble kinds of *Genista's* from the *Cape*, and *Maderaspatan*; some with Spines, others without. Six of the *Gossipium* kind, both from the *East* and the *West-Indies*. A multitude of exotic *Grasses* from most parts of the habitable World. A strange *Ilex* from *Virginia*, with tuberosé Roots: And others of the same Family from *Maderaspatan*.

Several *Laserpitiums*, with a critical distinction of each kind. Two sorts of *Silver Trees*, growing upon *Mount Atlas*; the first is said to be Pomiferous, the other is an *Epiphyllanthos*, both seem the Miracles of Nature. The *Silverwood* or *White-wood*, called by our Author *Leucoxylym*, is by him supposed the same with the *white Brasil*, or *Lignum Brasilianum, ut charta candidum Jonst. Dendrol. 454.* *Linscholen* tells us, 'tis whiter than either Chalk or Snow, *Ind. Or. P. 3. cap. 6.* It is a *Quinquefoliate* and *Siliquiferous Tree*, with winged Seed. The *Lignum Rhodium Tree*, called by the Planters of *Barbados* *Lightwood*, and *Lucinium* by our Author.

The various sorts of *Lycia*, from *Porterico*, *Candy*, and *Maderaspatan*. The *Lysimacha non papposa*, several kinds thereof from both the *Indies*. The *Mammee-Tree* of the *West-Indies*, which our Author suspects to be the *Arbor, Vini-fera, Couton, Juglandis, Similis* of *John Bauhine*, and the *Momen* of *Mr. Ogilbey*, which, as he relates, grows to the bigness of an *Apple-Tree*, the Fruit which it bears resembles a green *Cucumber*, of a pleasant Juice, the Skin always green and prickly, the Seed about the bigness of a *French Bean*, generally black, and streaked with golden-colour'd Veins. Two

Two sorts of the *Mangle-Tree*, of the *Arbor de Raiç* kind, though no Figg; the first is the *Paretuveir* of Monsieur Rochfort, the same with the Oyster-bearing Tree, that grows in *Sierra Liona* of *Purchas Navigat* Tom. 1. the true *Arbor de Raiç* of *Linschoten*, P. 4. *Ind. Or.* and one of the *Kandels* of *Hort. Malab.* The *Manihot Indorum*, or *Mandioca*, whereof the Indians make their Bread *Cassadar*.

The *Angelina* of *Piso*, and Blackwood of those of *Barbados*.

A strange sort of a Milky *Oleander*, with a yellow Flower, the *Esnotli*, *Nov. Hispan. Terent. apud Reccum.* p. 443: A *Nymphaea* from *Maderaspatan*, with a Leaf like the larger Indian *Cresse*, but much stiffer, which our Author conceives to be a sort of the true *Colocasia* or *Aegyptian Bean* of *Dioscorides* and *Theophrastus*, whose Root was called *Colocasia*.

Several strange Nuts from *America* and *Ceylon*, and one kind intercommon to the Islands both of *Barbados* and *Ceylon*: As also another in the *Appendix*, that came from *Veracruz*. Two sorts of most fragrant *Basil's* from *Maderaspatan*. Various *Passiflora*, from *Curassau*, *Brasil*, and other Parts of *America*. *Pentaptylloides* from *Sweden*, *Scotland*, and *Ireland*: A pretty Myrtifoliate *Periclymenum*, from *Maderaspatan*; and another from the same place. Another strange kind from *Zeylon*; a fourth from *America*, and a fifth Variegate in its Leaves from the Royal Garden at *Paris*. Great variety of *Phaseoli* from *Africa* and both the *Indies*; a long *Pepper* from *Brasil*; and several *Purshanes* both with and without Thorns, from the Summer Islands of *America*. Plumbs in abundance from *Barbados*, *Virginia*, *Malabar*, and *Maderaspatan*. Two sorts of *Sebesten's*, the true *Elemnifera*, which is a Plumm-Tree, and that *Nucipruniferous*, which in *Barbados* they call the *Mastick-Tree*. The *Sope-Berry*, which is properly a Plumm, or between Nut and Plumm, *Indian Damozen*, and the *Bully Bay*; the *Acaja* of the *Brasilians*, and *Iceaco* Plumm-Tree, that has this peculiar, that thereon Birds as big as Jays, with black & gold-colour'd Feathers build their pendulous Nests. The *Rhamnus's* from *Maderaspatan*, and the Trifoliate *Sumachs* from the Coast of *Africa*, are altogether new.

Two sorts of *Folliculiferous* Willows from *Barbados*, and the *Sassafras-Tree*, with its Fruit, whose Flowers are like the male *Cornel*, of which for many Reasons it may well be esteem'd a Kind. Its leaves break with araneous filaments, like those of scabious, which is proper also to the *Cornels*. It flowers early in the Spring, before its Leaves begin to put forth, so does the *Cornel*; nor are their Fruit and Qualities unlike. Our Author takes this to be the same with the *Lignum Auisi ex Orbe Atlantico adveſtum Goropii Hispan.* lib. 7. Au Ironwood from the *Cape*, and another from *Barbados*, which as it is the same mentioned in *Ligon*: It may also be the *Sideroxylum Charibbearum mucronatis foliis Ogilb. Americ.* 371.

There are no less than seven strange *Sisyrinchia's* from *Africa* and *Ceylon*, a most elegant *Syringa* with winged Leaves like *Ash*, scandent, and with Claspers, from *Maderaspatan*. A golden-flower'd *Telephium*, from the *Cape*. The

*Ticko*

*Techomahat*-Tree from Mexico. Three strange *Terebinths*, the *Palamalatte dicta*, that with the Leaf of a Rose-Tree, and a trifoliate kind; the *Palamalatta vulgo*.

Various *Thymelæa*'s hitherto unknown, from several parts of the World, and *Tithymals* in abundance, from *Ceylon*, *Mauritania*, *Æthiopia*, *Monomotapa*, and the Island of *Curassau*. There is an Arboreſcent ſort with a very large Leaf, no leſs venomous than the *Mancinello*, this is the *Tetlatia* of *Eusebius Nierembergius*, and by thoſe of *Barbados* called the *Poyſon-tree*. Another kind there is, called by ſome rhe *Mancinello Sylveſtris*. There is a pretty ſort of *Trifolium Sapium*, from *Maderaspatan*, with ſomewhat long Pods. This our Author thinks to be a Kin to *Lotus*, and may perhaps be a kind of that *Melilotus Syriaca* ſ. *Chalepenſis major coronata ſiliquis biuncialibus* *Moriſon*: *Icon. Sect. 2. Tab. 16. Num. 13.* As for *Viola*'s and *Virga aureas*, they are ſo numerous, and yet ſo new, that I muſt refer you to the Tables themſelves; the *Viſſera*'s are very curious indeed, and ſeveral ſtaining Woods from *Barbados* are very deſerving a more particular Remark; as alſo the prickly *Xanthium* from the Kingdom of *Portugal*. But I am obliged to haſten, and therefore I draw up all into this Conclusion; That ſure it muſt needs be a great Pleaſure to ſuch curious Perſons that have addiſted themſelves to the Botaniſk Studies, to ſee how far the Art it ſelf has been cultivated and Improv'd. By the ſingle effort of an unaffiſted Industry, and how capable it is of farther Improvements, would the Age but propoſe a ſuitable Encouragement.

The Work is follow'd by an Explication of the abbreviated Names of Gardens, Books, and Authors, made uſe of in the Tables, as alſo a general *Index* to all the Three Parts of *Phytographia*.

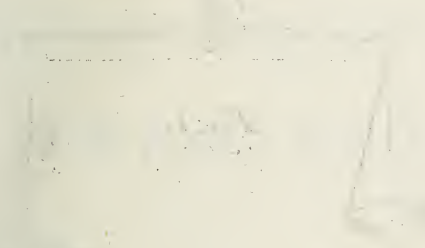
Of the Firſt and Second Part of the Authors *Phytographia*, published in the year 1691. there was an Account given in the *Philofophical Transactions*, N<sup>o</sup>. 193.

---

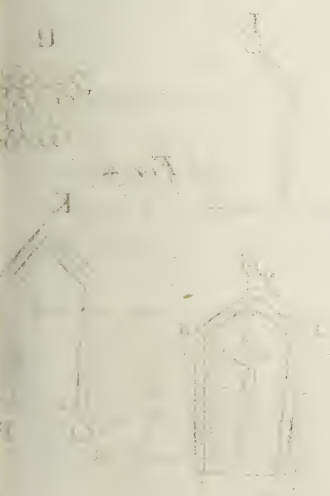
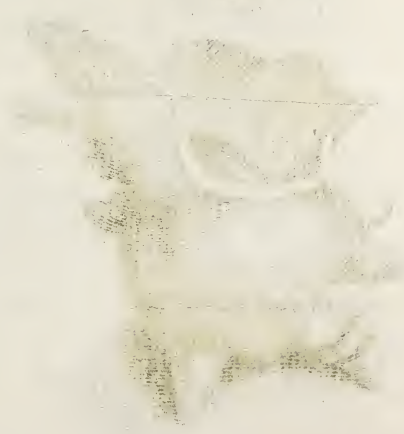
## L O N D O N :

Printed for, and Sold by *Samuel Smith*, Printer to the *Royal Society*; at the *Prince's Arms* in *St. Paul's Church-yard*, 1693.

*[Faint, illegible text at the top of the page]*



C  
C  
C  
C



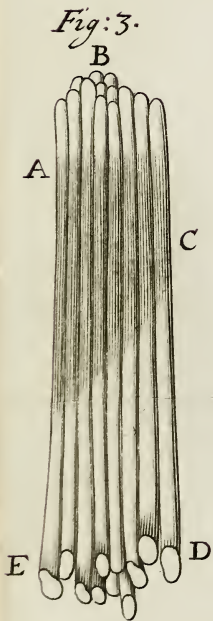
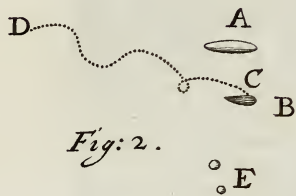
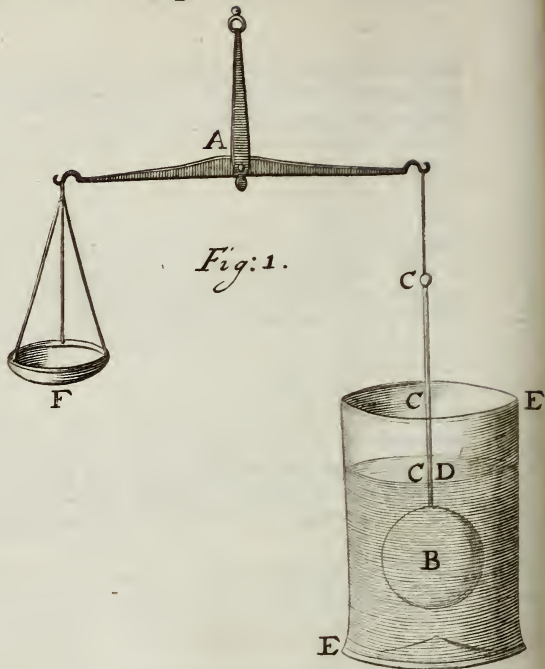
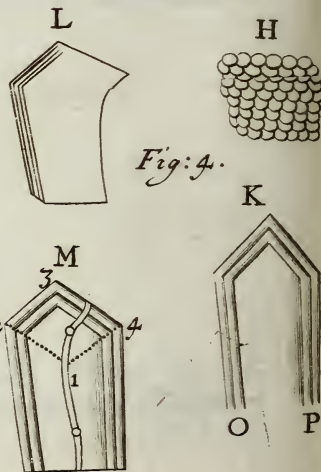
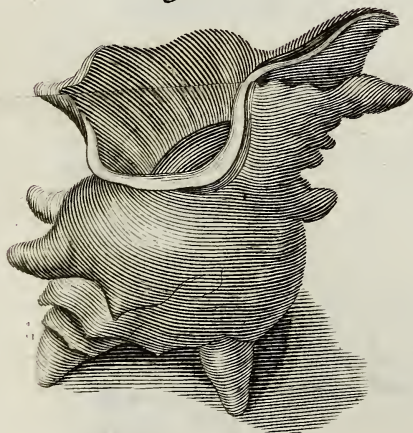


Fig. 5.



---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of February, 1693.*

---

## The CONTENTS.

1. **S**ome Experiments on a black shining Sand brought from Virginia, supposed to contain Iron, made by the late Dr. Allen Moulin, R. S. S. 2. A Paper of the Honourable Robert Boyle's, late Fellow of the Royal Society, being an Account of his examining Waters as to Freshness and Saltness; together with an account of the Trials made of the same at a Meeting of the Royal Society, by Hans Sloan, M. D. and S. R. S. To which is subjoyned another Method of making such Discoveries by the help of a Particular kind of Water-Poisse, by Robert Hooke, M. D. and R. Soc. Soc. 3. Three Quæries, concerning some Shells, used in Medicine, proposed by Mr. Samuel Dale, and answered by Martyn Lyster, M. D. and R. Soc. S. with a Figure of the Shell yielding the Purple of the Ancients. 4. The Abstract of a Letter from Mr. Anth. Van. Leeuwenhoek, R. S. S. to the Royal Society, containing some Microscopical Observations on small Animals, breeding on the out-sides of the Teeth; and on the Scaliness of the Scarf Skin, &c. 5. An Ac-

count of several Experiments made to examine the Nature of the Expansion and Contraction of Fluids by Heat and Cold, in order to ascertain the Divisions of the Thermometer, and to make that Instrument, in all places, without adjusting by a Standard. By Mr. Edm. Halley, S. R. S. 6. An Account of a Book, viz. *Novæ Hypotheseos ad explicanda febrium intermittentium Symptomata & Typos excogitatae, Hypotyposis, unà cum ætiologiâ Remediorum*; speciatim vero de curatione per *Corticem Peruvianum*, accessit Dissertaticuncula de Intest. norum motu Peristaltico. Authore Guilielmo Cole M.D. Imp. Lond. in 8°. 1693. Prostant apud S. Smith.

---

I. *Some Experiments on a Black Shining Sand brought from Virginia, suppos'd to contain Iron, made in March 1689. By Allen Moulten, M. D. and Fellow of the Royal Society, since Dead.*

1. A Small Phial fill'd with ordinary white Sand, and containing only  $3j. gr. xj.$  being fill'd with the *Virginia Sand* was found to contain  $3ij, \text{ʒ}ij, gr. j,$  that is,  $3j\beta.$  more than what was equal to it in bulk.

2. This Sand did apply to the *Magnet* both before and after Calcination, but the latter did apply better to it than the former.

3. A parcel of this Sand mix'd and calcin'd with powder'd Charcoal, and kept in a melting Furnace for about an hour, yielded no *Regulus*, but apply'd more vigorously to the Load-stone than either of the former.

4. I flux'd a parcel of this Sand with fix'd Nitre in a melting Furnace for above an Hour, but could obtain no *Regulus*, nor any substance that would apply to the Magnet, excepting a thin Crust that stuck firmly to a piece of Charcoal that dropt into the Crucible when the matter was in fusion.

5. I flux'd it also with Salt-Peter and powder'd Charcoal, dropping pieces of Charcoal afterwards into the Crucible. It continu'd about an hour in the melting Furnace in fusion, and that without producing a *Regulus* or a Substance that would apply to the Magnet, excepting only what stuck to the Charcoal, as in the former Experiment.

6. I flux'd another parcel of it with Salt-Peter and Flowers of Brimstone, without being able to procure any *Regulus*.

7. I pour'd good Spirit of Salt on a parcel of this Sand, but could observe no Luctation thereby produc'd.

8. I pour'd Spirit of Nitre both strong and weakned with Water on parcels of the same Sand, without being able to discover any Conflict.

9. I pour'd single *Aqua fortis* upon another parcel of it, without being able to perceive any Ebullition worth noting.

10. I pour'd double *Aqua fortis* upon another parcel of it, which for ought I could discover had no more effect on it then the former.

11. I pour'd also some *Aqua Regia* on a parcel of it, without discovering any sensible Effect.

12. I pour'd good Oil of *Vitriol* upon another of this Sand, but seeing no Bubbles thereby produc'd, I weakned the Oil with Water, but without any sensible effect.

13. I repeated all the former Experiments with the *Menstruums* upon this Sand after Calcination *per se* in a Crucible, but could scarce observe a Bubble produc'd by any of them.

14. I pour'd some of each of the Liquors upon Parcels of the Powder of this Sand calcin'd, without any Success.

*Note*, That I made these Experiments both in the Cold, and upon a Sand Furnace. So that to me there seems to be but little wanting to discover any Metal known to us, if it contain'd any such: For there is no Metal nor Oar that some of these *Menstruums* will not work on.

15. I powder'd a Fragment of a Load-stone, and pour'd some of these *Menstruums* upon it, without being able to find that they in the least prey'd upon it, any more than they did upon the Sand.

16. I pour'd some of the afore-mentioned *Menstruums* upon ordinary Sand taken out of a Sand Furnace, where it must have suffer'd some Calcination, but could find no more Bubbles produc'd thereby, than what might rationally be suppos'd to be produc'd from time, and other Dirt mixt with the Sand.

II. *An Account of the Honourable Robert Boyle's way of examining Waters as to Freshness and Saltness.*

*To be Subjoyn'd as an Appendix to his lately Printed Letter about Sweetned Sea-Water, Octob. 30. 1683.*

HAVING, since the Publication of the foregoing Letter, been commanded by the King, to show His Majesty an Experiment of the way herein mention'd, to examine the Freshness and Saltness of Waters; I did in His Presence, (and that of his Royal Highness, his Grace the Duke of *Grafton*, and several Persons of Quality) make tryal of it, both upon some Water prepar'd according to the Patentees way, and upon two or three Natural Waters, that were order'd to be brought. In all which Tryals, (in some whereof his Majesty, for greater certainty, was pleas'd to employ His own Hands) the Success was such, as mov'd him to vouchsafe the Experiment the Honour of his special Approbation, and to give me an encouraging Permission to communicate it, as a thing that may prove not unuseful to the Publick. This I think fit to mention, not only to procure to my way of trying Waters, the high Advantage of a Royal, and, (on Philosophical Accounts) Illustrious Patronage; but that, if this Method be found as beneficial as I wish it may, Men may know to whom they ought to acknowledge the early Publication of it. This is all my Haste allows me to premise, to the Account I am going to deliver, of the way of trying Waters hitherto spoken of: which Account I shall set down, as I drew it up to be dispatch'd to a Friend \*, in case I should have his Majesty's permission to impart it to him.

H

My

I.  
N.B. This Paper was deposited with the Secretaries of the Royal Society, An. 1683. sealed up and opened since the Authors Death.

\* Which should have been to the worthy Doctor *John Beal*, to whom the Letter this Paper refers to was written; but to the Authors Grief, and the great loss of the Commonwealth of Learning, he died before this Paper was written.

II. My way of examining the Freshness and Saltness of Waters, *tho'* (because it is wont to be surprizing the first time one sees it try'd, and has had the luck to be much talk'd of in many good Companies) 'tis thought to be an Invention very difficult, to be either found out or practis'd, is *yet* really no such mysterious thing as Men imagine it. And for my part, I hope it will be found much more considerable for its use, than I think it is for the degree of Skill and Sagacity, that was necessary to devise it. For when I remembred and consider'd, that (as I have found by various Trials) divers Metalline, and other Mineral Solutions could be readily precipitated, not only by the Spirit of Salt, but by crude Salt, whether dry or dissolv'd in Water, 'twas no very difficult matter for me to think, that by a heedful application of the Precipitating Quality of common Salt, one might discover whether any Particles of it, (at least in a number any way considerable) lay conceal'd in a distill'd Water, or any other propos'd to be examin'd.

III. To find whether I was not mistaken in this Conjecture, as also because it is very convenient to be as little as one can confin'd to one Material, I employ'd several Drugs, and those not all prepar'd by one *Menstruum*, to make the intended Discovery. And, tho' two or three of my other Trials had Successes, that I dislik'd not when I made them, yet that which at length I pitch'd upon as the most certain, and which therefore I meant, when I had the Honour to be sent for by his Majesty about the Patentees Water, was that which I think may be best understood, as well as recommended, by this short Narrative.

IV. I took some common Water distill'd in Glass Vessels, that it might leave its Corporeal Salt, if it had any, behind it, and put into a Thousand Grains of it, one Grain of dry common Salt: Into a convenient quantity, for Example, two or three Spoonfuls, of this thus impregnated

nated Liquor, I let fall a fit proportion, for instance Four or Five drops, of a *very strong* and well filtrated Solution of well-refined Silver, dissolv'd in clean *Aqua Fortis*; [for a shift, common or Sterling Silver will serve the turn:] And I made the Experiment succeed with Spirit of Nitre, instead of *Aqua fortis*, upon which there immediately appear'd a whitish Cloud, which tho' but slowly, descended to the bottom, and settled there in a white Precipitate.

N. B.

This Experiment having been several times, for the main of it, reiterated with Success, I thought fit to keep constant to the way of Probation I made use of in it, (and which Trials had recommended to me for between 20 and 30 Years) tho' (by reason of some things that *Hast* forbids me to mention) I pitch'd upon this way without at all denying, that Men of Sagacity, especially if well vers'd in Chymical Operations, may upon the same ground that I went upon, find some other and cheaper ways, tho' scarce any more nice and certain, of compassing the same end.

V.

After what has been hitherto said, I presume I may seasonably proceed, to subjoyn the four ensuing Advertisements.

VI.

And *First*, I shall give notice, that, to make the Experiment rather severely, than at all favourably, there was usually taken somewhat more than a thousand parts of Water to one of Salt.

*Next*, I observ'd, that having let fall a few drops of our Metalline Solution, into the Liquor obtain'd from Sea water by the Patentees way of Sweetning it, there did not presently ensue any white Cloud or precipitate, much less such an one as had been newly afforded by the Water, that was impregnated with less than a thousandth part of Salt. And if after some time there *happen'd* to appear (for 'tis not absolute necessary it should) a little Cloudiness in this Factitious Liquor, it was both slower pro-

VII.

\* VIII. And perhaps it may be proper, that I here observe (what is not wont to be taken notice of) That divers Solutions of Mineral Bodies may be Precipitated by *Dilution*; that is, (to explain this Expression) when the Solution has time enough allow'd to diffuse it self, through a great quantity of Water, the Saline Parts are thereby so diluted and weaken'd, that they are no longer able to sustain the Mineral Corpuscles, they kept swimming before, but make with them, and the Water, a confus'd and subsiding Mixture, usually of a whitish colour. This may appear when the Butter of Antimony, being put into common Water, is thereby quickly and plentifully precipitated in the form of that white Powder, that Chymists (not over-deceiv'dly) call *Mercurius Vita*. To which I may add, that I have also produc'd a Powder of that colour, by pouring into common Water a strong Solution of Tin Glass made in *Aqua Fortis*. And by the same way we have precipitated the Tincture for Solutions of the finer Parts) of Jalap, Benjamin, true Labdanum, Antimonial Sulphur, and divers other Bodies made in Vinous Spirits. If it were not for this Power, that Water has to weaken most Solutions of Bodies, I could have employ'd instead of that Silver, either Quick-silver dissolv'd in *Aqua fortis*, or Lead crude or calcin'd, in the same Liquor, or (which is more convenient) in strong Spirit of Vinegar; since these, and some others, are found to be precipitable by Salt Water into whitish Powders. But tho' a very heedful Observer may for a shift, make use of these Metalline Solutions, to guess at the Quality of Water, as to Freshness and Saltness; yet the Precipitation that is made by *Dilution*, is not difficult to be distinguish'd, from that which is perform'd by a true and proper *Precipitant*, (as in our case by the common Salt, that is harbour'd in the Pores of the Water) both by the *quickness* of the Effect, and the *copiousness* of the white Substance produc'd, and on both those accounts is very much inferiour to it; as may evidently appear in the very different Effects that our Solution of \_\_\_\_\_

\_\_\_\_\_ had upon the Parentees Water, or upon well distill'd common Water, compar'd with those it had upon Water impregnated with a thousandth part of Salt, and upon divers common undistilled Waters. This Advertisement I have plac'd in the Margent, as not thinking it fit either to omit it, or by inserting it in the Body of the Writing, to give too great an Interruption to the Series of my Discourse.

duc'd, and much less, than that which appear'd in the impregnated Water \*.

IX. Thirdly, The Usefulness of this Experiment is not to be estimat'd only by the *Examen* it helps us to make of dulcify'd Sea water, but much more by the Estimate, that by its means may be made of natural Fresh Waters, whether of Springs, Rivers, Clouds, Lakes, Wells, &c. For it being generally granted, that those Waters, *ceteris paribus*, are the best, as well for the Wholsomeness, as divers Oeconomical Uses, as Washing, Brewing, &c. that are freeest from Saltness, which is an adventitious, and in most cases, a hurtful Quality in Waters; by our way of examining these Liquors, a heedful Eye may in a trice discover, whether there be any latent Saltness in them, (as most Waters imbibe from the Soil they have travell'd, or do stagnate in) and may enable one, especially by the help of a little Practice, to give a near guess, how much one Water is fresher than another, as I have purposely try'd with

pleasure in differing Waters, that were ordinarily drunk, even by considerable Persons. And if once you have attentively mark'd, what change Four or Five drops, for instance, of our discovering Liquor, will make in two or three, or some other small determinate number of Spoonfuls, (or rather of half Ounces) of Water; 'twill not be difficult for a heedful Observer, keeping the same proportion between the two Liquors, to make a near Estimate, *whether* any Natural Water propos'd to him, have a greater, an equal, or a lesser degree of Freshness or Saltiness, than that Water that he has chosen for his Standard; and *how much*, in case there be a difference, the propos'd Liquor is less or more free from Saltiness than the other.

And that (to add this upon the by) such a difference in a Liquor of such frequent inward Use as Water (which is the *Basis* of Beer, Ale, Mead, and some other common Drinks) may have considerable Effects upon Humane Bodies in reference to Health, may be probably argued from the differing Effects that Waters more or less impregnated with Salt, have upon divers other Bodies. Since most Pump-Waters, for instance, will not boyl Peas and Beef, and some other Aliments, near so well as Spring Water or Rain Water, which are usually softer, and more free from the Saltiness we speak of. 'Tis commonly known to Barbers and Laundresses, that the same Pump-Water will not so well and uniformly, or without little Curdlings, dissolve Wash-balls and Soap, as Rain-Water, and some running Waters usually will: Nay, when I was curious of tempering Steel, I remember 'twas confess'd by the skillfullest Artists I made use of, that some Tools, (as Gravers, &c.) made of that hardest of Metals, would receive a differing Temper if they were quench'd in Pump Water, from that which the like Extinction in Spring Water, or River Water, would give them. But how to make our Estimate of the Freshness or Saltiness of Water come *nearest* the Truth, is a Problem,

X.

Problem, of which I have now neither time nor conveniency enough to deliver my Thoughts. And by what has been said, I hope it does already seem sufficiently probable, that the way above propos'd may prove of good use, both to Navigators, that are often necessitated to Water in unknown places, and to others that only, or frequently drink that Liquor, without having any better way than the Taste, (which is but an incompetent one) to estimate its Freshness and Saltness by \*.

\* XI. I might add on this occasion, That, whereas Experience has inform'd several Persons who have consult'd it, that divers Medecinal Waters, that are presum'd to owe their Vertues to the participation either of Metalline, or of other Mineral Bodies, do upon trial appear to leave sometimes little, and sometimes nothing behind them, except a kind of common Salt; our Precipitant may much assist Men to discover, *whether* a mineral Water propos'd to be examin'd, do, or do not contain, such a Salt; and if it do, *whether* it contain it copiously or no. This I have try'd upon more than one of our English mineral Waters, and thereby found in a trice, that one that is reputed of another nature, contain'd pretty store of Saline matter; and that another (which is still, for ought I have learn'd, of an unexamin'd and unknown Nature) is impregnated with a surprizing Plenty of Salcish Substance. But how and with what Cautions, our Precipitant may be the most usefully employ'd, about the Examen of medicinal and other mineral Waters, belongs not to this place, (but to || another Paper.) Upon which account I forbear to declare the use I have sometimes made of our Precipitant, in examining the fresh Urine of Men, the *Serum* of Humane Blood, and other Bodies belonging to what the Chymists call the *Animal Kingdom*.

|| *About the Examen of Mineral Waters.*

Salt, being dispersed through two thousand, and another time

XII. Fourthly, (and Lastly) tho' both in my Letter to Dr. J. B. and in this present Postscript, I did not for certain Reasons ascribe to our Method of examining Waters, a greater Nicety than to be able to discover one part of Salt in a thousand of Water, that Proportion being great enough to recommend it, and expres'd by a round number easie to be retain'd in ones Memory: Yet I would not have it thought but that, if it were requisite, our Method may make more nice Discoveries. For, having sometimes for Curiosities sake, put one Grain of Salt into no less than Fifteen Hundred of distilled Water, we could manifestly, (tho' not quite so conspicuously as before) make it appear by our way, that even this so lightly impregnated Liquor was not devoid of Salt, but had more of that in it, than some of the Patentees Water that I kept by me had; nay, I once found, that a Grain of dry

time that being dissolved in three Thousand times its Weight of the same kind of Liquor, so inconsiderable a proportion of Salt was plainly discoverable by our Precipitant.

But here Philosophical Candour forbids me to conceal an Objection that I made to my self, though it be the chief, if not the only considerable Scruple that occur'd to me, about our way of examining Waters. For I foresaw that it may be objected, that, whereas the Experiments hitherto mentioned have been try'd only upon Waters impregnated with gross or corporeal Sea-Salt, this perhaps may not hinder, but that they may be imbued with the Spirits of Marine Salt, which by reason of their activity, may be as unhealthful to the Drinker, as the grosser Salt it self. But tho' to this Surmise I might answer, that a very small Proportion of Spirit of Salt, may in many cases make the Water season'd with it, rather Medicinal than unwholsom; yet I shall answer more directly to the Objection, by saying, that to manifest it's not being well grounded, I took above a thousand Grains of distill'd Water, and, instead of corporeal Salt, put to it one single drop of *moderately strong* Spirit of Salt, (for I had *much stronger* by me, that I purposely declin'd to employ) and having shak'd it into the Water, I let fall into a Portion of this unequally compos'd Mixture, some drops of our Solution of Silver, which presently began to precipitate in a whitish Form; insomuch that, for ought appear'd to the Eye, this Trial succeeded better, than if the Water had been impregnated with but a thousandth part of Corporeal Salt. The like Experiment was made with the Patentees Water instead of the other. And to pursue this Trial a great way further, I had the Curiosity to diffuse one drop of Spirit of Salt into two thousand Grains of distill'd Rain Water; and upon letting fall some drops of our Precipitant into it, I found that the Success well answer'd my Expectation. And then,

to urge the Trial yet further, I added as much of the same distill'd Rain Water, as by a modest Conjecture made it amount to at least half as much more. So that one Grain of Spirit of Salt had a manifest Operation, tho' not quite so conspicuous as the former, upon above three thousand Grains of Water, whose Immunity from common Salt we try'd apart;) and possibly, if the Vial could have contain'd more, and would not have been, when fill'd, too heavy for our tender Ballance, the Discolouration of the Mixture would have been discernable, tho' but one Grain of Spirit of Salt had been put upon Four, or even Five Thousand Grains of Water. And that a drop of the Saline Spirit we made use of, did not equal in weight a grain of dry Salt; I found by this, that having let fall into a counterpois'd piece of Glass, ten drops of that Spirit, I found them to want near half a Grain of nine Grains weight; which way of estimating I chose, as less subject to any considerable Error, than that of weighing a single Drop by it self.

XIV. The like Trial I made by substituting above a thousand Grains of Rain Water, in the room of the like quantity of distill'd Water. And these two Experiments I the rather mention, because they do not only show how free the Patentees Water was from Spiritous, as well as from Corporal Sea-Salt; but also manifest that, whereas it is the Opinion of some Sea-men, and of a Person, for whom I have a profound respect, that Water ought to have a little saltishness to preserve it; if this be really a desirable Quality in our Artificial Water, it may in a trice be supply'd with as much Saltness, whether Corporal or Spirituous, as shall be requir'd, and consequently as will bring it to be equal in that quality to the common Water of Rivers, or of Springs. And perhaps 'twill not be impertinent to add on this occasion, that in some places, especially lying in hot Climates, it may sometimes be of good use to know, whether on the ac-  
count

count of the Sun's Heat, or that of the Subterranean Regions of the Earth, the Rain-Water is impregnated with Volatile (not Acid) Spirits, like those that are distill'd from Urine, and which I have for Curiosities sake, obtain'd from a Mineral Body, native Sal-armoniac ; upon which account I made a Trial, that inform'd me, that if Five or Six drops of strong Spirit of Urine (whose drops I observ'd to be but small) were shaken into a thousand Grains at least of distill'd or Rain Water, impregnated with but one of Salt, our Precipitant would make a Discovery of some Saltishness in the Liquor. And it were neither to be admir'd nor censur'd, if the Patentees Water should sometimes show a Change, when our Precipitant is plentifully put or long kept in it, especially that Change being a more light one, than that I came from speaking of. Since, for ought I have yet observed, not only such undistill'd Waters as are generally allow'd to be freely potable, but even those that Nature her self distils, are not always quite devoid of Saltness. For I have found Rain-Water that I caus'd to be carefully sav'd, after the House-tops had newly been well wash'd with former Rain, to grow a little troubled, if any store of our Precipitant were kept for some competent time in it. And being gently distill'd off, it left a residue, which with a little of our Solution afforded a far more suddenly made and copious Precipitate, than had been produc'd with the like quality even of Pump-Water it self. And, *tho'* I have met with Rain-Water that was more free from Salt than any Spring or River-water that I remember, I have examin'd ; yet, having for Curiosities sake made Trial of Snow-Water, (which if the Weather had been somewhat milder, would have been Rain) this Liquor, I say, which is thought to afford the lightest Water of all natural ones, I manifestly found by our way of examining it, not to be devoid of Saltness.

XV.

But to return to the Trial we made with the Spirit of Salt; these Experiments may not a little confirm the Freshness of the Patentees Water. And whereas some have either really suspected, or invidiously pretended, that even a moderate Action of the Fire upon Water, will make it brackish and putrifie: As I see no substantial grounds of this Surmise, so it appears by the foregoing Trials, that really the Patentees Water is not brackish, but is more free from Saltness, than most of the Waters Men do without scruple drink: And if it were true, that this Water should not keep quite so long as others, yet that were no more than is objected (how truly I now enquire not) to the Generality of distill'd Waters: And that this we speak of, may keep sweet longer than is necessary in a Ship, that can from time to time, within a few days supply it self with fresh out of the Sea, may be gather'd from these two things. The *First* is, That to satisfy my self, whether closeness would make the prepar'd Water soon putrefy, (as seem'd obvious to be surmis'd) or at least afford Dregs, I caus'd a Pint, or a Pound of it, to be hermetically sealed in a Vial, whereof I left by guess about a third part empty, and having above six Weeks after held this Vessel against the Light, I found the Water to be clear and limpid; tho' I did not judg it had deposited so much as the tenth part of a Grain of Feculency. And having open'd the Seal, and taken out a little of the Liquor, I did not find it alter'd, either as to Smell or Taste. The *Second* of the two things that were to be mention'd, is, That I have kept the Bottle of prepar'd Water mentioned in my Letter to Dr. *Beal*, in the same unstopt Vessel ever since *March*, that is so long, that 'tis now near eight Months old, and yet it continues sweet and well condition'd. And, if that which is called Crudity in Water does consist, (as probably it often times does) in certain gross Particles that are mingled with the purely aqueous ones, it is likely,

likely, that the Action of the Fire may divide and dissipate these into Minuter Particles, and thereby destroy the Texture that makes them hurtful; and by causing innumerable tumblings and rovings among the more earthy Particles, give them opportunity to make little Coalitions, whose weight precipitating them to the bottom, frees the pure Water from them.

And because 'tis but too probable, that the unwholesomeness of divers Waters proceed, not only, or perhaps not so much, from bare Crudity, as from a great quantity of grosser Particles, that are not easy to be rais'd, because of their being combin'd with fixt and earthy ones, that swim up and down in the Water they impregnate, as Silver or Mercury does in a Solution made with *Aqua fortis*, or rather as the Particles of Salt do in Pump-water, and many other common Waters: On this account I say, the Patentees Invention may very much correct such Waters, since by their way of sweetning those Liquors, the truly Aqueous Parts are not only freed from the Saline ones, but from the Mineral, and other gross and hurtful Corpuscles that may have lain conceal'd in the Liquor. As may be argued from hence, that having purposely in the gentle Fire of a digestive Furnace, slowly distill'd off a Pound of the Patentees Water, it left us in the Cucurbit so light and thin a Feculency, that the bottom of the Glass seem'd to be rather sullied than cover'd by it; and I did not judge that the whole Feculency, if we could have got it out, would have amounted to so much as two Grains.

But to return, after this short, and I hope not impertinent Digression, to what I was lately saying, of the Virtue of the Fire, to correct the Crudity of Waters; I shall proceed, and say, that perhaps 'twas upon some such Reasons, (to which others might be added, if I could in few Words confirm Paradoxical ones) that the last Great Duke of *Tuscany* when he drank Water, (for it was not,

XVI.

XVII.

as I perceive some have misunderstood, his only Drink) prefer'd for wholsomness that which was distill'd to that which was not ; and if herein that Learned Prince, and those of the same Opinion, were not mistaken, it will highly recommend the usefulness of the Patentees Invention to Mankind: For I shall on this occasion observe, that there are multitudes of Waters that are not considerably brackish to the Taste, that yet, by reason of some unheeded Saltness, as in most Pump-waters, are more frequently, by reason of Crudity, are not only unfit, or (at best) less fit, for divers Oeconomical Uses, as Washing, Boyling of some Meats, &c. but are very unwholsome; sometime to a degree, that makes them mischievous to whole Communities, and perhaps Nations. Of this 'twere to be wish'd, that it were harder to give Instances. I remember I have seen a notable one, in those hugh and unsightly Tumors about the Throat, which are observ'd by Travellers to be exceeding common, among those that inhabit the lower Tracts of Ground that lie between the *Rhetian*, *Helvetian*, and some other neighbouring Mountains; which monstrous Swellings are generally imputed to the Snow Waters that flow from the Mountains, and make the usual Drink of the meaner sort of People; whence 'tis observ'd, that Persons of better condition, who drink Wine more than Water, are either not at all, or far less troubled with these disfiguring *Goitres*, (as they call them.) But much more notable instances to our present purpose are afforded me by that Great, (and yet living) Traveller *Monsieur Tavernier* (Baron of *Aubonne*) who speaking of a Nation of *Cafres* or *Negroes*, that comes sometimes to trade with the *Portuguez* from a remote part of *Africk*, informs us, *That the Water of their Country is very bad, which is* (says he) *the reason that their Thighs do swell, and it is a wonder to see any one of them free.* Nay, which is far more, where he speaks of the *African Kingdom*

*Tavernier's Travels. Part II. Book II. chap. 23. pag. 156.*

or Empire) of *Monomotapa*, he has this memorable Passage, *The Natives never live long, by reason of the badness of the Waters in the Country. For at the Age of Twenty Five they begin to be Dropsical, so that 'tis a great wonder if any among them live above Forty Years.*

What *Monsieur Tavernier* delivers being taken for granted, it seems very probable, that these People may be much reliev'd, and be brought to live as long as other Nations, if they had so compendious a way as that of the Patentees, to provide themselves plentifully with Waters, whose Crudity is corrected, its grosser and heavier parts separated, and its brackishness destroy'd by the Fire, as its Action is regulated and help'd by their Invention. XVIII.

The Experiment mention'd in this Paper was try'd at a meeting of the *Royal Society*, Feb. 17. 169 $\frac{1}{2}$ : by Dr. *Slone*, with a Success answerable to the Assertions of the *Honourable Author*, and that a drop or two of Spirit of Salt mixed with common Water, would be by the same Method discovered.

At another meeting of the said Society on the 2d of *March* following, Dr. *Hooke* read a Lecture concerning another Method of his own for the discovering the smallest quantity of Salt contained in Water, from a Principle of *Hydrostaticks*; and after his Discourse thereof, he produc'd the *Apparatus* which he had prepared to exhibit the same before the Persons then present; and it was there shewn, that the Instrument he apply'd to that Scrutiny did very evidently discover the Mixture of a 2000<sup>th</sup> part of Salt added to common Water, and would easily have detected half that quantity of Salt added to an equal quantity of Water, as was judged by those that observ'd the Success thereof.

The Method of doing which Operation was by means of a large Poise of Glafs, somewhat of the shape of a Bolt-head, the Ball of which was about 3 Inches Diameter, but the Stem or Neck thereof was not above half a Line, or a twenty fourth part of an Inch; this was so poised by Red Lead put into it, as to make it but a little heavier than fair, or fresh Water. Then this Poise was suspended by the small Stem to the end of a slender Beam, which was very tender, and being not over-charged with weight, would turn with a small part of a Grain. This Beam was hung on a steady Frame, and the Poise hanging at one end of the same, cover'd with the Water to a certain Mark or Division made on the small Neck, it was so counterpoised by some small Weights put into the opposite Scale of the Ballance. Then (the weight of the Water contained in the Cistern or Vessel into which the Poise was immersed being first known) a 2000<sup>th</sup> part of it's weight was taken of common Salt weighed out, and put into the whole 2000 parts of the Water, which by being stirred soon dissolved. Then the Poise suspended as before, was viewed and examined by many then present, and they manifestly saw that near half an inch more of the Neck emerged out of the Water so seasoned, than did before the 2000<sup>th</sup> part of Salt was dissolved therein, This was only one use of this Method of discovering very small Alterations in the Constitutions of Bodies, the same Author having long since, namely, *October 25. 1677.* shewn to the same Society a Method of discovering divers Alterations much more curious, namely, to the 176000<sup>th</sup> part of it's weight.

This Description will be more easily apprehended by the first Figure, where *A* signifies the Beam, *B* the Ball of the Poise, *CC* the Neck, *D* the Mark to which it sunk  
in

in Fresh Water, *EE* the Cistern or Vessel containing the Water, *F* the Scale wherein the Weights to counterpoise it were put.

III. *Three Queries relating to Shells proposed by Mr. Samuel Dale, and answered by Dr. Martyn Lister. R.S.S.*

*The Queries.*

There are three things among *Shells*, in which I would be glad of *Dr. Lister's* Assistance, which if you can procure, will be a great Favour, and desire it may be done as soon as possible.

1. *What is the Entalia of the Shops? by what Authors described? under what Names? and how they differ from the Dentalia?*

2. *Of what Shell is the Blatta Byzantina the Operculum?*

3. *There are divers sorts of Purpuræ among Authors, which is that of the Shops? Likewise which sort of Buccina and Umbilici Marini ought to be used in the Shops?*

*The Answer to the Three Queries, by Dr. Lister.*

1. As to the *Entalia*, I do not remember to have seen any thing in the Shops under that Name. The Descriptions of the *Dentalia* in *Scroder* are very faulty, and both those and the *Entalia* by him should seem to be the Two Species of *Dentalia*, which are by me figured. The *Dentalium* being that which is commonly and in Plenty found about the Island of *Garnsey*, and elsewhere

where upon our Coast ; and is the same with that found in the *Mediterranean*. It is a long, slender, round Pipe, a little bending and tapering, hollow and open at both ends, without any Crack or Flaw, naturally, white at one end, and usually a little reddish ; very smooth and polish'd on the out-side, and from thence and the Figure called a *Dog-like Tooth*. The *Entalium*, or other *Species* of the *Dentalia* is very much longer and thicker than the former, much alike in other respects, save that this is streaked with high Ridges, and mostly of a greenish Colour. This *Species* I guess to come from the *Indies*. Note, that any thing that is wrought into, or channeled, is in the Modern *Italian* called an *Intaglia* ; whence I believe, and the nearness of the Word *Dentalia*, arose those distinctions of Names.

2. To the Second *Quære*, I take the *Blatta Byzantina* to have succeeded the *Unguis Odoratus*, and to have been brought into the Shops in its place. In *Dioscorides's* time the best was brought from the *Red Sea*, viz. the palest and fattest ; the blacker, and less, from *Babylon* or the *Persian Gulf* ; but it seems later Times took up with those found about *Constantinople* ; whence the present Shop *Blatta* had its Name. The Name of *Blatta* is given to this *Operculum*, from the Colour I guess ; as being of a dark Hair Colour, as the common *Blatta Pistinaria*, so common in *London*, is ; also this being a broad, thin, flat Beetle, like the Cover.

'Tis true, the same *Dioscorides* says, the *Unguis* was an *Operculum* (πῶμα χογχυλίον) like to that of the Purple Fish. He means what was used in his Time ; in which it seems the *Unguis Odoratus* was lost, or was not brought to *Europe*. But it will appear out of the same *Dioscorides*, that the *Unguis* was no *Operculum*. It will be worth the while to make out this Mistake, and consequently the Errors the Moderns have been in to substitute

an *Operculum* of a Marine *Turben* for the true *Unguis O-*  
*doratus*.

Take the History of the *Unguis* out of *Dioscorides*. ' It  
' is found, says he, in the Lakes of *India* where *Narde*  
' grows; wherefore the *Conchylia* feeding on *Narde* are  
' *Aromatick*. It is gathered after that the Lakes are dried  
' up with the Summer Heats. He concludes, the *Conchy-*  
' *lium* it self burnt or calcin'd, is of the same Efficacy  
' with the *Purpura* and *Buccinum* burnt in the Chapter of  
' *Narde*. He says farther, That the *Indian Narde* grew  
' near the River *Ganges*, that is, in certain Lakes, which  
the over-flowing of that River caused. Hence it appears  
(1) That the *Unguis Adoratus* was part of a *fresh Water*  
*Conchylium*. (2) Now if it was gathered in the Nardi-  
ferous Lakes upon the River *Ganges*, how comes it to  
pass that the same was brought out of the *Red Sea* and  
*Babylon*. And why should the Shell it self be brought,  
an useles Luggage so far, as from the River *Ganges* to  
*Greece*, the *Operculum* rarely being a Tenth part of the  
Shell it self. Now if it was not used to be brought and  
exposed to Sale, to what purpose to declare its Vertues,  
or how could the Experiment be made. I conjecture  
therefore, that the true *Unguis Odoratus* was something  
like the half of a *Pectunculus Fluviatilis*, so common in  
the River *Thames*, of the bigness and thickness of my  
Thumb Nail, and that for these Reasons:

1. That the *Unguis Odoratus* seems to have been a  
fresh-water *Bivalve* or Muscle, for that they stay'd till the  
Lakes on the River *Ganges* were dried up before they ga-  
ther'd them. Now *Bivalves* are ever buried in Sand  
and Mud, and never rise up and swim about and float  
as the *Turbinat* Snails do, to which latter only the  
*Operculum* belongs, and which therefore were always,  
and easily to be caught.

2. He calls this Snail *Conchylium*, and by that general Name distinguishes it from all the other sorts, concerning which he treats in several Chapters; which tho' in general it take in both kinds, as well *Turbinate* as *Bivalve*; yet it does more particularly denote a *Concha* or *Bivalve*.

3. The *Onyx* is expressly reckon'd by *Pliny* amongst the *Bivalves*. For (*l. 32. c. 11.*) he makes all these Synonymous, *Solen, five Aulos, five Donax, five Onyx, five Dactylus*. And again more particularly, (*lib. 9. c. 61.*) he says, *Concharum genere sunt Dactyli, ab Humanorum Unguium similitudine appellati*. So that in all probability the *Onyx Odoratus* brought more anciently out of the fresh-water Lakes about *Ganges* in *India*, was not unlike the common *Onyx* of the *Mediterranean*, which was of the *Solen* kind.

Whatever the *Blatta Byzantina* of our Shops is, which has certainly nothing of the Characters of the ancient Aromatick *Unguis*; and which in all probability was lost upon the account of the difficult Passage from *Ganges* into *Europe*. I lament its Loss, which I have reason to believe was a good Medicine, from its strong Aromatick Smell; which is much wanting in our *Testaceous Powders*, of which this was one of the number, so much used, and that not without good reason now-a-days, which are all very flat and insipid.

To the Third, The *Purpura* of the Ancients is well made out, and figured by *Fabius Columna*: And it is one of the most common *Murices* of the *Mediterranean Sea*. In this he could not be much mistaken, because, as I remember, he somewhere mentions heaps of those Shells where the *Officina Purpuræ* anciently were; and also from the Purple *Sanies* the Fish yields of it self. He mentions one or two more *Species* of *Turbinate* Snails, to be found in the *Mediterranean*, which yield a Purple Juice. Upon the whole matter it is indifferent, what sort

sort of Shell we use in the Shops, if it be to be calcined, provided it be a Sea-shell. Nor do I find either *Dioscorides* or *Ætius* to have distinguish'd betwixt the *Ostrea Purpura* or *Buccinum* calcined; but gives them all the same Caustick Virtue; possibly some one *Species* may have it in a higher degree, as we see the various sorts of Lime-stone, if calcined, differ in strength.

One thing I shall not omit before I end this Paper, because it is now in my mind, that tho' the *Species* of Shell or *Purpura* be scarce known to our Shops at this day, yet the use of the Purple Juice has been by Tradition at least transmitted down to our Times, and kept as a Secret even in these Islands, till Mr. *Cole* got hold of it, and publish'd it. Sir *Robert Southwell* the now President of the *R.S.* told me many years ago, that his own Mother in *Ireland* was famous for marking Handkerchiefs with the Juice of Fish; which Mark would never wash out. And the very Learned Mr. *John Beaumont* informs me of a passage in our *Beda's* Ecclesiastical History relating to the *Purple*, as a known thing in his time. The Passage is as follows:

*Bedæ, Historia Ecclesiastica Gentis Angl. l. i. c. i.*

*Variis Conchyliorum generibus exceptis: in quibus sunt*  
 & Musculæ, quibus inclusam sæpè Margaritam omnis quidem coloris optimam inveniunt, id est, & rubicundi & purpurei, & hyacinthi & Prasici sed maximè candidi. Sunt & Cochleæ satis superque abundantes, quibus Tinctura cocineæ coloris conficitur. Cujus rubor pulcherrimus nullo unquam solis ardore, nulla valet pluviarum injuria palescere; sed quo vetustior, eo solet esse venustior.

You see from this Passage the Purple Trade of Dying was used in *England*; and very much valued.

Of Mr. *Cole's* you have a Cut in the *Philosophical Transactions*, No. 178.

*Fig. 5.* Represents the true *Purpura* of the Ancients by the *Italians* called *Gerusolo*.

IV. *An Extract of a Letter from Mr. Anth. Van Leuwenhoek, Concerning Animalcules found on the Teeth; of the Scaleyness of the Skin, &c.*

**I** Have often endeavoured to discover Animalcules in Spittle, but in vain: But examining a kind of gritty Matter from between my Teeth, and mixing it sometimes with Rain-water, and sometimes with Spittle, both which before had no Animalcules, I discovered therein with admiration a great number of very small ones moving; the greatest whereof are represented Fig. 2. *A.* they had a very strong and swift Motion in the Water like Eeles, of these larger there were not many: A second sort is represented by *B.* these oft turned themselves round like a Top, and moved sometimes as is shewn by the Line *C.* *B.* these were much more in number. The Figure of the third sort I could not well discover, sometimes they appeared oval, and at other times round, they were so small that I could not discern them greater than as at *E.* they moved swiftly by each other like Gnats playing in the Air, and of these I discerned Thousands in a drop of Water they shewed no bigger than a Sand, and in the Drop, the Water was to the Animalcules as 9 to 1. But most of the Matter I examined, consisted of long slender parts all of a thickness, but differing in length as at *F.* and one crooked one amongst the rest; and because I have formerly observed Animalcules of this shape in Water, I endeavoured to discover if these lived but could not. I have found the same in the Matter taken from between the Teeth of  
other

other Persons, as well such as drank Wine and smoaked Tobacco, as of such as did neither, but not in their Spittle, in which I found no Animalcules. I found the same after I had washed my Teeth very well with Vinegar, tho' the Vinegar kill'd them when they were put into it. Amongst the rest I saw some transparent Particles twenty five times bigger than a Blood-globule, which had they not sunk down in the Liquor I should have taken for Particles of Fat.

I examined the supposed Worms taken out of the Skin of the Nose and other parts of the Face, but found them only soft brittle Particles of Fat: and perceiving on my Nose several small black Specks, I squeezed out some, and found them to be only a bundle of Hairs, and in one of these I told thirty six small Hairs besides the Matter that stuck about them. *Fig. 3.* *A B C D E*, represents one of these Hair bundles, as it shew'd in the Microscope, *A B C* was that dark part which lookt like a black Speck in the Skin; every where else they were transparent. *E D* is the Roots of the Hairs, some longer, some shorter; these Hairs are easily rubb'd off the Skin, the Nourishment thereof being not sufficient to maintain them any long time, or give them growth.

In a Letter to Mr. *Oldenburg*, in the Year, 1674. I mentioned that I could not otherwise perceive, but that the Scarf-insensible-skin consisted of small round Scales and declared my Sense of the Skins fabrick thus, That continually as it was worn away on the outside, it was supplied from beneath, and in several Observations since I have found nothing new; for viewing them always by a common Microscope they shewed as at *H, Fig. 4*, which Scales I judged of that Minuteness, that a Sand might cover two hundred or more of them; but viewing them with a better Microscope I find they are not formed by  
the

the moisture transpiring through the Skin, as I then imagined ; but that all the upper part of our Skin is scaly, if I may be allowed to use that word, for they are very like those of Fish, tho' they are without Comparison smaller, and serve to the same purpose, which is to defend the Skin ; these Scales lay upon one another as those of Fish: they were five-sided, and I could plainly perceive a Border or Line about them, *K O P* represents a full grown Scale, *O P* the part joyned to the Skin ; which was always narrower than the upper part ; other Scales were not so long, nor even at the edges, being either worn or not full grown ; they were as I guess'd about twenty five times broader than thick ; they lay three double, for there was not about  $\frac{1}{3}$  of each visible ; others lay as is represented *Fig. M.* the part 1, 2, 3, 4, being only visible ; this Scale was one of the most perfect, several of the rest being not so sharp pointed ; the Scales of Fish lie after the same manner, only they never shed their Scales, and our Skin peels often ; sometimes a Thousand Scales and more, together in a Flake. I took of some of the Scarf-skin from a small Scar that remained from a Blood-letting twenty five Years since, and found thereon many such Scales as is represented by *L*, upon many of these Scales appeared several irregular Lines, as in *Fig. M* is represented, in some places whereof were seen very small Globules  $\frac{1}{3}$  of a Blood-globule in size ; as is likewise shewn. In this part, I believe a Flea thrusts his Sting into the Skin, between the two uppermost Scales.

By these Observations I have (now as well as formerly) shewn that there are no Pores in our upper Skin, but that the Moisture thrust out of our Body gets forth between the Scales, at which places there may be possibly Channels for it to issue at: if we consider,

der, that two hundred of these Scales may be covered with a Sand, and that each Scale may have many Pores on the sides, besides the places where it is to be nourisht: we may conclude the whole Skin to be but as one continued Pore.

I then examined some of those Scales on the inside of my Hand, where the Skin was thickest, and found that they differed from the other only in that they were thicker, and beset with many Globules and Stripes; whereas the others on the Body are clearer; and whereas those on the Body fall off, and peel for want of nourishment, those on the inside of the Hand by reason of a great quantity of a clammy Matter driven out thro' the Skin are fastened to one another, so as to make a callous Substance. Labour and working likewise forcing out a greater quantity of this glutinous Matter.

---

V. An

V. *An Account of several Experiments made to examine the Nature of the Expansion and Contraction of Fluids by Heat and Cold, in order to ascertain the Divisions of the Thermometer, and to make that Instrument, in all places, without adjusting by a Standard.* By Mr. Edm. Halley, S. R. S.

**Q**ualities, such as Heat and Cold, Moisture and Dryness, and the like, are not otherwise to be estimated, but by their Effect on the *Quantity* of some body they act on, encreasing or lessening the Dimensions thereof; or else by the Motions they produce, both which subject them to Mensuration; but it is still a Question how to ascertain the proportional Heat or Cold, &c. that is between any two Climates or Seasons, so as to conclude the one, for Example, twice as hot or twice as cold as the other, tho' the Instruments now in use abundantly suffice to shew when the Temper of the Air is the same, and when it is Warmer or Cooler. The Reason hereof is, that we know not the Causes of the Expansion of *Fluids* by Heat, or of their Contraction by Cold, as arising from the Nature of their constituent parts, which are so far from being Objects of our Sense, that they even surpass our most refined Reasonings, and extort a Confession of our Ignorance after all our Endeavours. For the same degree of Heat does not proportionally expand all *Fluids*; some swelling with a gentle Warmth, and others not till they be considerably Hot; some boiling with a moderate Heat, and others not at all. Some capable of great Expansion, others encreasing very little; so that it may well be concluded that no one of them does encrease and diminish in the same

same proportion with the Heat, and consequently that the *Thermometers* graduated by equal Parts of the Expansion of any Fluid, are not sufficient Standards of Heat or Cold.

This will be more evident from the Experiments which I made some time since, with Water, Mercury, and Spirit of Wine, wherein the following Particulars were very remarkable.

I. I took a large Bolt-Head, holding about  $3\frac{1}{2}$  l. of Water, with a narrow Neck to make the Augment thereof more sensible; and having filled it with Water, and some few Inches up the Neck, I noted exactly to what Mark the Water came; then I immersed it into a Skillet of warm Water, and let it stand so long, till I concluded the warm Water had communicat'd its Temper to the Water included in the Bolt Head. And I found that tho' the Water were warm, much beyond the degree of the Summers Heat, and notwithstanding it was Winter; yet that gentle Heat had scarce any effect in dilating the Water, so that it scarce appeared to have ascended in the Neck of the Bolt-head. Then I took the Skillet and set it over the Fire, when it was observable that the Water as it grew hot did slowly ascend in the Neck, especially at first; but after it began to boil in the Skillet, the Expansion thereof became more visible, and it ascended apace till such time as it stopped again, the utmost Effort of Boiling Water being able to raise it no higher: Then having made a Mark at the utmost height whereto it had arisen, I took it out, and had the satisfaction to observe, that though it was not raised so high without a very strong boiling, yet it subsided very slowly, as retaining some time the space it had acquir'd from the Heat, even after the Heat was pass'd, and the Glass was so cool as to be touched without burning the Fingers. However the next morning I found it reduced to the first Mark, where it stood when at first put in, ha-

ving lost nothing sensible by Evaporation during the Experiment, which I attribute to the length of the Neck wherein the Vapors were condensed into Drops before they reached the Top. Then I examined how much Water would raise that in the Neck to the Mark where-to it had been encreased by boiling, and found it was a *twenty sixth part* of the bulk of the first Water, which upon repeated Experiment I found to be true; but it was obvious that Water, encreasing so very little with all the degrees of Heat the Air receives from the Sun, was a very improper Fluid to make a *Thermometer* withal; and besides, any freezing Liquor is useles for this purpose in these Northern Climates.

II. I took a smaller Bolt-head with a proportional Cane or Neck, and filled it, after the same manner, with *Mercury*, and having boiled it as above, I observed that 125 Ounces of *Mercury* had encreased the space of 810 Grains, or a *Seventy fourth part* of its bulk when Cold. But it was very remarkable, that whereas a gentle Heat had scarce any effect on Water, here on the contrary, the *Mercury* did sensibly ascend at first, and had almost attained its greatest Expansion before the Water boiled in the Skillet. And after it boiled, though I let it stand very long over the Fire, I could not discern that the most vehement boiling had any effect on it, above what appeared when it first began to boil: The *Mercury* being taken out, as it cooled subsided, and in a few Hours returned to the Mark whereat it stood before it was put into the Water. This Fluid being so sensible of a gentle Warmth, and withal not subject to evaporate without a good degree of Fire, might most properly be applied to the Construction of *Thermometers* were its Expansion more considerable.

However small as it is, it is sufficient to disturb the precise nicety of the *Mercurial Barometers*, shewing the counterpoise of the Pressure of the Atmosphere by a Cylinder.





linder of *Mercury*; for if *Mercury* be more expanded, and consequently lighter in warm Weather than in cold, it will necessarily follow, that the same weight of Atmosphere will require a taller Cylinder in Summer, and a shorter in Winter to counterpoise it. And if the Extremity of Weather do but occasion an 150th part difference, as 'tis probable it doth, the effect thereof on a *Barometer* will be a tenth of an Inch above and below the Mean, or a Fifth in all.

III. I fill'd the smaller Bolt-head with Spirit of Wine, and having set it in the Skillet of Water over the Fire, I found that it ascended gradually as the Heat encreas'd, but slower at first, and faster after it was well warm. At length being arriv'd at a certain degree of Heat, it would fall a boiling with great Violence, emitting Bubbles, which coming into the Neck of the Bolt-head, would lift all the Incumbent Spirit, till they had made their way through. And these succeeding one another very fast, would often raise the Spirit to the top of the Neck, and spill it; so that I found I could go no further with this Liquor, than to that degree of Heat which occasion'd this boiling, and which wanted very much of that of boiling Water, being almost tolerable to the Touch. It was however very remarkable how exactly this degree of Heat was determin'd by the expansion of the Spirit, for in the instant it reached a certain Mark on the Neck, it began to emit its Bubbles: and having been taken out a little to cool and subside, it would certainly and constantly fall a bubbling again, when upon a second Immersion, it was arriv'd at the aforesaid Mark: During this Experiment, it appeared both by the Dew on the Neck, and by the Scent in the Room, that tho' the Neck were about 30 Inches long, yet the Spirit did evaporate very fast for the smallness of the Surface of the Liquor. And I have often noted the like Evaporations condensed in

Dew within the Head of the ordinary seal'd *Thermometers*, in very hot Weather.

This degree of Heat which made Spirit of Wine begin to boil, being determined so nicely as I have said, made me conclude, that this might very properly be taken for the Limit of the Scale of Heat in a *Thermometer*; and the effect thereof in the expansion of any other Fluid being accurately noted, might be easily transferred to any sort of *Thermometer* whatsoever. Only it must be observed, that the Spirit of Wine used to this purpose be highly rectified or dephlegmed, for otherwise the differing Goodness of the Spirit will occasion it to boil sooner or later, and thereby pervert the designed Exactness. And by the way give me leave to hint, that the sooner or later boiling of Spirit or Spiritous Liquors may possibly be as good a Test of their Strength and Perfection as their Specific Gravity, or any other yet used.

The Spirit of Wine I made use of was possibly none of the best, but I observed that at the point of boiling it had encreas'd a *twelfth part* in bulk: Which great Dilatation makes it a Liquor sufficiently adapted to our purpose, were it not for the evaporation thereof; and for the difference in goodness of the Spirit; and for that in length of time it becomes as it were effete, and loses gradually a part of its expansive Power, as I have been informed by those who have long kept them.

All these Experiments were made in the Months of *February* and *March* about Four Years since, the Weather being reasonably cold, and not freezing; and since I have not had the opportunity to try the effect of extreme Cold in contracting these Liquors, which must be refer'd till some sharp Winter present us with a Season proper for these Trials.

IV. Several other Liquors may be examined after this manner, but these alledged may suffice to shew the differing Effects of Heat upon differing Fluids; and that this

this Power of dilating and contracting with Heat and Cold is as specifically in them as their Gravity, Refraction, &c. But in none is it comparably so conspicuous as in that rare Elastick Fluid the Air; for by several Experiments that I have made, I find that the Heat of Summer does expand the ordinary Air about a *Thirtieth part*; and that late Honourable Patron of Experimental Philosophy, Mr. Boyle, in his History of Cold, *Tit. 18. Parag. 8. pag. 475.* alleges his own Trials, proving that the force of the strongest Cold in *England* does not contract the Air above a *twentieth part*: So that the Sum of a twentieth and thirtieth part being a twelfth part, we may conclude that the same Air which is extream Cold occupieth *twelve parts of space*, in very hot Summer Weather will require *thirteen* such Spaces; which is as great an Expansion as that of Spirit of Wine when it begins to boil: For which reason, and for its being so very sensible of Warmth or Cold, and continuing to exert the same Elastick Power after never so long being included, in my Opinion it is much the most proper Fluid for the purpose of *Thermometers*.

Now the *Thermometers* hitherto in use are of Two sorts; the one shewing the differing Temper of Heat and Cold by the Expansion of Spirit of Wine, the other by the Air; but I cannot learn that any of them of either sort were ever made or adjusted, so as it might be concluded, what the Degrees or Divisions of the said Instruments did mean; neither were they ever otherwise graduated, but by Standards kept by each particular Workman, without any agreement or reference to one another: So that whatsoever Observations any curious Person may make by his *Thermometer*, to signify the degree of Heat in the Air or other thing, (which is of constant Use in Philosophical Matters) cannot be understood, unless by those who have by them *Thermometers* of the same Make and Adjustment. Much less has the way been  
 shown

Shewn how to make this Instrument without a Standard, or to make two of them to agree artificially without comparing them together.

I thought to have finished this Discourse with shewing a Method of constructing and regulating *Thermometers* to the best Advantage; but finding it necessary to make some Experiments with more Curiosity than I have yet done, especially upon the Airs Expansions. I crave leave, till one of the next Transactions, to inform my self more fully in the matter, being unwilling to leave to the Trial of others, what perhaps I have better opportunity to examine my self, especially in what is most difficult in this nice Affair: I shall only propose, that whereas the usual *Thermometers* with Spirit of Wine, do some of them begin their degrees from a Point, which is that whereat the Spirit stands when it is so cold as to freeze Oyl of Anniseeds; and others from the Point of beginning to freeze Water: I conceive these Points are not so justly determinable, but with a considerable latitude: And that the just beginning of the Scales of Heat and Cold should not be from such a Point as freezes any thing, but rather from Temperature, such as is in places deep under ground; where the Heat of the Summer, or Cold in Winter have (by the certain Experiment of the curious Mr. *Mariotte* in the *Grottoes* under the Observatory at *Paris*) been found to have no manner of effect. But of this more hereafter.

## VI. An Account of a BOOK.

*Novæ Hypotheseos, ad explicanda februm intermittentium Symptomata & Typos excogitatae Hypotyposis. Unà cum Ætiologiâ Remediorum; speciatim vero de curatione per Corticem Peruvianum. Accessit Dissertatiuncula de Intestinorum motu Peristaltico. Authore Guilielmo Cole, M. D. Lond. in 8°. 1693.*

THE Learned Author declaring himself unsatisfied with the former *Hypothesis* about the Production of *Intermitting Fevers*, but supposing, from the Consideration of the Symptoms, that their Origine is owing to the *Nervosum Genus*, has, agreeably to that Conjecture, formed to himself a new one; by which, (having revolv'd it long in his Thoughts) he thinks he can give himself a clearer Account of the reason both of the Symptoms and Method of Cure, (particularly that by the *Cortex Peruvianus*) than from what others have laid down:

To clear his way to it, he first takes notice of Four *Hypotheses* concerning them, which have either chiefly obtained, or, he thinks are the most considerable, *viz.* That of the *Ancients*, who deduce them from *Humours* putrifying in *primis viis*; of *Sylvius*, who places his *Minera* in the *Pancreas*; of *Dr. Willis* in the Mass of Blood; of *Dr. Jones* in the *Habit of the Body*: Of his Dissent from each of which he alledges some Reasons; though in the general, (agreeably to three of them) that a *Ferment* to be somewhere reconded out of the Road of the circulating Blood, and there gradually maturated, is necessary to produce an interpolate Distemper.

In order to determine both the Matter and Form of this Ferment, he lays down some obvious Conditions of it ; of which though some may agree to one, some to another of the enumerated Hypotheses, yet he endeavours to shew, that All will not agree to any one of them, and therefore thinks such a one is to be searched for, to which they easily will.

His own Opinion therefore is, That the *Cortical part of the Brain* may be the primary *Seat* of this Febrile Ferment; and that the Liquor to be there separated, becoming disproportionate to the Animal Functions, is the *Minera* of it; and, being thence dispensed into all parts of the *Systema Nervorum*, may by degrees rise to such a Maturation as may produce the Fits.

Here he takes occasion to endeavour to establish the Existence of the *Nervous Juice*, in confirmation of what he had heretofore delivered, and indeed (for a main Argument to evince it) to revive and farther make out, by a somewhat long Deduction, the Opinion of Dr. *Eat*, *Glisson*, &c. That we are not only directly, but *materially* nourished by that Juice; for a particular Account of which we refer to the Author.

To this Notion of his, he endeavours to shew, that the alledged Conditions all agree; which done, he lays down his *Hypothesis* of the manner of the Production of the *Paroxysme* minutely; supposing, that some Incongruous, though at first inoffensive, matter (on the score of *Procatartick* Causes he points at) being admitted into the Roots of the Nerves in the *Cortical* part of the *Brain*, is from them propelled into the *Medullary*, and thence into the Tracts of the *Nerves* and *Fibres* (which he takes to be but *Propagines Nervorum*) of the whole Body; in which moving slowly, it by degrees maturates into a *Fermentative Substance*, and acquires an Acrimony: With which when they are filled, and the Acrimony becomes troublesome, they contract themselves to expel it,

it; but it being confined for some time (for Reasons alledged) does necessarily put them upon repeated Contractions (in which he places the Nature of the *Rigor*) till they at last expel it into the Mass of Blood, amongst whose very *Heterogeneous* Particles (many of which too, are *Sulphurous*) it makes a great Commotion; which cannot cease till both the Particles of this Ferment, and the disturbed Ones of the Blood, are subdued and reduced into order, or expelled. But this *Atony* of the Glandules of the Brain continuing, nay in some measure increased by the Disease, the fore-mentioned Admission of more *Heterogeneous* Matter must be repeated, as, in the same order, the Maturation, Eruption into act, and Extrusion of it, with the alledged Consequents; and that so often till either by Medicines, or the change of Season, or other Causes, these Glandules come to recover their *Pristine Force*.

This *Hypothesis* he endeavours to confirm from some obvious general Considerations, and then proceeds first to enumerate, in their order of Invasion, the *Symptoms* which most usually offer themselves, and then to solve them from his *Hypothesis*.

This done, he considers the *Types*; which not having been accounted for to his Satisfaction by former Authors, he takes himself to be obliged to try whether they can be from his *Hypothesis*, and therefore offers a new one about them to consideration.

Therefore in the first place he considers that the three sorts of regular and usual *Types*, *Quotidian*, *Tertian*, and *Quartan*, do generally observe certain determinate Seasons of the Year, and not frequently happen at others, *viz.* *Quotidians* in the *Winter*, *Tertians* in the *Spring*, and *Quartans* in the *Autumn*; but that rarely *Intermittents* begin in the Summer. In the several Constitutions of these Seasons he supposes our Blood and other Juices obtain likewise different Constitutions, which he

explains ; so that there must, in general, be a difference in the circumstances of Diseases, though of the same Denomination, which happen in either of them. But to sign a reason why we have *Periodical* returns, he considers, *First*, That we generally *Eat* at determinate Times, from whence the admission, as well as distribution of the *Nutritious Juice* (which he before supposed to be by the *Nerves*) must be *Periodical*. But this being not sufficient, since most persons eat oftner than once a day, he considers, *Secondly*, That we sleep ordinarily but once in 24 Hours, at which time the *Brain* being relaxed, admits the Suppliments of Nourishment for the next day, as upon waking it begins, and all day after continues gently to protrude it (at least more vigorously) through the whole *Fibrous System* ; in which time it advances in it's Maturation, as usually toward becoming a fit *Nutritious Juice*, so now, being in some degree incongruous, toward a *Febrifick Ferment* ; so that, *ceteris paribus*, a *Diary* Period (unless when a greater, or more depraved, quantity than usual of *Heterogeneous* matter abounds) may be hence expected. But to determine the reason of longer *Periods*, he supposes, *Thirdly*, We must have recourse to the different Constitutions of the year : And in the *Spring* the Air abounding (by general consent) with *Nitrous* Particles, which though active, and thence apt to exagitate and exalt a *Morbifick Ferment*, yet helping to constitute the Principles of *Vitality*, and in some degree corroborative of the *Tone* of the *Glandules*, they hinder, in some measure, the encrease of the *Morbid* matter in them, so that so much cannot be congested in the *Systeme* of the *Nerves* and *Fibres* as to rise to a degree of *Vellication* able to produce a *Paroxysme* ; whence there is a necessity of a *second Night's supplies* to yield a proportionable quantity to the effect. But in the *Autumn*, *Acids* abounding, which both in some degree repress *Fermentation*, and withal help to constringe the *Tone* of the parts,

parts, the Congestion cannot be made so suddenly as in other Seasons ; and therefore, since the admission of the matter is had in Sleep, enough cannot be taken in under a *second Night's Interval* to supply enough for a Turgescence ; which the nature of the matter in some measure hinders from rising up to it.

The *longer Periods* he supposes are deducible from a greater disposition to Acidity in the *Nervous Juice*. And that the Seat of the Distemper is there, the Consideration of the *Symptoms*, wholly or chiefly affecting the *Nervosum Genus* in those longer Periods, so far as he has observed, seem to him a cogent Argument.

As to the *Anomalies* of them, he supposes them, in the *Fourth* place, deducible partly from the *Variety* of the Constitutions of *Particular Persons*, partly from particular *Changes* of the *Air, Aliments, &c.* and from *external occasions*, which cannot be enumerated.

Then he comes to consider the *Method of Cure* : And since several Administrations are necessary (some at one time of the Distemper, some at another ; and some for some Persons, some for others, according to various Circumstances) he goes through them, and endeavours to render an Account in general, on what Score *Plebotomy, Vomits, Purgers, Diaphoreticks, Diureticks, Altering Medicines, as Digestives, Specificks, Opiats, and Pericarpia* produce their effects, when 'tis proper in their turns to use them. After which he delivers a sufficient account of the particular Methods which he conceives proper for each of the three sorts of intermitting Fevers.

But since the *Cortex Peruvianus* is become so Celebrated, as well as it is an effectual Remedy for them all, he in an entire Chapter offers an *Ætiology* of it, agreeably to the Hypothesis he has laid down of their Source, and from Mechanical Principles. To form which, he, 157, enumerates several *Observables* relating to its known effects and circumstances of its Exhibition. 2ly. He considers

siders the *Texture* of it, which he takes to be very compact, and not quickly dissoluble by the Ferments 'tis now to meet with. *3ly.* He enquires into the *Scene* of its Operation, where he traces it through the *ways of the Chyle*, those of the *Blood*, the *Habit* of the Body, and the *Systema Nervorum*, and thinking (for the Reasons he alledges) 'tis not to be found, adequately to the effect, in the three former, he places it in the last, and endeavours to make it out from several Deductions. *4ly.* He describes in a Mechanical way the *manner of its Action*; supposing that some of its Particles having undergone several Comminutions (tho not a Dissolution) from the various Firmments they have passed, arrive at last, with the Blood, at the Brain; and being, with some of its Vehicle, separated there from the grosser parts of both, in the Cortical Glandules, they are admitted into the tubulated Roots of the Nervous Tree, by the way that the Nutritious Juice is supplied; into which those of them, which are not small enough to pass those Straits along with the Juice, being just admitted, stick there till other appealing Substances give them a farther Comminution, and so pretrude them along: But on the score of their irregular sides he supposes they leave room (indeed) between them and the sides of those round Vessels for the finer Juice to pass, but preclude the entrance to the grosser (which he has supposed, is the matter that makes the Febrile Ferment) and thereby prove no way injurious to the Animal Functions, since enough, and that the purest, may pass by them to actuate the Nerves. Whilst these Particles stick here, he conceives that by softly concinating the including Coats with their Angles, they may cause them to contract themselves to their due Tone, and they crumbling by degrees as that is doing, leave the part in its natural Estate, and so (without a fresh Cause) the Distemper ceases. *5ly.* He endeavours to shew, that all the mentioned *Observables* agree to his Hypothesis. *Lastly,* To accomodate these Speculations to Practice, he lays down briefly the Method to be observed in relation to the giving it; thinking withal, it may be useful in most Chronical Periodical Distempers; and concludes with a couple of Histories, to confirm his Notion of the Seat of the Distemper, and the Scene of the Operation of the Cortex.

His subjoined Discourse concerning the Spiral Fibres of the Intestines having been many years since published in *English* in the Philosophical Transactions, he now, at the importunity of some Friends, has thought fit to publish in *Latine*.

---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of March, 1693.*

---

## The CONTENTS.

- I. *Some farther Considerations on the Bressaw Bills of Mortality, by the same Hand with the former. 196.*  
 II. *What a Compleat Treatise of Navigation should contain: Drawn up in the Year 1685. by Sir William Petty, late Fellow of the R. Soc. III. A Letter from Sir Robert Redding, late S. R. S. concerning Pearl-Fishing in the North of Ireland, communicated by Dr. Lister, R. S. S. IV. An Account of two Plants lately brought from the Cape of Good Hope, communicated by Dr. Hans Sloan, R. S. S. V. The Extracts of Four Letters from Mr. John Banister to Dr. Lister, R. S. S. VI. An Account of the digging and preparing the Lapis Calaminaris, in a Letter from Mr. Giles Pooley to Sir Robert Southwell, Pres. R. S. VII. An Arithmetical Paradox concerning the Chances of Lotteries: By the Honourable Francis Roberts, Esq; S. R. S. VIII. An Account of Books. 1. Horti Indici Malabarici. Pars Quarta, Quinta & Sexta. With some Remarks upon them. By Tancred Robinson, M. D. S. R. S. 2. A Treatise of the Roman Ports and Forts in Kent, by William Somner, &c. Oxon. in 8°. 1693.*

I. *Some further Considerations on the Breslaw Bills of Mortality. By the same Hand, &c.*

S I R,

WHAT I gave you in my former Discourse on these Bills, was chiefly designed for the Computation of the Values of Annuities on Lives, wherein I believe I have performed what the short Period of my Observations would permit, in relation to exactness, but at the same time do earnestly desire, that their Learned Author Dr. *Newman* of *Breslaw* would please to continue them after the same manner for yet some years further, that so the casual Irregularities and apparent Discordance in the Table, *p.* 599. may by a certain number of Chances be rectified and ascertain'd.

Were this *Calculus* founded on the Experience of a very great number of Years, it would be very well worth the while to think of Methods for facilitating the Computation of the Value of two, three, or more Lives; which as propos'd in my former, seems (as I am inform'd) a Work of too much Difficulty for the ordinary Arithmetician to undertake. I have sought, if it were possible, to find a Theorem that might be more concise than the Rules there laid down, but in vain; for all that can be done to expedite it, is by Tables of Logarithms ready computed, to exhibit the *Rationes* of *N* to *T* in each single Life, for every third, fourth or fifth Year of Age, as occasion shall require; and these Logarithms being added to the Logarithms of the present Value of Money payable after so many Years, will give a Series of Numbers, the Sum of which will shew the Value of the Annuity sought. However for each Number of this Series two Logarithms for a single Life, three for two Lives, and four for three Lives, must necessarily be

be added together. If you think the matter, under the uncertainties I have mentioned, to deserve it, I shall shortly give you such a Table of Logarithms as I speak of, and an Example or two of the use thereof: But by Vulgar Arithmetick the labour of these Numbers were immense; and nothing will more recommend the useful Invention of Logarithms to all Lovers of Numbers, than the advantage of Dispatch in this and such like Computations.

Besides the uses mentioned in my former, it may perhaps not be an unacceptable thing to infer from the same Tables, how unjustly we repine at the shortness of our Lives, and think our selves wronged if we attain not Old Age; whereas it appears hereby, that the one half of those that are born are dead in Seventeen years time, 1238 being in that time reduced to 616. So that instead of murmuring at what we call an untimely Death, we ought with Patience and unconcern to submit to that Dissolution which is the necessary Condition of our perishable Materials, and of our nice and frail Structure and Composition: And to account it as a Blessing that we have survived, perhaps by many Years, that Period of Life, whereat the one half of the whole Race of Mankind does not arrive.

A second Observation I make upon the said Table, is that the Growth and Encrease of Mankind is not so much stinted by any thing in the Nature of the *Species*, as it is from the cautious difficulty most People make to adventure on the state of *Marriage*, from the prospect of the Trouble and Charge of providing for a Family. Nor are the poorer sort of People herein to be blamed, since their difficulty of subsisting is occasion'd by the unequal Distribution of Possessions, all being necessarily fed from the Earth, of which yet so few are Masters. So that besides themselves and Families, they are yet to work for those who own the Ground that feeds them: And of  
such

such does by very much the greater part of Mankind consist; otherwise it is plain, that there might well be four times as many Births as we now find. For by computation from the Table, I find that there are nearly 15000 Persons above 16 and under 45, of which at least 7000 are Women capable to bear Children. Of these notwithstanding there are but 1238 born yearly, which is but little more than a sixth part: So that about one in six of these Women do breed yearly; whereas were they all married, it would not appear strange or unlikely, that four of six should bring a Child every year. The Political Consequences hereof I shall not insist on, only the Strength and Glory of a King being in the multitude of his Subjects, I shall only hint, that above all things, Celibacy ought to be discouraged, as, by extraordinary Taxing and Military Service: And those who have numerous Families of Children to be countenanced and encouraged by such Laws as the *Jus trium Liberorum* among the *Romans*. But especially, by an effectual Care to provide for the Subsistence of the Poor, by finding them Employments, whereby they may earn their Bread, without being chargeable to the Publick.

II. *What a Compleat Treatise of Navigation should contain. Drawn up in the Year 1685. by Sir William Petty late Fellow of the Royal Society.*

I. **W**Hat *Arithmetick* in whole Numbers and Fractions, as also in *Decimals* and *Logarithmes*, is necessary for the same? And what *Books* are best for teaching so much thereof?

2. What *Vulgar Practical Mechanical Geometry* performable by the Scale and Compass is sufficient?

3. What *Trigonometry*, Right Lined, and Spherical will suffice?

4. How many Stars are to be known?

5. What *Instruments* are best for use at Sea, with the Construction of them, and the manner of using them?

6. The whole Skill of the *Magnet*, as to the directive Vertues thereof, and all the Accidents which may befall it.

7. The *Hydrography* of the Globe of the Earth, the Perspective of the Coasts, and the Description of the under-water-bottom of the Sea.

8. The knowledge of *Winds* and *Meteors*, so far as the same is attainable.

9. The History and Skill of all sorts of *Fishings*.

10. The Art of *Medicine* and *Chyrurgery*, peculiarly for the Sea.

11. The Common Laws of the *Admiralty*, and *Jurisdiction* of the Sea.

12. The several *Victuallings* and *Cloathings*, fit for Sea-men.

13. The whole Science of *Ebbing* and *Flowing*, as also of *Currents* and *Eddyes* at Sea.

○

14. *Dro.*

14. *Dromometry*, and the Measures of a Ships Motions at Sea.

15. The *Building* of Ships of all sorts, with the several *Rigging* and *Sails* for each *Species*, and the *Use* of all the *Parts* and *Motions* of a *Ship*.

16. *Naval Oeconomy* according to several *Voyages* and *Countries*.

17. The *Art* of *Conting*, *Rowing* and *Sailing* of all the several sorts of *Vessels*.

18. The *Gunnery*, *Fire-works* and other *Armatures* peculiar to *Sea* and *Sea-Fights*.

19. The *Art* of *Loading* and *Unloading* the Chief *Commodities*, to the best *Advantage*.

20. The *Art* of *Weighing* sunken Ships and *Goods*, as also of *diving* for sunken *Goods* in deep *Water*.

21. The *General Philosophy* of the *Motion* and *Figures* of the *Air*, the *Sea*, and of *Seasons*; of *Timber*, *Iron*, *Hemp*, *Tar*, *Brimstone*, *Tallow*, &c. and of their several *Uses* in *Naval Affairs*.

22. An *Account* of *Five* or *Six* of the best *Navies* of *Europe*, with that of the *Arcenals*, *Magazines*, *Docks*, *Tards*, &c.

23. An *Account* of all the *Shipping* able to cross the *Seas* belonging to each *Kingdom* and *State* of *Europe*.

24. An *Account* of all the chief *Commercial parts* of the *World*; with mention of what *Commodities* are originally carried from, and ultimately to any of them.

25. An *Account* of the Chief *Sea-Fights*, and all other *Naval Expeditions* and *Exploits*, relating to *War*, *Trade* or *Discovery*, which hath happened in this last *Century*.

26. Of the most advantageous use of *Telescopes* for several purposes at *Sea*.

27. Of the several *Depths* of the *Sea*, and *Heights* of the *Atmosphere*.

28. The

28. The Art of making *Sea-Water fresh* and potable, and fit for all uses in Food and Physick at Sea.

---

III. *A Letter from Sir Robert Redding, late Fellow of the R. S. concerning Pearl-Fishing in the North of Ireland; communicated to the Publisher by Dr. Lister. R. S. S.*

Dear SIR,

Being in the North in *August* last, and calling to remembrance your Desires to have some of the Muscle-shells sent you wherein the Pearls were found, I stayed behind my Company one day like an old Hound from following the Stag, and bestowed it in Enquiries from others, and some small Trials in the Rivers; but having by me neither Queries to direct my Search, nor Books to inform me what had been delivered by others on this Subject, I must needs fall short in those Points that are most curious and most wanting, and take notice only of what is too common and most known in the Natural History of this Shell-fish.

I have sent you four or five of the Shells, and a few of the Pearls, though clouded and little worth, taken out of the River near *Omagh* in the County of *Tyrone*, in which County are four Rivers abounding with these Muscles, all emptying themselves into *Lough foyle*, whereon stands the Town of *Derry*, and so into the Sea. There are also other Rivers in the County of *Donegall*, a River near *Dundalk*, the *Shure* running by *Waterford*, the *Lough* called *Lough-Lean* in *Kerry*, which afford the like Fish; and no doubt there be many more that I do

not know : All these places are at the feet of very great Mountains.

The manner of their Fishing is not extraordinary, the poor People in the warm Months before Harvest is ripe, whilst the Rivers are low and clear, go into the Water, some with their Toes, some with wooden Tongs, and some by putting a sharpned Stick into the opening of the Shell take them up : And although by common Estimate not above one Shell in a Hundred may have a Pearl, and of those Pearls not above one in a Hundred be tolerably clear, yet a vast number of fair Merchantable Pearls, and too good for the Apothecary, are offered to Sale by those People every Summer Assize. Some Gentlemen of the Country make good Advantage thereof, and my self whilst there, saw one Pearl bought for 50 Shillings that weighed 36 Carats, and was valued at 40 *l.* and had it been as clear as some others produced therewith, would certainly have been very valuable. Every body abounds with stories of the good Pennyworths of the Country, but I will add but one more: A Miller took out a Pearl which he sold for 4 *l.* 10 *s.* to a Man that sold it for 10 *l.* who sold it to the late Lady *Glenanly* for 30 *l.* with whom I saw it in a Necklace ; she refused 80 *l.* for it from the late Dutchess of *Ormond*. I was informed that in the course of the River of about Sixteen Miles, there were many deep Pools, which could never have been searched by these unmechanical People, for whom I made a Dredge with some Teeth in the Knife of it to rake them out of the Sand, and in that only particular differing from the common Oyster Dredge ; as also little Hand-dredges, not unlike what I had seen Men in the River of *Thames* taking up Ballast with.

I took up many young Muscles, but these have never any Pearl in them, and do think to get some Pond or small Brook by the Rivers side to preserve them in, rather than to destroy them unprofitably.

The Natives, though very foul Feeders, will not eat the Fish, which seems to me to cut like the Oyster, blackish green; and were it not too great a Digression from the Subject, and too offensive to good Stomachs, I could entertain you with their last *Lenten* Fare, when Horse-flesh dead of Diseases, and the Blubber of a Whale cast up by chance, (when it would fly upon the opening of the Bung-hole of the Barrel like Bottle Beer) was sought for, and begged for Food, so lazy and improvident many of them are. The Shell is fastned with two Cartilages, one at each end, whereas the Oyster and Scallop are with one only in the middle. The natural Posture they keep to, neither lying on the side, as those I saw, or set up in the Sand like Eggs in Salt, with the sharp end downwards, and the opening side turned from the Torrent, as the People say, I leave to be further enquired into; but I saw them lying in part opened, and putting forth their White Fins like a Tongue out of the Mouth, which directs the Eye to them in the Water, being otherwise black as the stones in the River.

The backs of the Shells just about the Hinges on which the Valves do open are all broken and bruised both young and old, and shew the several Crusts and Scales that make the Shell, and is caused (I think till I know better) by the many great stones that are driven over them by the Floods which are most impetuous after any little Rain.

You will observe the in-sides of the shells are of an Oriental and Pearly Colour and substance like a flat Pearl, especially when first opened; and I was told by an ingenious Person living upon the place, that he had  
observed

observed in some shells under the first Coat a Liquor that was very orient and clear, that would move upon the Pressure of the Finger, but that such a Muscle never had Pearl, which Liquor I should think was the true Mother of Pearl.

The part where the Pearl lieth is in the Toe or lesser end, at the extremity of the Gut, and out of the body of the Fish between the two Films or Skins that line the shell: I was careful to leave one Pearl in its Bed; but the Fish stinks so extremely and so soon, and shrunk into nothing, that I fear it will be hard to preserve the parts entire for the Inspection.

I believe that this Pearl answereth to the Stone in other Animals, and certainly like that encreaseth by several Crusts growing over one another, which appeareth by pinching the Pearl in a Vice, and the upper Coat will crack and leap away; and this Stone is cast off by the Muscle, and voided as it is able; and many shells that have had Pearls in them are found now to have none, which will appear by these instances. The shells that have the best Pearls are wrinkled, twisted or bunched, and not smooth and equal as those that have none, as you may observe by one of the Shells herewith sent, of a lighter Colour than the rest; this shell yielded a Pearl sold for 12 £. And the crafty Fellows will guess so well by the shell, that though you watch them never so carefully, they will open such shells under the Water, and put the Pearls in their Mouths, or otherwise conceal them. That same person told me, that when they have been taking up shells, and believed by such signs as I have mentioned, that they were sure of good purchase, and refused good Sums for their shares, that yet they found no Pearl at all in many of them. Upon Discourse with an old Man that had been long at this Trade, he advised me to seek not only when the Waters were low, but in a dusky gloomy day also,

Left

Left, said he, the Fish see you, for then he will shed his Pearl in the sand: Of which I believed no more, than that some Muscles had voided their Pearls, and such are often found in the Sands.

I conceive that these Pearls if once dark will never be clear upon any alteration in the Health or Age of the Muscle, or of the Moon; and that if the first Seed be black, all the Coats superinduced will be still clouded; but yet would be glad to be directed in any further Enquiry of any amendment that may be made by the Season of the Year, Age of the Moon or Fisi, or place in the Rivers, the bottoms whereof I observed to be part sandy, part stony, and part ousey, and of a black Clay.

It may be also considered, whether brackish Water will alter the Colour; for many Muscles are driven down the Rivers Four or Five Miles within the flowing of the Tide, namely, to a place called the *Griöbin*, where the greatest Salmon-fishing is next to that of *Colerain*.

You will observe the same Pearl clear at one end, and dark at the other; it may be enquired whether the Colour ever changed from one to the other, or was primigenial, as they still continue. I shall desire your kindness in sending me some Heads of Enquiries, for I have many Acquaintance upon the place, with Directions how I may preserve the Muscle to send you, and whether such dark Pearl may not be as proper for the Apothecary as other more clear, and what better Engines you can direct us unto to take them up with, no place being deeper than 12 Feet.

I send you also herewith some Stones of an Amber Colour taken out of a Spring called *Cranbourn-Spring* near *Lough-Neab*, which the Country-People tell us grow at the end of a little Rush, and drop off, and are

to

to be found only on *May* day Eve, and good for God knows what : They look like the Germinations of some of your Salts, but in the Fire shewed no signs thereof by crackling ; they are Electrical and Angular, and being pounded, the Powder is white. I have several Stones and Minerals by me, which if I knew were acceptable to you, should be sent forwards ; but I would gladly first be assured you are not displeas'd with these Trifles from

*Yours, &c.*

Dublin, Oct. 13.  
1688.

IV. *An Account of two Plants lately brought from the Cape of Good-hope, communicated by Dr. Sloane, R.S.S.*

**A**lderman *Charles Chamberlain* having favoured the Royal Society to present them (among other natural Rarities) with two Branches of Trees and their Fruits, brought from the *Cape of Good-hope* by Mr. *Goddard*, which being very curious, and are not yet any where perfectly described, it was thought fit to publish their Figures and Descriptions ; and that the rather, because the first of them has been brought hither for its Beauty in Pots, as well as raised in *England* from the Seed brought from the *Cape of Good-hope*, where it is called the *Silver Pine*.

*Conifera salicis facie, folio S fructu, tomento sericeo, candicante, obductis, semine pennato.*

*The Silver Pine-Tree.*

THE Twig of this Tree (see the *Fig. Lit. A*) had a great many Leaves set round it very close to one another, so as to hide the Twig its self there where they grow, each of the largest of them being about Four Inches long, and  $\frac{3}{4}$  of an Inch broad in the middle where broadest, from whence they decrease towards both Extrems ending in a Point, being like those of the Osier Willow, only broader, and all cover'd over with the thickest, finest, and longest white silken Hair or Down that ever any Plant I remember to have seen has. The Cones (see the *Fig. lit. B*) are of the bigness of those of the Cedars of *Lebanon*, and of the same shape the *Cuticula* or small Skin of each Scale, being cover'd over with a white short Down or Wool, shining also like Silk. Between the Scales is lodged the Seed, (see the *Fig. lit. C*) which is almost as large as the Pine-Nut, near the same shape, of a dark brown Colour, and having a rising eminent Line or Belly running through the middle of it from end to end. This Seed lies in a thin reddish brown Membrane, which has on its top Four Feathers like those belonging to the Seeds of *Clematis*, which being between the Scales, and rising above them, adds a very great Beauty to the Cone, and may likewise serve for Wings by means of the Wind to loosen or carry the Seeds to distant places, thereby propagating its self. The Seed with its Membrane and Wings is well expressed in the *Fig. lit. D*.

This grows at the *Cape of Good-hope*, where I am assured by Mr. *James Pettiver*, that it is planted by the *Dutch* in their Famous Garden, being thought one of its greatest Ornaments.

The first Author I have observed that seems to mention this is Captain *Nicholas Downton*, who speaking of things he observed by the *Cape of Good-hope apud Purchas, lib. 3. cap. 12. § 1. p. 276.* says, 'In divers places  
'scatteringly we saw some Trees of small Stature, some-  
' what broad topped, bearing a Fruit in bigness and pro-  
' portion like a Pine-Apple, but the Husk not so hard  
' and spungie, the Seed whereof were devoured by  
' the Birds, the Husks remaining on the Trees, the  
' Leaves whereof were in form of our Housleek in *Eng-  
' land*, but not so thick.

Mr. *Breynius* likewise in his first Century of Exotick Plants, pag. 22. mentions a larger sort of *Frutex Æthiopicus Conifer foliis cneori, salici æmulus*, which perhaps may be this.

Dr. *Plucknet* in the Third Part of his *Phytographia, Tab. 200.* has figured this under the name of *Leucadendros Africana Arbor tota Argentea. sericea foliis integris, Atlas Tree D. Herman*, which was the top of one of these Young Trees which came to Mr. *Doody*.

2. *Conifera Alypi folio, seminibus pennatis pluribus in medio coni conglomeratis, & non inter squammas aliorum conorum more nascentibus!*

The Branch of this Tree (see the *Fig. lit. E*) had a brown coloured smooth Bark with a whitish hard Wood, and small pith. The Leaves (expressed to their natural Bigness *lit. F*) were round it without any Order, very thick set, having no Foot-stalks, being about 2 inches and  $\frac{1}{2}$  long, and about  $\frac{1}{3}$  of an inch broad near the farther end where broadest, smooth, hard, and of a brownish or dirty green colour; on the top of the Branch comes the Fruit, (see the *Fig. lit. G*) which is surrounded by three or four Twigs (see the *Fig. lit. H, I, K*) overtopping it, and with their Leaves almost hiding it. It is about Five Inches long, and is made up of many Scales hard and red enclosing one another, the lowermost  
and

and outwardmost being very short, the inwardmost Four Inches long, each of them ending in a Point, some Scales having on their out-sides a gummy Juice. In the middle of these Scales were the first Rudiments of many Seeds, the same not being fully ripe, each of which (see the *Fig. lit. L*) is set about with a great quantity of  $\frac{1}{2}$  inch long, yellow fine silken Down, (see the *Fig. lit. M*) having a two Inches long *Stylus* or String, (see the *Fig. lit. N*) and yellowish Membranes enclosing the *Stylus* and *Tomentum*, being feathered at top with Feathers for the same purposes, and like the former.

I cannot find this mentioned by any Author, unless it be that of *Breynius* in his Appendix to his first Century, p. 22. *Frutex Africanus, fruticis terribilis Narbonensium folio capitulis oblongis squammosis*, gathered by *Wilhelmus Ten Rhine*, and sent to him from the *Cape of Good-hope*.

---

V. *The Extracts of Four Letters from Mr. John Banister to Dr. Lister, communicated by him to the Publisher.*

S I R,

TO do right to the Memory of my Friend Mr. *Banister*, who indeed was a very Learned and Sagacious Naturalist; had lived 14 years at least in *Virginia*, and therefore, having employed much of his Time that way, was most likely to have given us a very good Natural History of that place. I understand after his Death the Government of that place took special care of his Papers to seal them up, and transmit them to my Lord Bishop of *London* here, in

whose Hands they are, and therefore I doubt not but they will be carefully and speedily publish'd, unless possibly, it may not be thought as proper, being posthumous and incoherent Pieces, to have them printed in your Transactions, which is a saving Register of many good things, which else would be in danger to be lost; besides the advantages of Design, which here will cost the Author nothing, and which is the great Trouble in the Publication of things relating to Natural History; you are best able to conduct and manage such Papers through the Hands of unruly Men, such as the Gravers are, as being excellently well skilled in that Art. However, I think it will be very obliging in you, to offer to my Lord of London your Service in that kind, before my Lord shall have otherwise disposed of them.

In the meantime, to give you a slight touch out of my Papers of what he was doing, I will extract a Line or two out of Three or Four Letters which I received from him.

Virginia, May 5. 1668.

*I have sent you what Variety of Land or Fresh-water Snails our Country affords, at least what I have observed in it, of those I did receive about 10 or 12 Species, which I have taken care to Figure.*

April 19. 1689.

*I have sent you what Muscles our Freshes afford, at least what as yet come within my Observation.*

I received Six Species, which I have caused very carefully to be Figured and Graved.

*I have also sent a parcel of Drawings rowled up for my Lord of London; they are most of them of Plants com-*

mon in our Woods, but possibly may be Strangers to the Gardens of Europe.

The Phalangium Spurium is not that of Zanoni; nor the Dipetalos Brasiliæna of Margrave. To the Description I made of it in the Year 1679. I find this Quære, An Gentianella Indica Bontii? We have an other small one of this kind, that runs upon the ground, which I have not yet drawn. The Mercurialis differs little from, if it be not the same with the Mercurialis Zeylanica, &c. Herman. Cat. Leyd. App. Vide Mr. Ray in App. p. 1854.

This is the Catalogue of the rest of the Figures and Names of Plants then sent.

Periclymenum perfoliatum semper virens & florens.

Helleborine Ophioglossii Folio.

Securidaca trifolia flore patulo cæruleo, radice Glycyrrhizæ sapore.

Cacalia foliis rotundioribus ad caulem sessilibus.

Crotolaria Americana hirsuta minor, herbacea, caule ad summum sagittato Herman. Append.

Pseudo-Lathyrus luteus, glaber, & hirsutus, siliquis tumentibus nobis in Catalogo.

Here he makes mention of a Catalogue which he sent in the Year 1679. to the Bishop of London.

Convolvulus monococcus.

Mercurialis Hermaphroditica tricoccus, seu Julifera simul & fructum ferens. Mercurialis Zeilanica tricoccus cum acetabulis. Kupampruja Zeilanensis, Herman. Cat. Leyd. fortè.

Fungus Holofericeus infernè lamellatus, supernè ab insertione, concharum more striatus, & transversim fasciatus.

Fungus

Fungus parvus rubellus subtus porosus.

Fungus pulverulentus, cute duplici, coriacea scilicet & membranacea tectus.

Muscus rupestris repens claviculis foliosis, erectis, quadratis.

Pseudophalangium ramosum, majus, erectum.

Blitum Spinosum.

Arisarum Tryphyllon.

Laurus Tulipifera baccis rubellis, cono erecto capsulato inclusis.

Muscipula Regia, seu Lychnis viscosa flore amplo cocinco.

Ricinus lactescens fici foliis, spinulis mordacibus armatus.

Ulmaria major trifolia flore amplo pentapetalo.

Gnaphalium alterum Americanum.

N. 1, 2. (N. B. These Tables I suppose are with the rest of his Papers.)

*At the bottom of the Table of Insects are of those sort of Flies that Mouffet calls Musca Lupus. I have observed that these, and some others, as the Tabani, Afili, &c. that have but two Wings, have growing out of their Body, under each Wing, a small flexible Apex or Pointel, with which they poise their Body, and keep it in Æquilibrium, as the Dancer of the Rope does with his Pole; for pull these off, and their Flight is short and unsteady: Nor can they, tho' they have the use of their Wings, guide themselves so, as to keep themselves from the ground, or to avoid striking against, whatever is in their way.*

At the Top of the Table, *Tab. n. 1. Vespa Ichneumon fusca. 2. Vespa Ichneumon atræ-cærulea. 3. The Nympha common to them both. 4. Their Houses which they make of Dirt. 5. The Spiders with which they hatch their*

their Young. 6. A spurious Brood of some other Ichneumon sometimes found in their Nests.

Virginia, Aug. 2. 1690.

Amongst a parcel of Plants, Shells, Insects, &c. by me transmitted this year, (to whom I know not; he means, I suppose, Draughts and Figures) be pleased to accept of this short Description of a Land-Snail, whose Figure is that N. 1. 1. The out-side is of an Ash colour, inclining to a Yellow, the in-side White, with a Blush of Red; and in the middle of the Entry on the Inturn of the Shell, grows a small white Tooth, or Protuberance. But what is most remarkable, the Shell its self is transparent; and you may plainly perceive by the Opacity there, that the Body of the Animal lies near the Spiral String or Center, on which the Arch is turned, and that the Empty part of the Shell is spread with a thin spotted Film. Near the Tooth, but more inward, is to be seen a little waterish Speck, which by a kind of Systole and Diastole contracts and dilates its self; from this proceeds a lympid Trunk, which runs into the Film, and there divides into Branches: These grow lesser, and spread as the Animal recedes or approaches the Mouth; and when it is out, extend themselves to the very Lip of the Shell. I suppose the same to be in all, at least the Land-kind, tho' not easily to be discerned. It is likely also, that the Film, the Nautilus or Carvil (as the Sailors call it) exerts, may be analogous to this.

This Description of the Heart of a Snail agrees well with the Anatomy thereof, made, and long since published by *Harder*; also with that other Anatomy of the same Animals, by *Franciscus Redi*.

Virginia,

Virginia, May 12. 1692.

*I have sent you another parcel of Fresh-water and Land Snails, in which I believe some are new. [And so there was divers Species, all which I have carefully caused to be graved.] There is a small one of the Land-kind, with a dented Aperture, that I formerly sent; Time had worn that Shell smooth and white; but I lately found it with an outward Coat, on which it is hirsute, or rather finely echinated. I am apt to believe that these, nor hardly any else are dented, till they are at their full growth; for you will find several small ones amongst these with an open entrance, that seem to belong to this kind.*

*I hitherto observed very little Variety of Naked Snails; I know of but one kind, which is a small Ash-coloured and spotted one, and milkey like yours, Tit. XVI. but some of these I would have sent, but, &c.*

I send you the Originals, that you may see I have done fairly by my Friend in the Extracts; which I desire you to keep among the Society's Papers.

April, 18. 93.

Yours, &amp;c.

---

VI. *An Account of digging and preparing the Lapis Calaminaris, in a Letter from Mr. Giles Pooley to Sir Robert Southwel President of the R. S.*

S I R,

**I** Promis'd a long while ago to give you an Account of the *Lapis Calaminaris* which is digged and prepared here near me; that I have not, as I intended long before

before this performed that Promise, I hope your kindness will excuse, being I have been taken off by some necessary occasions from making my Enquiries hitherto concerning it ; and understanding that it did not require any great hast, so that I hope this following Account will not come too late.

As to the finding out the *Calamine*, which I think the first thing to inform you of, the *Groovers* tell me there is no certainty at all, but that it is a meer Lottery : They are neither certain of it from the Surface of the Earth, which, as they observe, gives little or no signs thereof ; sometimes they say an oily Steam and Smell ariseth out of the Earth where they guess some Mines to be, but not *Calamine* ; nor from the Nature of the Ground, it being found sometimes in Meadows, sometimes in Arable, sometimes in Pasture ; and as I have observed, most commonly in barren and rocky Ground : Neither from the Colour or Taste of the Waters running thereabouts, they being much of the same Colour, Taste, Clearness and Wholsomness with other Water : Nor from the withering of the Grass upon the Superficies of the Earth, or the Leaves of the Trees, they being as fresh where *Calamine* lies, as in any other place. But this I observe, that they always dig for it upon, or near the Hills ; for they expect none in those Grounds which have no Communication with Hills.

The Method they take for finding out a Vein is by digging a Trench as deep as till they come to the Rocks where they expect it lies, across the place where they hope for a Course ; which Trench they generally dig from North to South, or near upon that Point, the Courses usually lying from East to West, or at Six a Clock, as their Term is. Though this is not constant neither ; for sometimes the Courses, Seams or Rakes as they call them, lie at Nine a Clock, and sometimes are perpendicular, which they call the High time of the  
Q
Day,

Day, or Twelve a Clock; and these Courses they esteem the best. These Seams or Courses run between the Rocks, generally wider than those of Lead-Ore, unless they are inclosed in very hard Cliffs, and then they are as narrow as the Veins of Lead. The Colour of the Earth where *Calamine* lies, is generally a yellow Grit, but sometimes black; for all Countries, as they term their under-ground Works, are not alike. *Calamine* it self is of several Colours, some white, some reddish, some greyish, some blackish, which is counted the best; but when this is broken, it is of several Colours. In working for it below in the Countries, they use the same way and Instruments as they do in Lead-Mines; and sometimes they light upon a good quantity of Lead, but always find some Eyes of Lead among the *Calamine*, which in ordering of it they separate: Though I think in Lead Mines they do not always find *Calamine*. In landing of the *Calamine* some pieces are bigger than others of different sizes, as other Stones are, and mixt with the gritty Earth; yet I have been informed by a Person concerned in these Works, that they have found one entire piece of 8 or 10 Tun, which by reason of its bigness was forc'd to be broken in the Groove before it could be landed; but generally in these Grooves where I made my Enquiry, it riseth in small Particles, some more, some less, and some about the bigness of a Nut, and this they call a small *Calamine*. In ancient Works, (which are those that have been forsaken and afterwards workt in again) Damps and Staunches sometimes arise, but never in new Works; but that these Damps arise, an experienc'd Groover tells me is the Fault of those Workmen, that do not take care to carry Air along with them, which is done by Air-Shafts, as in Lead-Mines.

When

When they have landed a good quantity of this *Calamine*, which is done by winding it up in Buckets from their Works, they carry it away to the places where they wash, clean or buddle it, as their Term is, which they perform after this manner. They enclose a small piece of Ground with Boards or Turfs, through which a clear Stream of Water runs ; within this Enclosure they shovel their *Calamine* with the rest of the impure and earthy parts ; and these impure and earthy parts the running Water which comes in at one end of the Enclosure carries away at the other end, and leaves the Lead, and the *Calamine*, and the other heavier stony and sparry parts behind ; and for the better cleansing or buddling the *Calamine* while it is in this Enclosure, they often turn it, that so the Water passing through may wash it the better : When they have thus washed it with this running Stream as clean as they can, having rak'd up the bigger parts both of the Lead and the *Calamine*, they afterwards put the smaller parts, that they may lose none of their Ore, into Sieves made of strong Wire at the bottom ; and these Sieves, with the *Calamine*, Lead, and the Remainder of the earthy, sparry and stony parts which the Water could not wash away, they often dip and shake up and down in a great Tub of Water, by which shaking of the Sieves, the parts of the Lead which is mixt amongst the *Calamine* sink or pitch down to the bottom of the Sieves, as being heaviest, the parts of the *Calamine* in the middle, and the other sparry, stony and trashy parts rise up to the top, which as they rise, they skim off, and throw among the rest of the Rubbish, and then they take off the *Calamine*, and after that the Lead. When they have thus cleansed the *Calamine* as well as they can, it being not yet clean enough, they are forc'd to spread it upon a Board, and so pick out with their hands the trash and stones that remain. I cannot tell whether you will

apprehend this Description of their buddling the smaller *Calamine*; but you must know that all of it doth not require so much trouble; for some riseth big enough out of the Works to be cleansed and pickt fit for the Calcining Oven without all this Charge and Pains: And I have seen several Loads of this great *Calamine*, which had no mixture of Earth or Trash in it.

After they have prepared their *Calamine* by washing and picking, they then carry it to the Oven, which, at least that which I saw, is much bigger than any Bakers Oven, and made much in the same Fashion, only this way of heating, burning or baking the *Calamine* is different; for it is not done as bread is; for they cast in their Coals into a Hearth made on one side of the Oven, which is divided from the Oven it self by a Hem or Partition made open at the top, whereby the Flame of the Fire passeth over, and so heats and bakes the *Calamine*. They let it lie in the Oven for the space of Four or Five Hours, the Fire burning all the while, according to the strength of the *Calamine*, some being much stronger than other, and so requiring longer time; and while it continues in the Oven, they turn it several times with long Iron Cole-rakes; when it is sufficiently burnt, baked and dried, they beat it to a Powder with long Iron Hammers like Mallets, upon a thick Plank, picking out what Stones they find amongst it; so that at last the *Calamine* is reduced to Dust: From the Oven it is conveyed in Sacks to some Port, where being bought by the Merchants, it is carried beyond-Sea, commonly I think to *Holland*, whether I refer you to be further informed concerning the use of it. I made enquiry what Medical or other Vertue there was known to be in it, and I have been informed by several credible Persons, that the Dust of *Calamine*, contrary to other Dust which blinds, doth conduce much to the curing of sore Eyes  
of

of Men, and that it is frequently made use of for the taking of Films from the Eyes of Horses and other Beasts. I hear also that they sell good quantities of it to the Druggists of *London*, but for what use I know not. This is all I could learn concerning *Calamine*. If I have omitted any thing wherein you are desirous of further Information ; or if in any other Concern of this Nature I can be serviceable, you may freely command,

Wrighton,  
Oct. 25. 84.

Tours, &c.

VIII. *An Arithmetical Paradox, concerning the Chances of Lotteries, by the Honourable Francis Roberts, Esq; Fellow of the R. S.*

**A**S some Truths (like the *Axiomes* of *Geometry* and *Metaphysicks*) are self-evident at the first View, so there are others no less certain in their Foundation, that have a very different Aspect, and without a strict and careful Examination rather seem repugnant.

We may find Instances of this kind in most Sciences.

In *Geometry*, That a Body of an infinite Length may yet have but a finite Magnitude.

In *Geography*, That if *Antwerp* be due East to *London*, for that reason *London* cannot be West to *Antwerp*.

In *Astronomy*, That at the *Barbadoes* (and other places between the Line and Tropick) the Sun, part of the Year, comes twice in a Morning to some Points of the Compass.

In *Hydrostaticks*, That a hollow Cone (standing upon its Basis) being fill'd with Water, the Water shall press the bottom with three times the Weight, as if the same Water was frozen to Ice; and Figures might be contrived to make it press a hundred times as much.

These Speculations, as they are generally pleasant, so they may also be of good use to warn us of the Mistakes we are liable to, by careless and superficial reasoning.

I shall add one Instance in *Arithmetick*, which perhaps may seem as great a Paradox as any of the former.

There are two Lotteries, at either of which a Gamester paying a Shilling for a Lot or Throw; the First Lottery upon a just Computation of the Odds has 3 to 1 of the Gamester, the Second Lottery but 2 to 1; nevertheless the Gamester has the very same disadvantage (and no more) in playing at the First Lottery as the Second.

It looks very like a Contradiction, that the Disadvantage should be no greater in playing against 3 to 1 than 2 to 1, but it may thus be resolv'd.

Let the  $\left. \begin{array}{l} 1\text{ sh.} \\ 2\text{ d.} \end{array} \right\}$  Lottery consist of  $\left. \begin{array}{l} 3 \\ 4 \end{array} \right\}$  Blanks and  $\left. \begin{array}{l} 3 \\ 2 \end{array} \right\}$  Prizes of  $\left. \begin{array}{l} 16\text{ pence} \\ 2\text{ shill.} \end{array} \right\}$  a piece.

In the first Lottery the Gamester hazards a Shilling to win a Groat, and the Chances being equal, it is evident there is 3 to one against him.

In the Second Lottery the Gamester ventures a Shilling against a Shilling, and the Lots being 4 to 2, his Disadvantage is 2 to 1.

And a Lot at either of them being truly worth just 8 Pence, (*viz.* the 6th part of 3 times 16 Pence, or twice 2 Shillings) the Disadvantage must be the very same

same in both Cafes, that is, the Gamefter pays a Shilling for a Lot that is worth but 8 Pence.

The Method of finding this Answer being fomewhat out of the common Road, I fhall here add it, and thereby infinite Solutions of the fame kind may be difcovered.

1<sup>st</sup> Lottery.

2<sup>d</sup> Lottery.

Let  $a$  = the number of Blanks.  $m$  = the number of Blanks  
 $b$  = the number of Prizes.  $n$  = the number of Prizes  
 $r$  = the Value of a Prize.  $s$  = the value of a Prize.

$i$  = to what you pay for a Lot, viz. a Shilling.

So the Lottery has it's Chances for  $i$ , and the Gamefter his for  $r - i$ . Now the true Odds confifting of the compounded Proportion of the Chances and the Values, viz.  $\frac{a}{b}$  and  $\frac{i}{r-i}$ , the Share of the Lottery will be  $a$ , and that of the Gamefter  $r b - b$ . Therefore as the present cafe stands, the first Lottery must be  $a = 3 r b - 3 b$ , and by the like reasoning the second Lottery will be  $m = 2 s n - 2 n$ . Now the Value of a Lot being the Sum of the Prizes divided by the number of Lots, ( which must be equal in both Lotteries ) it yields

$$\frac{r b}{a + b} = \frac{s n}{m + n}$$

So to proceed.

$\left. \begin{array}{l} a \\ b \\ r \\ m \\ n \\ s \end{array} \right\} = ?$	$\left. \begin{array}{l} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{array} \right\}$	$\left. \begin{array}{l} a = 3 r b - 3 b \\ m = 2 s n - 2 n \\ \frac{r b}{a + b} = \frac{s n}{m + n} \\ (*) \\ (*) \\ (*) \end{array} \right\}$
---	---	---

$q = ?$	7	Let $\frac{rb}{a+b} = q$
$7 * a + b$	8	$rb = qa + qb$
$8 \times 3$	9	$3rb = 3qa + 3qb$
$1 + 3b$	10	$3rb = a + 3b$
9, 10	11	$3qa + 3qb = a + 3b$
<b>Scope</b>	12	If $a = 0$ to avoid negative Numbers.
11, 12	13	$3b = 3qb$
$13 \div 3b$	14	$q = 1$
12, 14	15	$q > 1$ makes $a < 0$ $q < 1$ makes $a > 0$
<b>Scope</b>	16	If $b = 0$
11, 16	17	$3qa = a$
$17 \div 3a$	18	$q = \frac{1}{3}$
16, 18	19	$q < \frac{1}{3}$ makes $b < 0$ $q > \frac{1}{3}$ makes $b > 0$
3, 7,	20	$\frac{sn}{m+n} = q$
$20 * m + n$	21	$sn = qm + qn$
21 * 2	22	$2sn = 2qm + 2qn$
$2 + 2n$	23	$2sn = m + 2n$
22, 23	24	$2qm + 2qn = m + 2n$
<b>Scope</b>	25	If $m = 0$
24, 25	26	$2qn = 2n$
$26 \div 2n$	27	$q = 1$
25, 27	28	$q > 1$ makes $m < 0$ $q < 1$ makes $m > 0$
<b>Scope</b>	29	If $n = 0$
24, 29	30	$2qm = m$
$30 \div 2m$	31	$q = \frac{1}{2}$
29, 31	32	$q < \frac{1}{2}$ makes $n < 0$ $q > \frac{1}{2}$ makes $n > 0$
15, 19, 28, 32	33	that $a b m n$ may be $> 0$ , $q$ must be $> \frac{1}{2} < 1$

$$\begin{array}{r|l}
 33, 4 (*) & 34 \text{ Let therefore } Q = \\
 7, 34 & 35 \frac{rb}{a+b} = \frac{2}{3} \\
 35 *, 10 & 36 3rb = 2a + 2b = a + 3b \\
 36 - & 37 a = b
 \end{array}$$

$$\begin{array}{r|l}
 20, 34 & 38 \frac{sn}{m+n} = \frac{2}{3} \\
 38 * - & 39 3sn = 2m + 2n \\
 39 * \frac{2}{-} & 40 6sn = 4m + 4n \\
 23 * 3 & 41 6sn = 3m + 6n \\
 40, 41 & 42 4m + 4n = 3m + 6n \\
 42 - & 43 m = 2n
 \end{array}$$

$$\begin{array}{r|l}
 1 \div 37 & 44 1 = 3r - 3 \\
 44 + 3 & 45 3r = 4 \\
 2 \div n, 43 & 46 2 = 2s - 2 \\
 46 + 2 & 47 2s = 4
 \end{array}$$

$$\begin{array}{r|l}
 5 (*) & 48 \text{ Let } A = 3 \\
 37, 48 & 49 B = 3 \\
 45 \div 3 & 50 R = \frac{4}{3}, \text{ id est, 16 Pence.} \\
 6 (*) & 51 \text{ Let } M = 4 \\
 43, 51 & 52 N = 2 \\
 47 \div 2 & 53 S = 2 \quad 2 \text{ Shillings.}
 \end{array}$$

## VIII. An Account of BOOKS.

I. *Horti Indici Malabarici.*

Pars Quarta, Quinta &amp; Sexta.

With some Remarks upon them by T. R. M. D.  
S. R. S.

THE three first Volumes of this Work having been taken notice of in the *Philosophical Transactions*, N. 155. from pag. 100. to pag. 109. I shall continue the Account of the rest, in which the *Heer Van Rheedee* (lately the Worthy Governour of *Malabar*, now chief *Intendant* of all the *Dutch Colonies in India*) gives a most illustrious Specimen of his Industry and Generosity, as also a noble Example to other *Residents* in Foreign Countries, having at leisure Hours Collected, Design'd, Painted, Describ'd, and learnt the Natural Products, together with their Uses in Trade, Diet and Medicine; and all in order to communicate his Discoveries to the World, amidst his many great Employments in the Commonwealth both at Home and Abroad.

This Fourth Tome contains Sixty One Trees, Shrubs and Arboreſcent Herbs, together with their Sculptures and Descriptions from the Life; particularly of their Flowers, Fruits, Seeds, and their Vessels, (the Symbolical and Essential Marks of Plants) neglected, or else unobserved by the *Ancients*, whose *Genius* and *Spirit* penetrated very deep in most things, except Natural History,

in which they are very obscure, confus'd, and unintelligible, even to the nicest *Criticks*, and all for want of describing things with their proper Characteristic Notes, which clearly distinguish them one from another. In the last Age this was first started by the laborious and learned *Gesner*, afterwards prosecuted by those two *Italian Wits*, *Andreas Cæsalpinus*, and *Fabius Columna*, but lately most improv'd by our own deservedly famous *Country-man* Mr. *John Ray* in his excellent *Histories of Plants and Animals*.

The Exactness and Accuracy of the Moderns far above the *Ancients* in this part of Knowledge is so plain to any Man of common Observation or Reading, that I cannot but wonder some should speak so contemptuously of the last Ages, as tho they only copied or commented those that went before; No useful Inventions? No Improvements amongst us? This may pass amongst some *Smatterers* in Philosophy, or *Ancient Bigots*, but never with Men of *Science*, or *free Thought*; nor indeed with any *Body* tolerably vers'd in the History of Nature or Arts: So little need is there of *Transcribing* (as some fancy) the *Old Books*, that if we join both all the *Ancient* and *New* together, they will scarce make above an *Essay* towards the Discovery and Knowledge of almost *Infinite* and *Inexhaustible Nature*. *Veniet tempus, quo ista, quæ nunc latent, in lucem dies extrahet, & longioris ævi diligentia*, was the Opinion of the *Ancients* themselves. But to the present *Work* before us, of which some particulars are to be touch'd upon.

Amongst the many rare Vegetables, we have a compleat History of that Pruniferous Tree, called *Mango*, by the *English*, *Mao* or *Mau* by the *Indians*, *Ambo* by the *Brachmans*, which grows above 40 foot in height, and 18 in thickness, sweating out an odoriferous gummy Substance; its Leaves and Root are of an Aromatic

tick Quality ; the Flowers grow in Clusters like those of the Vine, are pentapetalose, white, and marked within with a yellow Spot, and a Honey Spicy *Style*, to which succeeds the Fruit of the Figure of a Kidney, as large as a Goose Egg, first green and chequered with white *Punctums*, then yellowish, and afterwards of a Golden Colour, with a thin downy Skin ; the Stone is oblong flattish, and lanuginose, the Kernel whereof resembles that of an Almond ; of these there are as many varieties in *India*, as Peaches and Plums in *Europe* : The Wood is in use amongst the *Gentiles* in burning their Dead Bodies, to which 'tis consecrated, and for making their Coffins or Urns. The *Brachmans* adorn their Habitations with the Boughs on Festival days, they rub their Teeth with the Leaves, and use them as they do the *Betel* and *Fausel*, (the first of the *Pepper*, the latter of the *Palm* kind) the Gum is given in all sorts of Fluxes. The Fruit is either eaten out of Wine, or Pickle, or in Conserve, sometimes stufed with fresh Ginger, Garlick, Mustard, &c. and sprinkled with Salt, Oyl and Vinegar, and so eaten with Rice and other Meats, as we do *Gurchens* and *Olives*. Out of the dry'd Kernels they make a Meal, of which they prepare several sorts of Meat.

To this we might add the Historiés of many other exotick and rare Trees describ'd, and elegantly Figur'd in this Fourth Part, as the *Adamaran*, a sort of Almond-Tree, out of which the *Indians* make Cakes, milky Emulsions, and an Oyl by Expression ; it bears Fruit three times in one Year. *Panem-Palka* a Species of Nutmeg, which the *Turkish* and *Jewish* Merchants sometimes substitute instead of the true with the Mace on it, and sell the Oyl for genuine. The *Samstravadi*, with the Flowers and Fruit whereof the *Ethnick* and Superstitious Pilgrims deck their Bodies after having Consecrated them ; the *Portugueses* call it *Rosairos*, numbring their Prayers with them instead of Beads ; 'tis a sort of Plum call'd *Jambos*,

of which there are several Species in this Volume. *Pæ-  
ënoe*, out of which when young, the *Indians* make  
their Masts, and entire Vessels out of the grown Trunks,  
capable of holding 60 Men ; they flourish above 300  
years, and afford a sort of Gum *Anime* or *Copal*, us'd  
by the Natives as Frankincense in their Sacrifices. The  
Timber is not easily subject to the Worm. *Poerinsii*, a  
sort of Soap-Tree, with the Fruit whereof they wash,  
and make their Combs and Musical Instruments out of  
the Wood. *Ponga*, like unto the *Tataiba* of *Piso*, or  
the *Fustick-Wood* Tree. *Ponna*, distilling a Substance  
like the *Gutta Gamba* or *Gummi Gotte*, with which it  
agrees in many qualities. *Tsierou-Ponna*, call'd *Kina*,  
in the Island of *Ceylon*. *Perin-Toddali*, a sort of *Zyzy-  
phus* or *Fujube* distilling our common *Lacca*. *Ravapou*,  
a second kind of *Arbor Tristis*, a-kin to the *Jasmins* ;  
this is very fragrant, and expands upon the rising of the  
Sun. *Bengieiri*, whose Wood resembles the *Lignum Mo-  
luccense* or *Panave*. *Aria Bepou*, which is the true *Nimbo*  
of *Acosta*, of which there are two Species. To these  
we might add some Indian *Ricini*, *Cisti*, several kinds of  
*Limes*, *Althæa's*, Plums, Oriental Elder, Barberry, &c.  
with their Uses, all contain'd in this Fourth Tome.

### *Horti Indici Malabaricz.*

#### Pars Quinta.

THIS Fifth Volume comprehends 60 Trees and  
Shrubs, most of them Bacciferous, excellently  
engraven in large Copper Plates. The *Katou-karua* is a  
Second Species of Cinnamon observ'd wild in several  
Provinces of *Malabar*, the other sort being described in  
the first part of this Work under the Name of *Karua*,  
both inferiour to the Cinamon-Tree growing in the  
Woods

Woods of *Ceylon*, tho' all alike in Leaf, Flower and Fruit. *Beeſha*, whoſe Leaves are arundinaceous, a-kin to the *Ily* or *Bambou Cane* deſcribed in the firſt Tome, out of the *Beeſha* the Natives make their Baskets, Arrows, and Writing Pens. *Nola-Ili*, a third Species of *Bambou*, ſent as Merchandize into *Persia*, *Arabia*, and the *Turkiſh* Empire, where they make long Pipes of it for the ſmoaking their Tobacco. *Cammetti*, a ſort of Tree Tithymal or Spurge above Forty Foot high, with the Decoction whereof they kill Worms, and cure Ulcers: The milky Juice of this Plant mixt with the Powder of *Carcapula* (a ſort of *Gutta Gamba* or *Gemou*) is ſaid to perform Wonders in Dropsies. Many of the reſt contain'd in this Fifth Volume may be referr'd to our *Vitis Idæa*, to the *Myrtles*, the *Lauriſtines* or *Wild Bays*; to the *Rhamnus*, *Euonymus*, &c. all which the *Indians* apply to many uſes in Phyſick, Mechanicks, and Agriculture.

---

*Horti Malabarici.*

## Pars Sexta.

**I**N this Sixth Volume we have describ'd and figur'd 61 Trees and Shrubs, the greatest part whereof are Siliquose, as the *Tsetti-Mandarum* call'd by *Breynius Frutex Pavonius* five *Crista Pavonis*, and by the *Portugueses, Flos Pavonius*, from the Pride and Figure of its Flower. Its Seed is not unlike that of *Aldinus* his *Acacia* in the *Farnesian* Garden, yet it seems a-kin to the *Senna* kind.

*Tsiapangam*, call'd by the Dutch *Rasphout*, not unlike the Red Wood of *Brazil* in all its parts, and in the dying Trade, for which 'tis sold up and down. The *Lobe* or *Pod* is figur'd by *Clusius* in his *Exbot. l. 3. c. 16.* But here we have the full History of it.

*Mouricou*, commonly call'd the *Coral Tree*, of which there are several Species in both *Indies*; 'tis spinose, and trifoliolate, the Flower and Seed of a coccineous Colour. In the Island of *St. Maurice* it exceeds in height all the other Trees, therefore 'tis called *Elephantina*. It's Trunk is loaded with Snails, and the *Pepper-Shrub* often climbs up it like Ivy. Out of the Wood the Natives make Sheaths for Knives and Swords, and with it and a calcin'd Stone they polish Perspective Glasses; with the Bark they wash their Vests called *Sarassas*, and make the Confection *Caril* out of the Flowers.

*Wellia Tagera*, call'd in several places of *India Coupang*, of great use and success in gouty cases, as the *Kopang-Tree* of *New England* is reported to be by our Planters; hence some style it *Arbor Antiarthritica*.

To these we might add the *Katou-Conna*, a sort of *Cassia Fistula*. The *Thora Paerou* or *Cajan-Tree*, an arborescent *Phaseolus* or *Laburnum*, much cultivated at the *Cape*, affording a most refreshing Pulse to the Sea-men. *Mandsjadi*, with whose Seed they weigh Pearls. *Niir-Pongelion*, whose long trumpet Flower resembles that of *Dutroy*; Parrots are said to be much delighted with the Fruit, and the *Indians* make Nets of the Boughs and Root. *Ifora-Murri* with its Conical Pod wreathed Spirally. Here are also many sorts of *Kandel-Trees*, some of which are a-kin to the *Mangrove* of *America*. The *Hina-Pareti*, or *Rosa Sinensis*, with many other elegant *Alcea's* and *Althæa's*. The *Moringa*, with several curious *Acacia's* and *Colutea's*. Many of the rest may be refer'd to *Clusius* his Exotick Lobes and Fruits, which this Volume doth much illustrate, the latter part whereof exhibits some *Indian* Jasmines, and large Capers, belonging rather to the Bacciferous Tome.

---

*A Treatise of the Roman Ports and Forts in Kent. By William Somner, &c. To which is prefixt the Life of Mr. Somner. Printed at Oxford at the Theatre, in 8°. 1693.*

**T**HIS Book treating more of Antiquities than Natural Philosophy, will upon that account claim less room in these Tracts; wherefore our Account thereof shall be accordingly succinct.

The Life of the Author taking up the greater part of the Book, is wrote by an ingenious Gentleman, who therein commemorates several great Patrons of Learning;

ing ; next he shews the Pains our Author took to acquire the *Saxon* Language, then almost lost, of the gradual Decay of which Language he gives a short History. Then he gives an Account of our Authors other Studies and Works; whence it appears he intended a compleat Treatise of the Antiquities of *Kent*, this of the *Roman* Ports and Forts being a part thereof. Speaking of the Difficulties of compiling Treatises of this Nature, he gives a short View of several Antiquaries, and their Designs and Labours, most whereof are unpublish'd, and many lost. He gives an Account of our Authors Treatise of Gavel-kind, publish'd in the year 1660, in 4to. His *Saxon* Dictionary; and concludes with a List of his Posthumous Manuscripts.

In the Treatise it self the Author begins with *Rutupium*, and rejecting other Opinions, places it at *Sandwich*, making *Richborough* Castle a *Pharus* to guide the Sea-men into the Harbour, and makes *Gessoriacum*, more anciently *Portus Iccius*, to be *Bolen*; which *Rutupium* he says was then, and sometime after called *Lundenwich*, at which place he affirms *Cæsar* first landed; tho the Author of the Life allows of Mr. *Halleys* Account thereof publish'd in a late Transaction. As to the *Goodwyn Sands*, he denies them ever to have been firm Land; they are more soft, fluid and porous, and yet tenacious, and consequently more voracious than other Sands, which are harder, solider and rockier. Since they are not mentioned by any Writers of great Antiquity, he believes they may be of late Emergency, and possibly caused by the great Inundation in *Flanders* about *William* the Second's, or *Henry* the First's Time; the recess of which Water from these places probably left the *Goodwin Sands* shallower than formerly.

Next our Author speaks of *Dubris*, now *Dover*: To omit his Derivation of the Name, he observes it was a *Roman* Port, and has all along so continued. *Bolen* on the *French* Coast, and *Rutupium* on the *British*, being in

time supplanted, the one first by *Witsand*, and at last by *Calis*, the other by *Dover*, at which place our Author makes *Cæsar* to have first attempted to land: The Fortification of the place in those days was more from Nature than Art. The Rock being cut into such Indentures, as resembled and were instead of Walls with Battlements, which Time hath now worn away. Proceeding to the Port of *Lemanis*, which he makes new *Romney*, so called from being the *Romans* Port; and which altho for some Hundreds of years it has lain dry, yet had formerly a fair and commodious River running by it, and emptying it self into the Sea, much nearer the Town than now, where he endeavours to shew, that there was formerly a River of the name of *Rother*, *Romney* and *Limene*, and that it had its mouth at or by *Romney*; and when, and upon what occasion it forsook its wonted Channel. The two first he proves by old Records, where he observes that it's Mouth was wide enough to receive a Fleet of 250 Sail of *Danish* Pirates, *An.* 893. which towed up their Vessels Four Miles within the Land; which place it hath now so forsaken, that there is neither Harbour nor Channel, which was turned another way by a great Inundation of the Sea about the year 1287. and so the Haven lost for want of the River to scour and keep it open. Next he gives the Derivation of *Romney*, *Apledore*, *Gilford* and *Winckelsey*. And so much for the *Ports*.

As to the *Forts*, he begins with *Regulbium* now *Reculver*, where are still the Remains of *Roman* Tile; here he observes by the way from *Mr. Burton*, that all places ending in *Chester*, arise from the Ruines of the Old *Roman Castra*, this place being once called *Raculf-cester*. All the *Roman* Colonies, &c. being upon Hills, he believes this might be placed on the Ascent where the Church now stands, or in the Church-yard, of which place and its Antiquities he enlarges.

2. The next Fort is *Ratupium*, or *Richborough*, of which before amongst the *Ports*. The Remains of the Walls of

of this Fort compass in almost as much ground as the Tower of *London*; here there has been, and still is, more *Roman* Coins found than in any place in *England*.

3. *Dubris* or *Dover*, where he believes the Church to have risen out of the old *Roman* Fortrefs, and the square Tower in the middle fitted with Holes for Speculation, to have been the very *Roman Specula* or Watch-Tower, and the *Devil's Drop* the Remains of the *Roman Pharos*.

4. *Folkstone*, a place famous for *Roman* Antiquities, which he suspects the same with the *Lapis Tituli* of *Ninius*, taking the Word *Stonar*, where *Lambert* places *Lapis Tituli* to be a Corruption of (and formerly written) *Estanore* and *Estanores*, signifying the Eastern Border or Coast.

5. *Lim* or *Limbill*, where *Stutfall-Castle*, with a large Circuit of 10 Acres, was of old enclosed with a *Roman* Wall, ruined not so much by Time, as a Seisure of its Materials for the building of *Lim-Church* and the Archdeacons castellated Mansion. The Name *Stutfall* he derives from *Stod fold*, there being formerly kept and stabled a Stud of Mares. This place is also called *Shipwey*.

6. The last *Kentish* Fort is *Anderida* or *Anderidos*, as to the Situation whereof he is less certain, whether at *Pemsey*, *Hastings*, or *Newenden*, tho' he inclines to one of the former. The *Weald* was formerly called *Sylva Andred*, a Desert place unpeopled, fill'd only with Herds of Deer and Drovers of Hogs. He ends this Treatise with an Enumeration of the Quit-rents formerly paid out of the *Weald*, as *Gavel-swine*, *Scot-ale*, *Pannage*, *Gate-penny*, *Sumer-hus silver*, *Corredy*, and *Danger*.

The whole is concluded with a Catalogue of the Lord Wardens of the *Cinque-Ports*.

---

*An Additional Note to Page 670. of this Transaction.*

Mention being made in this Letter of Mr. *Banisters*, of the little Pointel found under the Wings of several

veral Flies, I thought fit to transcribe what Dr. *Hook* says concerning the same in his *Micrographia*, and to give the Figure thereof, as it is by him described. See *Lit. Q.* in regard the Book is very scarce, *Micrographia, Observ.* 38. pag. 173. ' Whilst I was examining and considering the curious Mechanism of the Wings, I observed that under the Wings of most kinds of Flies, Bees, &c. there were placed certain Pendulums, or extended drops (as I may call them from their resembling Motion and Figure) for they much resembled a long hanging drop of some transparent viscous Liquor; and I observed them constantly to move just before the Wings of the Fly began to move; so that at the first sight I could not but guess, that there was some excellent use as to the Regulation of the Motion of the Wings, and did fancy that it might be something like the Handle of a Cock, which by vibrating to and fro, might as 'twere open and shut the Cock, and thereby give a passage to the determinate Influences into the Muscles: Afterwards, upon some other Trials, I supposed that they might be for some use in Respiration, which for many Reasons I suppose those Animals to use; and methought it was not very improbable, but that they might have convenient passages under the Wings for the emitting (at least) of the Air, if not admitting, as in the Gills of Fishes is most evident. Or perhaps this Pendulum might be somewhat like the Staff to a Pump, whereby these Creatures might exercise their Analogous Lungs, and not only draw in, but force out the Air they live by: But these were but Conjectures, and upon further examination seem'd less probable.

---

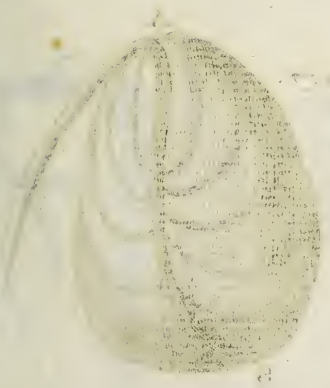
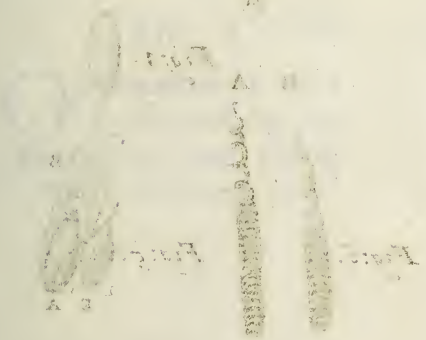
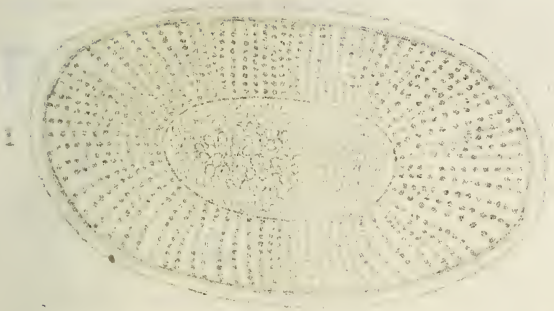
AN ADVERTISEMENT.

**T**HE Ingenious are desired, That if they have any loose Papers relating to the same Design with those of *Sir William Petty's*, Printed in this Transaction, they will please to communicate them, which Favour shall be acknowledged by the like Communications by the Publisher.

---

L O N D O N, Printed for, and Sold by *S. Smith* and *B. Walford*, Printers to the Royal Society, at the Princes Arms in *St. Paul's Church-yard*. 1693.

*Faint handwritten text at the top of the page, possibly a title or description.*



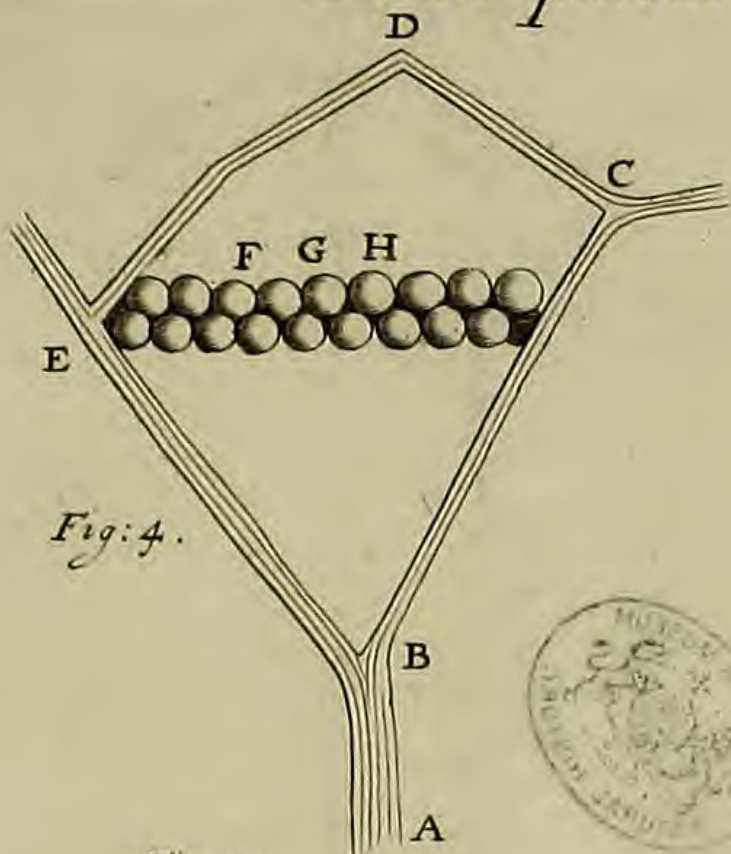


Fig: 2.

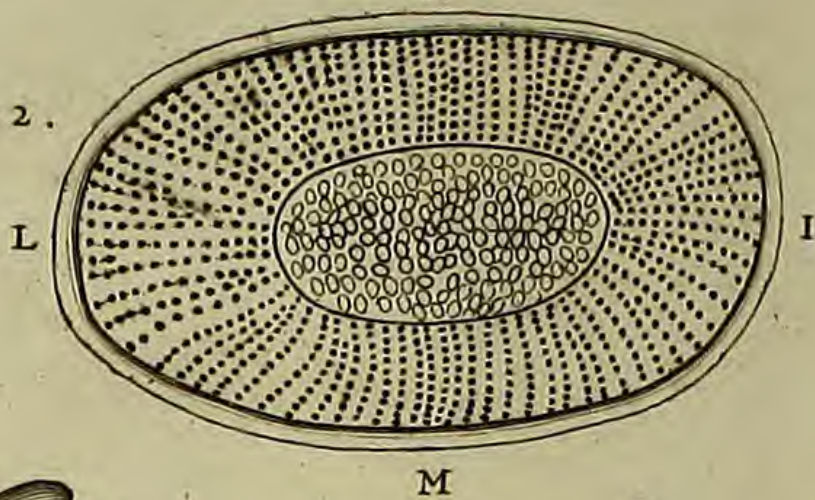


Fig: 3.



Fig: 1.



Fig: 6.



Fig: 5.

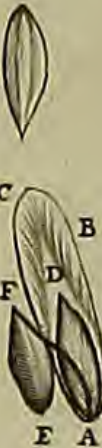


Fig: 4.



Fig: 15.

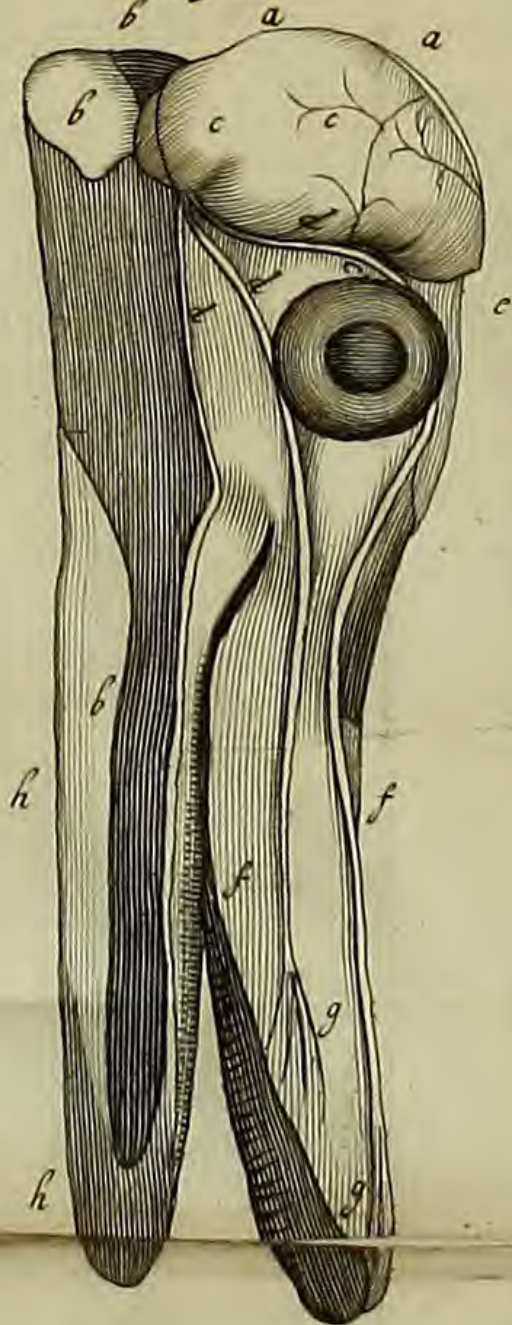


Fig: 14.

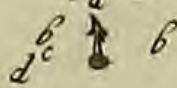


Fig: 7.

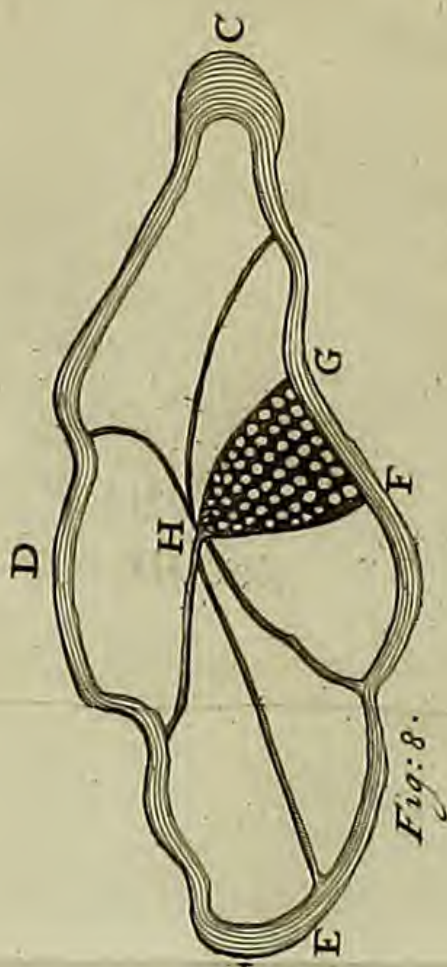
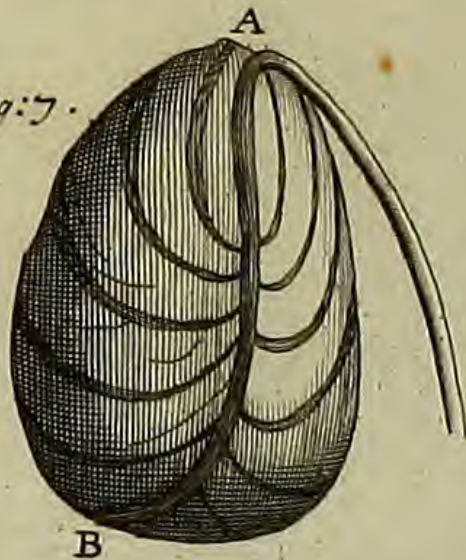


Fig: 8.

Fig: 9.

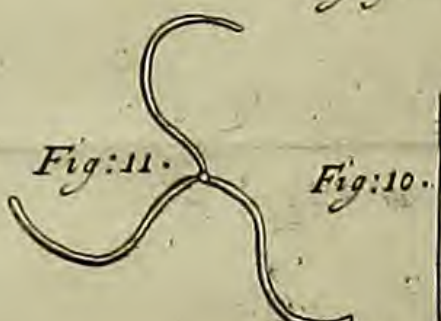


Fig: 11.

Fig: 10.

Fig: 13.

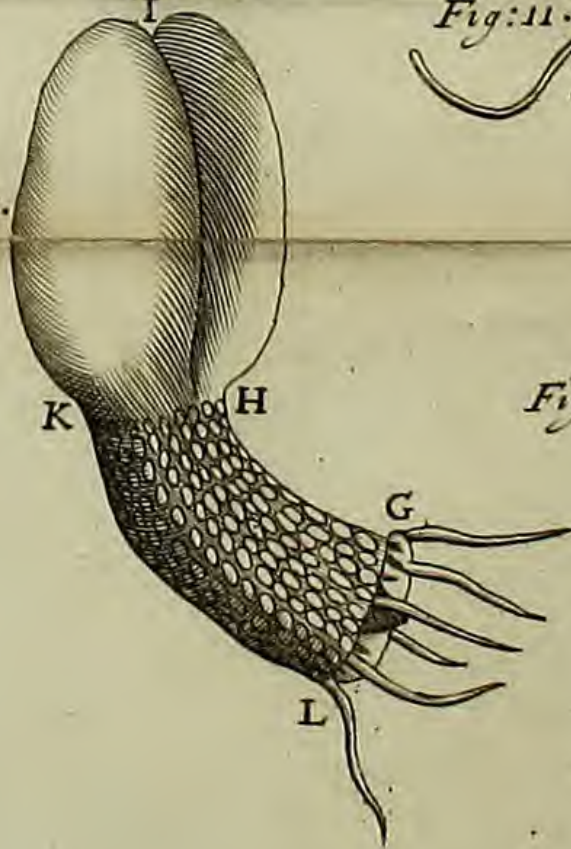
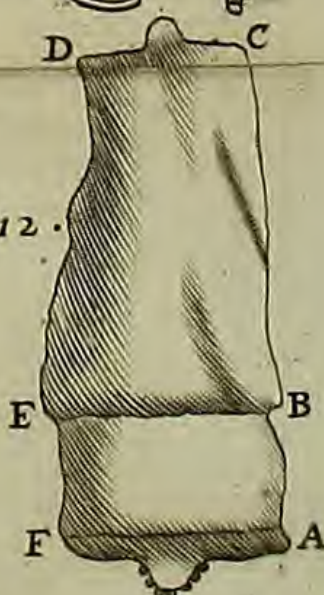


Fig: 12.



---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of April, 1693.*

---

## The CONTENTS.

- I. **O**bservations on the comparative, intensive or specific Gravities of various Bodies made by Mr. J.C.  
 II. Extracts of some Letters from Mr. John Sturdie of Lancashire concerning Iron Ore, and more particularly of the Hæmatites wrought into Iron at Milthrop-Forge in that County, communicated by Martin Lister, M. D. and S. R. S. III. The Extract of a Letter from Mr. Anth. Van. Leeuwenhoek concerning the Seeds of some Plants, with Observations on the manner of the Propagation of Plants and Animals. IV. Part of a Letter from Sir R.B. S. R. S. to Dr. Lister, concerning the Giants Cawsway in the County of Antrim in Ireland. V. A Relation of a Storm of Thunder and Lightning, &c. at Oundle in Northamptonshire on the 20th of March last, by Mr. W. R.  
 VI. Some Anatomical Observations in the Heads of several Fowl, made by the late Allen Moulin, M.D. S. R. S.  
 VII. An Account of Books. 1. ΠΥΡΡΟΛΟΓΙΑ, seu Exercitationes de Morbis Universalibus Acutis. Auth. Ric. Morton M.D. &c. Lond. in 8°. 1692 2. Catalogus Plantarum Horti Academici Argentinenfis, &c. adcurante Marco Mappo M.D. &c. Argentorati apud Frid. Spoor, 1691. in 12°. 3. Stephani Chauvini Thesaurus Philosophicus, &c. in Fol. 1692.

I. *Observations of the Comparative, Intensive or Specific Gravities of various Bodies. Made by Mr. F. C.*

Pump-water.	1000	Borax.	1720
Cork.	237	A spotted factitious Marble.	1822
Sassafras-Wood.	482	A Gally-Pot.	1928
Juniper Wood (dry.)	556	Oyster shell.	2092
Plum-tree (dry.)	663	Murex-shell.	2590
Mastic.	849	Lapis manati.	2270
Santalum Citrinum.	809	Selenitis.	2322
Santalum album.	1041	Wood petrefied in <i>Lough-Neagh</i> .	2341
Santalum rubrum.	1128	Onyx stone.	2510
Ebony.	1177	Turcois-stone.	2508
Lignum Rhodium.	1125	English Agat.	2512
Lignum Asphaltum.	1179	Grammatias lapis.	2515
Aloes.	1177	A Cornelian.	2568
Succinum pellucidum.	1065	Corallachates.	2605
Succinum pingue.	1087	Talc.	2657
Jet.	1238	Coral.	2689
The top part of a Rhinoceros-horn.	1242	Hyacinth (spurious.)	2631
The top part of an Ox-horn	1840	Jasper (spurious.)	2666
The (Blade) bone of an Ox.	1656	A pellucid Pibble.	2641
An human Calculus.	1240	Rock Crystal.	2659
Another Calculus humanus.	1433	Crystallum Didiaclasticum	2704
Another Calculus.	1664	A red Paste.	2842
Brimstone, such as commonly sold.	1811	Lapis Nephriticus.	2894
		Lapis Amiantus from <i>Wales</i>	2913
		Lapis	

Lapis Lazuli.	3054	Wrought Brass.	8280
An Hone.	3288	Hammer'd Brass.	8349
Sardachates.	3598	A false Guinea.	9075
A Granat.	3978	A true Guinea.	18888
A Golden Marcasite.	4589	Sterling Silver.	10535
A blew Slate with shining Particles.	3500	A brass Half-Crown.	9468
A mineral stone, yielding 1 part in 160 Metal.	2650	Electrum, a British Coin.	12071
The Metal thence extract- ed.	8500	A Gold Coin of <i>Barbary</i> .	17548
The (reputed) Silver Ore of <i>Wales</i> .	7464	A Gold Medal from <i>Mo- rocco</i> .	18420
The Metal thence extract- ed.	11087	A <i>Mentz</i> Gold Ducat.	18261
Bismuth.	9859	A Gold Coin of <i>Alexan- ders</i> .	18893
Spelter.	7065	A Gold Medal of <i>Q. Mary</i> .	19100
Spelter Soder.	8362	A Gold Medal of <i>Q. Eli- zabeth</i> .	19125
Iron of a Key.	7643	A Medal esteem'd to be near fine Gold.	19636
Steel.	7852		
Cast Brass.	8100		

II. *Extracts of some Letters from Mr. John Sturdie of Lancashire concerning Iron Ore; and more particularly of the Hæmatites, wrought into Iron at Milthrop-Forge in that County. Communicated by Dr. Martin Lister, S. R. S.*

*Townley, March 14. 1674.*

S I R,

YOU will receive herewith some of the Cinder you desir'd, as also a little of Iron-stone both burnt and unburnt. They have several sorts of Iron-stone, and  
of

of different Natures ; for some makes *Coldshire-Iron*, that is, such as is brittle, when it is cold ; another sort makes *Redshire*, that is, such as is apt to break if it be hammered, when it is of a dark red Heat, and therefore are never melted down but in mixture, and so they yield an indifferent good sort of Iron. They have of late made it much better than heretofore, by melting the Sow-metal over again, as likewise by using Turf and Charcoal, whereas formerly their Fuel was only Charcoal. They once made Trial of Pit-Coal, but with bad Success. The small dusty part of their Charcoal is useful for burning the Iron-stone ; for every 17 Baskets of this burnt Stone they put in one of Brimstone unburnt to make it melt freely, and cast the Cinder. There is no other Cinder swimming above but such like as this I send you, only sometimes it is more vitrified than it is at other times. They always take it off from the melted Iron with a Coal rake at a hole in the Furnace-mouth before they let the Metal run. There is nothing remains in the bottom of the Hearth, all becomes either Iron or Cinder.

The Furnace is built on the side of an Hill, the bottom is about two yards square, and so rises perpendicular for a yard or more, which is also lined within with a Wall of the best Fire-stone to keep off the force of the Fire from the Walls of the Furnace : The Bellows (which are very large, and played with Water) enter about the middle of the *Focus*. The rest of the Furnace is raised upon this 6 or 7 yards square-wise, but tapering ; so that the sides draw towards each other by degrees, and the top-hole (where they throw in Baskets of Stone and Fuel) is but about  $\frac{1}{2}$  a yard square. Into this place they put down a Pole, to know how far it hath rested after a certain time ; and when they find it to have subsided about a yard and  $\frac{1}{2}$ , then they put in more, till the Furnace be full again.

*Thurnham.*

Thurnham, Aug. 12. 1675.

S I R,

Though I am in daily expectation of some of the *Milthrop* Iron-stone, and may possibly get it before this Letter reach you, yet I thought it not convenient any longer to defer the Account I received thereof from a Gentleman concerned in the Work, for fear some of the Circumstances should slip out of my Memory.

The Oar is got in *Fournesse* (a division of *Lancashire*) at least 15 Miles from *Milthrop*. Some of it is hard, but feels soft and smooth on the out-side like Velvet. Some is soft as Clay, but all is red, and lies in Beds like Coal.

The Furnace in which it is melted is not above a yard and  $\frac{1}{2}$  over, and about the same height. The Hearth is all of Sow-Iron, much of the Shape of a broad-brim'd Hat with the Crown downwards. The Sides are of Stone, arched towards the top; in the midst is a Tunnel at which they put in Charcoal, on which when it is kindled, they put Oar (first broken into pieces as big as a Pigeons Egg) so much as they intend to melt down.

Then they set their Bellows on work, which are moved with Water, and go into the midst of the Furnace-Wall, and keep blowing for some 12 hours, feeding it still with new Charcoal as it settles.

Then they pull out a Stopple at the bottom of the Wall, and out comes all the Glassie-Cinder being very liquid, leaving the Iron in a Lump (for it does not flow) in that Conical Hole in the midst of the Hearth.

This they take out with great Tongs and put under heavy Hammars (played also with Water) whereby after several Heatings (in the same Furnace where it is melted) it is beaten into Barrs. They get about an

U

Hundred

Hundred weight of Metal at one melting, which is the Product of about three times so much Oar.

Thurnham, Sept. 25. 1675.

S I R,

I Send now at last the promised Parcels of Iron Oar, one sort of it seems to be good *Hæmatites*. It seems I either did not rightly apprehend, or was not clearly enough informed by the Person from whom I had the Account I sent you, of the Furnace in which they melt down their Oar.

It is very much like a common Black-Smiths, *viz.* A plain open Hearth or bottom without any enclosing Walls, only where the nose of the Bellows come in through a Wall there is a hollow place (which they call the Furnace) made of Iron Plates, as is also that part of the Hearth next adjoining. This hollow place they fill and up-heap with Charcoal, and lay the Oar (broken small) all round about the Charcoal upon the flat Hearth, to bake it as it were, or neal and thrust it in by little and little into the Hollow, where it is melted by the Blast. The glassie *Scoriæ* run very thin, but the Metal is never in a perfect Fusion, but settles as it were in a Clod, that they take it out with Tongs, and turn it under great Hammers, which at the same time beat off (especially at first taking out of the Furnace) a deal of courser *Scoriæ*, and form it after several Heats into Bars. They use no Lime-stone or other thing to promote the Flux, for that I enquired particularly. As to other matters my former Relation is exact enough.

#### POSTSCRIPT.

S I R,

AFTER the Sealing of my Letter that comes with this, I met with one who hath promised to send me

me some soft Oar, as also a little of a Chryſtalline Spar that grows to it, and the reſt that you deſire.

As to your Queries.

*Steel is not made from that they call Steel-Oar, but Iron, ſuch as is made from the reſt.*

*All the Oars that were ſent you lie in one Bed or Seam, but the hard Oars lie uſually next the Rocks on each ſide, and the ſoft Oar in the miſt.*

*The Rocks between which they lie are a grey Lime-ſtone.*

*There is no rock underneath (as you ſeem to conceive) for the Oar lies between Rocks on each ſide, or rather in the Cleſts of Rocks which they follow, ſtill digging deeper many Fathoms. Sometimes the ſaid Cleſts (which are filled with Oar) are an Inch, ſometimes a Foot broad, ſometimes three or four Yards, but ſtill one continued Vein running downwards towards the Center of the Earth.*

Thurnham, Nov. 14. 1675.

I ſhall ſhortly meet with one from *Fournes*, and ſhall get you a Reſolution of your Queries, as alſo ſome of the Oar you deſire. They uſe it frequently, and with great Succeſs, as a Medicine for the Murrain in Cattle, and for all Diſeaſes in Swine, to which laſt they will give a good handful or two in Milk.

N. B. *This is meant of the ſoft Oar like Clay. I have this to add, that this Clay Hæmatites is as good, if not better, than that which is brought from the Eaſt Indies. Witneſs the Tea-Pots now to be ſold at the Potters in the Poultreſy in Cheap-ſide, which not only for Art, but for beautiful Colour too, are far beyond any we have from China. Theſe are made of the Engliſh Hæmatites in Staffordſhire, as I take it, by two Dutch-men, incomparable Artiſts.*

Westm. May 1. 93.

I am, &c. M. L.

U 2

III. A

III. *A Lettèr from Mr. Anth. Van Leeuwenhoek concerning the Seeds of Plants, with Observations on the manner of the Propagation of Plants and Animals.*

**I**N the Seed of an *Ash* represented of the natural Size by *Fig. 1.* I observed not only two large Leaves, but that part also whence the Root takes its Rile, was extraordinary big; this part of the Seed I always found uppermost when growing on the Tree, so that the Seeds have a contrary Situation on the Tree to what they have in the Earth. These two Leaves of the Seed or Lobes were filled up with an innumerable quantity of very small Globules, except where the Fibres were visible: Which likewise were composed of much smaller Globules, and took their Origine from that part whence the Root proceeds. This supposed Root I cut through the middle, and have represented it *Fig. 2.* wherein the outward Ring represents the Bark, the next represents the woody part full of dark-coloured Pricks, which are the Fibres thereof. The innermost Oval represents the Pith, composed of round Bodies. I have likewise found that the bigness of the Seeds of Plants does no way answer to the Size of the Leaves of the Plant, there being very small Rudiments of the Leaves and Plant in the large Seeds of the Oak and Peach represented by *Fig. 3.* and on the contrary, very considerable ones in the Seeds of the *Ash*.

As I have formerly observed in the fleshy *Fibres* of the *Muscles*, that there were no Blood-Vessels intermixt with them, but they were placed only in the Membranes that encompassed the *Muscles*, and shew'd how the  
fleshy

fleshy Muscles might be nourish'd by these Blood-Vessels, so I find the Leaves of Plants to be made up of Globules included in the Membrane that makes the Superficies of the Leaf in all places but where the Fibres are conspicuous. The manner how I suppose these Globules, and by consequence the Leaf is nourish'd is thus: The Liqueur or Sap is conveyed in the Vessel *BC*, *Fig. 4.* and is communicated first to the Globule *F*, from that to *G*, thence to *H*, and so on; as if you should put several small Pellets of dry'd Clay in a glass Vessel, if the Water touch but one of them, you will find it communicated by that to the Second, Third, and so on till they are all Wet.

I could not find any thing to satisfy my Curiosity in the small Seeds of *Figs* and *Strawberries*; possibly they were not ripe enough; for I doubt not but that they have the same parts that larger Seeds have.

And if in the small Seeds of the *Ash* (6 whereof weigh not 4 Grains) there are to be seen not only perfect Leaves with their Vessels, but the woody part also, and that from whence the Root shoots out (nay plainer than in the Walnut or Hazel) we may well conclude that wise Nature proceeds after the same manner in all its Operations of Generation and Propagation; every Seed containing not only the Rudiments of the future Plant, but also a certain fine Flower to nourish it so long, till striking Root into the Earth, it may thence receive its Nutriment. This Flower is of an oily Nature, and the more oily the longer will the Seeds live out of the ground. And as Plants are not *Male* and *Female*, nor have a *Matrix* for the first Reception and Sustentation of the Young, so the Parent Tree produces a perfect Plant wrapt up in the Seed which the Earth receives and nourishes. I have likewise found that of such Trees as are reckon'd *Male* and *Female*, very few that bore Seeds the last year have bore any this year; so that I question  
whether

whether the Trees which we find without Seeds may be therefore called *Male Trees*.

I think it now past all doubt, that the *Generation of Animals* is from an *Animalcule* in the *Male Sperm*: And tho I have often fancied that I have discovered the Parts and Membranes of the *Fetus* in this *Animalcule*, so as to say there is the Head, there the Shoulders, and there the Thighs, yet I will affirm nothing herein, till I shall be so lucky as to find an *Animalcule* large enough to discover this Truth, which I am not quite in despair of, since I have been so fortunate as to meet with in the small Seeds of the Ash, Leaves and Rudiments of the future Plant far larger than in the Seed of any Plant I have yet examined.

But to examine the matter a little closer : *Nature* proceeds almost after the same Method in her Operations as to the Production of *Plants* and *Animals*: For as the *Animalcule* of the *Male Sperm* cannot live in the *Matrix*, without being wrapt up in the several Coverings, and receiving its Nourishment ; so neither can the Seed of the Plant subsist without continual nourishment, and has also its Coats to encompass it: And which is observable, as the *Fetus* has but one ligament consisting of several Vessels, by which it is fastned and nourish'd, so all the Seeds which I have seen have but one Ligament, made up of several Vessels also, which is sometimes longer, sometimes shorter. I will present the Reader with the Draughts of some Seeds. *Fig. 5.* *A B C* is the outward Membrane of the Seed of an *Ash*, *A D* the place where the Seed it self lies, which is taken out and represented by *E F*. *A F* is the Ligament by which the Seed *E F* receives its Nourishment, the part *A* being only joyned to the Tree ; and what is more observable, the point of the Seed *F* where the Ligament is fastned, is likewise the place whence the Root proceeds: So that the Root is the last that parts from the Tree, which at first,

first, while the Seed is young, is upwards; but afterwards the Seed and Fruit growing heavier, it bends the Stalk, and turns downwards to the Earth. The same thing is in Apples, Pears, &c. These Ligaments by which the Seeds are nourish'd have their Coats or Bark within which, as I guess, are more than 100 small Vessels, in the *Filberd*, all wreathed and twisted up after a Spiral manner, as in *Fig. 6*. It is observable, that this *Ligament* is fastned (in almost all Seeds) to that part whence the *Embrio* Plant arises, as in *Fig. 7*. which represents a *Filberd* larger than the Life, that the Vessels proceeding from the *Ligament* may be more visible. Where the *Ligament* goes from *A* to *B* branching all the way into Ramifications, and they again into lesser, all which meet again at the place whence they began, that is, where the Plant is to have it's beginning.

In the *8th Fig.* I have shewn the *Ligament* of an *Almond*, which being naturally pretty large, I the rather pitch'd upon it. It is cut transverse. *C D E F G* is the *Cortical* part thereof; it is divided into 7 Partitions meeting at *H*, each whereof is of a reddish Substance; the Vessels to be seen in one of the spaces are represented by *F G H*, from the View whereof may be collected the great number of Vessels in the whole *Ligament*, by means whereof the Seeds of the *Almond* and *Filberd* are nourish'd: For I could find no difference in the Ligaments of these two Seeds, only in the *Almond* all the parts were larger.

If we consider the Propagation of *Animals*, and that they are so long nourish'd in the *Uterus* by means of the *Umbilical* Vessels, till they are fit for a more open Life, and are then no longer kept Prisoners. And again, that the *Embrio* which is to be the future Plant, perhaps a Tree is so long contained in that Body which we call the Seed, and fed by means of a *Ligament* from its *Matrix*, to wit, the Tree, till it be of a competent growth,

and

and has a sufficiency to provide for it self, and grow when exposed on the bare ground, and then it is no longer kept up. I say, if we consider these two Methods of *Nature*, we shall not find any other difference between *Plants* and *Animals*, than that the first wanting a locomotive Power, cannot couple as *Animals* do, and therefore must contain in the same Individual, not only the Origine of the future *Plants* which I compared to the *Animalcule* in the *Male Sperm*, but also the maternal Nourishment sufficient for it till it is furnish'd with a Root to provide for it self. This Nourishment is a sort of Flour which encompasses the *Embrio* Plant, and in the Seed makes the two Lobes.

If we compare *Plants* with *Birds*, we shall find that as in *Birds* which are Male and Female, it is necessary for the *Animalcule* of the Male already endowed with a living Soul to be placed near the Yelk of the Egg of the Female, to be thence so long nourish'd till it is fit to receive its Food from the Mother, or gather it off the Ground: So in *Plants* the *Embrio* is placed next to a sort of Fine Flour which I compare to the Yelk of the Egg, which not only defends the young Plant, but likewise affords it its first *Aliment*.

We may likewise compare the Propagation of *Trees* with *Fish*, and find the same Agreement. In fine, the Egg in *Animals* seems to be for the same use as the Lobes of the Seed in *Plants*.

Although I have formerly asserted, that the *Female* served only to afford nourishment to the *Animalcules* of the *Male Sperm*, and that *Plants* grow out of the substance wherewith they are watered; yet I acknowledge for a certain Truth, that a great *Variety* is caused in *Animals* by the Nourishment received from the Mother. So by a Horse and She-Asse a *Mule* is generated, which is like neither, but participates of both, differing from the Horse, especially in the Ears and Tail; since the Ass

atounding

abounding in that nourishment which produces the Ears, and wanting that which gives a long Tail, it must necessarily be like the Mother in those two particulars. So from a *White* Man and *Negro* Woman a *Mestico* is born: And from a large Pigeon or *Cropper* and a small wild Hen Pigeon, the Young are like neither; the Egg of the Female is not sufficient to nourish the *Animalcule* of the Male, so as to give it the Size of its Father. And thus Plants receive a great alteration from the different Soils in which the Seeds are planted. So *Apples* brought from *France* are with us in great esteem; and what care soever we take in the Trees themselves, yet they soon degenerate in our Soil; which change proceeds from the different Salts they meet with in the ground. And I believe if we could take the *Embryo* Plant out of one Seed and put it into another, so as it would grow, we should have a new Plant from thence like to neither: As if we should take the *Embryo* out of the *Walnut* (which I will liken to the *Animalcule* of the *Horse*) and so join it to the Seed of the *Chestnut* (which I compare to the *Matrix* of the *Ass*) that it would grow, the Plant produced by this Union would be a new and unknown Tree.

*Willows* are usually planted by thrusting a Stake into the Ground in wet places, yet finding several young ones on the Banks of Rivers, I judged these grew from the Seed. Wherefore in the beginning of *June*, examining the downy Seeds of these Plants, I found several brownish Particles, not much bigger than Sand; which the Microscope discover'd to be the Seeds thereof, which are contained in several little Violet-colour'd Boxes, of which in a little Sprig there were 75 placed by one another, each containing 3, 4, or 5 small Seeds, encompass'd with a pappous Down. *Fig. 9.* represents these Seeds of the natural bigness. The Down or Pappous part is joined by one common Knot or Center first, and so to the Seed, and consists of 2, 3, 4, 5 or 6 small Threds, which so

soon as the *Capsula* breaks upon the ripening of the Seed; spreads its self every way, as *Fig. 10.* tho' before the Threds were closed up in one, as *Fig. 11.* by which means it easily carries the small Seeds on the Wings of the Wind to great distances. Viewing these Seeds more nicely, I saw that part whence the Root has its beginning (which makes one third part of the Seed) furnish with very many Vessels, consisting only of oblong and round Particles. The rest of the Seed consisted of two Lobes of a dark herby Colour made up of Globules, and between these, two very small Points rising up, which were the beginnings of the Leaves of the Tree or *Embrio*-Plant, which the Lobes themselves were to nourish till it should be furnish'd with a Root to provide for it self.

I took some of these very small Seeds, and sowed them in wet Sand in my Closet in *June*, the better to discover the manner of their growth. These Seeds being very much dried, and thereby shrunk, appeared thro' the Microscope, as *Fig. 12.* though they were not all alike, some being more, some less dried up. *ABEF* is that part whence the Root shoots forth. When they had lain in the wet Sand 36 hours, they shewed as *Fig. 13.* the Proportion of the part *G H K L* being then considerable, and in so short a time 6 Roots were shot out from it, and the two Lobes *H I K* began to shew themselves. In 72 Hours the Roots began to divide and ramify; and to take hold on the Sand. That which is observable in this Tree is, that the Seeds come to their perfect maturity before the Leaves of the Tree have their full growth, whereas other Trees perfect not their Seeds till after the Fruit in *Autumn*; so that this Tree has its young Plant grown up the first Year. The same is observable in the *Elm*; some of the Seeds whereof I gather'd in *May*, dry'd and sow'd them, and in three days they sprung up. I try'd the same in the downy Seeds of the

the

the *Poplar* and *Indian Cotton*. If these distinctions of parts are so soon visible in these small Seeds, why should we doubt the production of an *Animal* from the so often named *Animalcules*. Indeed we must own our selves at a stand, when we would find out how these *Animalcules* receive Life, and that not before the *Male* has attained a certain Age; and the rather, since we hold that the matter whence these *Animalcules* proceed, was likewise in that *Animalcule* it self when it was first committed to the *Matrix*. And indeed that very extraordinary minuteness, by which one Creature is transmitted to another, is incomprehensible.

Nor can we be better satisfied as to this matter in Trees than Men; for we see plainly, that very many Trees growing from Seed are some years before they bring forth Fruit and Seeds, at least such Seeds as will produce another Plant. So that we cannot say, that that Seed which will produce a Tree depends only on the Tree; but that the substance of the Seed, by means whereof a Tree is propagated, depends on that Seed from whence the Tree it self also proceeded. And tho' we may after some manner imagine how the Fruit, as an Apple or Pear, consisting of several round Particles (to omit the Vessels) may be produced, since there are 8 or 10, it may be more Ligaments (each whereof has a multitude of Vessels) which may transmit several Juices; yet how can we conceive that the Origine of a Plant can be thus formed. So that we see the beginning of the Propagation of the Tree is to us incomprehensible, although we see it done before our Eyes; and we may suppose it after the same way as it is in Man. To conclude, the Tree after 8 or 10 years begins to bear Seed, which depends not only on the Tree, but on the former Seed: So it is in the *Male Sperme*, which has its Original not only from the *Male*, but from the *Animalcule* from

whence the Male its self was produced. So that the first essential beginnings of things which are incomprehensibly small, will be always hidden from us.

---

IV. *Part of a Letter from Sir R. B. S.R.S. to Dr. Lister, concerning the Giants Causeway in the County of Antrim in Ireland.*

*Old Bawn, Apr. 24. 1693.*

————— Concerning the Giants Causeway. Prolixity in a Philosophical Description I'm sure you'll pardon; for I was very exact in getting it from a person that was *rei compos*, perhaps *peritus*; a Scholar (a Master of Arts in *Cambridge*) and a Traveller, who went on purpose the last Summer with the present Bishop of *Derry* to see it. It is in the County of *Antrim*, about 7 Miles East of *Colrain*, and 31 Miles to the East of the mouth of the River of *Derry*. The Coast there is a very great height from the Sea, but rising gradually on the Land side to the edge of the Precipice, it is all cover'd with an excellent sweet Grass; when you come to the Precipice, there is no going down there it is so perpendicularly steep, but with much Labour and some Hazard it may be climb'd up. By other ways and windings one comes down to the *Strand*; in which, from the foot of this Precipice, there runs out Northward, into the Main Ocean, a raised Causeway of about 80 foot broad, and about 20 foot high above the rest of the *Strand*; its sides are perpendicular, it went on above two hundred foot to the Sea-Water; that is, it was so far in view; but as  
he

he was there told, it did not advance much farther, under the Superficies of the Water. This whole Causeway consists all of Pillars of perpendicular Cylinders, Hexagones and Pentagones, of about 18 and 20 Inches Diameter, but so justly shot one by another, that not any thing thicker than a Knife will enter between the sides of the Pillars. The Pillars do not consist of Joints, as you were informed, but each Cylinder is one solid piece, only indeed in breaking it breaks cross-wisely or horizontally, and not length-wisely, which we commonly call splitting; and it is by its thus breaking, that the Texture of the middle of the Causeway is discovered; for pieces have been broken from many of the Cylinders that are in the middle, (pieces of unequal lengths) whereby one sees (so deep) the perpendicular sides and edges of the circumjacent Cylinders. [Pardon the Impropriety of the Word.]

That the Cylinders do not consist of Joints, is manifest from this, that the pieces so broken off, have their bottoms as often convex or concave as flat and even; and many such pieces there are lying loose upon the Sand of the Shore, which the Sea has washed down from it. When one walks upon the Sand below it, the side of this Causeway has its Face all in Angles, the several Cylinders having some two, some three of their sides open to view. This Gentleman, tho' he had no Notion of *Astroites*, yet believes them all to be natural, because there is no other sort of Stone or Rock there: Nay, that very vast high Precipice does consist all of Cylinders; tho' some shorter and some longer (whereby you may now understand it not impossible to climb it up, as by steps, tho' irregular ones) and all the Stones that one sees on that Coast, whether single or in Clusters, or that rise up any where out of the Sand, are all Cylinders, tho' of never so different Angles; for there are also four-squared upon the same Shore. This Causeway runs out into the Northern  
Ocean,

Ocean, having no Land over against it any where. This is all I can now tell you of it, and from this imperfect Description you may form what Queries you think fit. I dare not promise you that I shall go to see it this Summer (it being full Sevenscore Miles off) tho' I have a great Temptation as well as Desire so to do; but if I do not, I can get your Queries wel answered upon the place.

---

V. *The Relation of a Storm of Thunder, Lightning and Hail at Oundle in Northamptonshire on the 20th of March 169<sup>2</sup>/<sub>3</sub>. By Mr. W. R.*

THE Day on which the Storm happened was the 20th of March; the Day was stormy, as the Weather had been some time before; but about eight at Night there arose a very violent Gust of Wind, at *South-West*, which lasted an hour and half, till the *Thunder-clap* was over, during which time it rained very fast. A quarter of an hour, or thereabouts, after Nine, fell a mighty Storm of *Hail* intermixed with *Rain*, which lay very white, and some depth on the ground, and to me appeared to have Snow mixed with it. During that Storm happened the *Lightnings*, which were but two *Flashes*, but very violent and strange; it had hailed near a quarter of an hour before the Lightning; it was extraordinary blew, and of a Sulphureous Smell. It seemed to stand still in the House some considerable time, and was so great, that a Gentleman who sat below stairs, thought that the House had been on Fire above, and that

that the Flames rolled down Stairs. The Clap of *Thunder* which immediately followed seemed to all like the suddain Discharge of five or six Field-pieces, not with that rolling, deep noise *Thunder* usually carries along with it: Indeed, for my part, I thought it had been Guns. The Second Flash and Clap followed within a few Minutes of the first, but not with that Violence as the former: Which Flash fir'd the *Steeple* I cannot say, but a piece of Wood to which the Lead of the Windows was nailed (the Windows being nothing but Lead cut full of Holes) was set on fire, and kindled very fast, and might have done a great deal of Mischiefe, had not the earliness of the Night, and timely help prevented it. This Storm seemed to run in a direct Course; for several of our side-Towns perceived little of it; and I believe it broke chiefly over us, for I hear of no Effects it had any where else, but only at *Kettering*, where one of their Bells, as some say, received some damage, and the Wires of the Chimes were twisted one within another: The Wind was very blustering all the Night after.

Oundle, Apr. 22.

L. 6 9 3.

Tours, &c.

VI. *Anatomical Observations in the Heads of Fowl made at several times. By the late Allen Moulen, M. D. S. R. S. Read before the Royal Society, Feb. 1. 1687.*

I. **I**N the Heads of all the Fowl that I had an opportunity to examine, I constantly found only one *Aquæductus*, or Passage from the Ears into the Pallat; whereas

whereas in Men, Quadrupedes, and some Amphibious Fish, there are always two, one on each side below the entrance of the Nostrils into the Pallat, and opening towards the Nostrils, for the more convenient reception of Air, as is supposed. This Passage in Fowl is exactly in the middle of the Pallat, below the entrance of the Nostrils into it: It is a membranous Tube, capable of admitting a Ravens, if not a Goose Quill in larger Fowl, such as Turkeys, Geese, &c. and reaches backward as far as the Communication from Ear to Ear, and hence it comes to serve both; whereas there is a necessity of two in those Animals, whose Ears do not communicate.

2. I have purposely examined the Heads of all the Species of Fowl I could procure, and constantly found a hollow space between the two Tables between the *Os Cuneiforme* reaching from Ear to Ear, and as far forward as the aforesaid common *Aquæductus*, or rather *Ductus Aereus*, the contrivance of it seeming more to favour this than the former use. This Cavity in all Fowl (as far as I have observ'd) reaches above the *Labyrinthus* on each side, so that whatever impulse is made on the *Tympanum* on the one side, may not only be very readily communicated by means of the internal Air to the *Labyrinthus* of the same, but also to that of the opposite side. Hence probably proceeds the quickness of Hearing and Vigilancy of Fowl, notwithstanding their wanting a *Cochlea*, the defect of which seems to be by this Structure more than supplied, no other Creatures that we know of having any thing of it. It is not improbable that the opposite Ear to a Sound is altogether as much affected by it as that next it, if not more. There are several *Laminulæ* and Pillars of hard Bone between the two Tables in these Cavities, designed, as may be supposed, partly for their Maintenance at a convenient distance, and partly for breaking of the Air, so as to hinder Echoes

choes and confus'd representations of Objects. In confirmation of which last Reason Sir *John Hoskins* did ingeniously observe, that Pillars in Churches very much prevented Ecchoes : And for the same reason these might also hinder them in the Heads of this particular Structure.

3. In the Heads of *Woodcocks*, besides the passages now describ'd, I found one on each side the Bone, making the Orbit of the Eye proceeding from the Ear, and reaching forward towards the setting on of the Beak, near which they join'd in one, and turn'd under the Skull in a small passage leading to the Cavity, by which the Ears communicate, and which is above describ'd, into which it enters. These passages are also in the Heads of *Snites*; and moreover, one over the *Sinus Longitudinalis*, and another over the *Sinus Lateralis* of the Brain. Note, that in the killing of *Snites* and smaller Birds, if care be not taken that the Head be not bruise'd, these passages cannot be discover'd for Blood extravasated in them. Note also, that the *Laminulae* and bony Pillars are every where to be observ'd where there is a passage, excepting under the Skull, in the passage from the setting of the Bill to the first passage describ'd.

4. In the Heads of *Parrots* and *Paroquets*, besides the first describ'd passage, I observ'd between the two Tables every where Cells opening into others, and those into others, so that there was not any part scarcely of the Skull that was not taken up with them. And this did not only appear by pouring into one Ear freed from its Drum, the other also being removed, a Tincture of Cochineal, and then blowing of it into all these Cells, so that no part was free from Tincture; but it appeared also to the naked Eye, notwithstanding that sometimes it was difficult to trace the Communications of them by reason of numerousness of the *Laminulae* and Pillars aforesaid.

5. In Singing Birds the Structure of these passages is like that of the *Parrot* and *Paroquet*, only that the Pillars and *Laminule* are less than they should seem to be in proportion to the Heads. From whence it is probable, that these Birds are by this Structure enabled to distinguish Sounds and Notes, and also imitate them better, having a more musical Ear.

6. In the Heads of *Pullets*, *Geese* and *Ducks* I found only the first describ'd passage distinctly, but in *Pluvers*, *Bustards*, and some other, I found another that went over the *Sinus Lateralis* of the Brain from Ear to Ear. This seems to be design'd to make them more watchful than Domestick Fowl, or yet those that live much on the Water, because they are liable to a great many Dangers that the others are exempt from. Note, that there are for the most part great varieties in the Structures of all Fowls Heads.

7. In the Ears of all the Fowl that I could examine, I never found any more than one Bone and a Cartilage, making a Joint with it that was easily moveable. The Cartilage had generally an Epiphise or two, one on each side, which were very flexible, as it self was. The Bone was small and very hard, having at the end of it a broad Plate of the same Substance very thin, upon which it rested as on its *Basis*. I got that of a *Pullets* Ear, represented in *Fig. 4.* where *a* is the main *Cartilage*, and *b b* the two *Epiphyses*, *c* the small Bone, and *d* the *Basis* or broad end of it. Note, that in the Figure, part of the Drum sticking to it is represented together with the Cartilages.

8. I observ'd three pair of *Nerves* in all the broad bill'd Birds that I could meet with, and in all such as feel for their Food out of their sight, as *Snites*, *Woodcocks*, *Curlews*, *Geese*, *Ducks*, *Teale*, *Widgeon*, &c. These *Nerves* are very large, equalling almost the *Optick Nerve* in thickness; they begin a little more forward than the  
*Auditory*

*Auditory Nerve* from a little Protuberance which seems to be made for them: One of them goes over the *Optick Nerve* in the Orbit of the Eye, the other two go under the Eye. Two are distributed nigh the end of the upper Bill, and are there very much expanded, passing through the Bone into the Membrane, lining the Roof of the Mouth. The third Pair is distributed near the end of the lower Bill, and subdivided like the former. Note, that Birds that pick their Food where they can see it have not these *Nerves*, and that the Pair of Nerves belonging to the upper Bill is considerably smaller in proportion to the Fowls than those observ'd above; whence it is probable that these *Nerves* were designed for some great use, both on the account of their number and their largeness; and that the use to be assign'd to them must be to enable them to distinguish (whether by tasting or feeling I will not now distinguish) their Food, there being a necessity of a more exquisite Sense in these Fowl, than in any other. *Fig. 15.* represents these in a Ducks Head, where *a a* expresses the Edge of the *Cranium*, which was in part remov'd for the more clear view of these Nerves, *b b* are the *Cells* about the Ear between the two Tables above described, *c c* the *Brain* laid bare with its Blood-Vessels, *d d d* the three *Nerves* on one side, *e* the *Optick Nerve*, *f f f* the Skin and part of the Bone remov'd to bring the Nerve in view, *g g* the two Nerves expanded near the end of the upper Bill, *h h* that in the lower.

9. All the *Eyes* of Fowl and of *Fish* that I have examined were more or less *cartilaginous*; for the *Scleroticis* is a *Cartilago sui generis*, especially near the *Cornea* in all these Animals. And in the larger sorts of both I remembered to have found the whole *Scleroticis* such a kind of a *Cartilage*.

10. In the Eyes of Fish I observ'd that the *Processus Ciliaris* is not fastned to the joining of the *Cornea* & *Sclerotis*, as in all other Animals that I dissected, so as to hinder the watery Humour to go any further backward. For I constantly observ'd that the *Humor Aqueus* may move a good way backward in some, and in others almost as far as the *Optick Nerve*. I shall at another time make some Remarks on this.

11. I have in as many *Fish* as I could conveniently examine carefully, found a Membrane which cover'd the *Tunica Cornea*, so as not to let any Water come to it. This answers the *Membrana Nictitans* in Fowl, and reaches on all sides to the *Cutis* of the Fish to which it is fastned; this is transparent, and pretty thin, and so is also the *Cornea*, if compar'd to that of the *Quadrapeds*.

12. I have frequently observ'd in smaller Fowl, that the Membrane of the *Drum* was double; for I have by gently pulling away the Membrane lining the Tube of the *Ear*, I observ'd at the bottom of it a transparent Membrane, which at first I took to be the Membrane of the *Drum*, but upon Examination I found that the Membrane of the *Drum* was still entire and in its proper place. I have sometimes observed this in larger *Fowl*, in a *Seal*, and in some other Animals, and am apt to think from a case mentioned in *Du Verneyes* Book of the *Ear*, that it is so in Men; and if so, it is likely it may be so in most, if not in all Animals. The Observation was as followeth; A Person that was deaf for some time died, whose Ears Mr. *Du Verneye* examin'd, in order to find out the cause of his Deafness, which he found to be a thick Membrane growing in the *Ear* before the *Drum*, which hindred the Impulses in the Air to be communicated to it. Now I take it to be more likely that the Membrane should be double, and that the outward was preternaturally incrassated, then that a Membrane should grow in a place where the sides do not touch.

## VII. An Account of BOOKS.

Η ΥΠΕΤΟΛΟΓΙΑ: *Sen Exercitationes de Morbis Universalibus Acutis Authore Richardo Morton Med. I). Regii Collegii Medic. Lond. Socio & Censore. Lond. in 8<sup>o</sup>. 1692.*

**T**HE Doctor knowing well, that Indications in the Cure of Diseases cannot but be uncertain, if they are not founded upon an accurate Knowledge of their true Cause, which (at least in the universal Diseases) cannot be clearly discerned, unless the Origination, Situation, Structure and mutual Connexion of the Parts affected be also understood, shews in his Præliminary Discourse, that the Brain is the part which is first formed in the whole Body; then gives an account of its Substance, and how all the parts, whether Membranes, Muscles, Vessels, Viscera, Tendons, Cartilages or Bones are derived from it, and are Continuations of it, and are actuated and enabled to perform all their several Functions by Animal Spirits which they receive from thence. From whence he is induc'd to believe, that not only Cephalick Diseases, but all universal Distempers Acute or Chronic, are primarily occasion'd by these Animal Spirits when they are disorder'd, and their Oeconomy perverted by an extraneous and disagreeable Ferment, by which the Blood and the rest of the Humours are afterwards corrupted; and that therefore in the Cure of Universal Diseases, the principal Indications ought to be taken from the Disorders of the Spirits, and not

not from the Corruption of the Humours ; tho he denies not that the Indications arising from the Corruption of the Humours may also have their use.

In order to establish his Hypothesis, he demonstrates the following *Lemma's*, That there are really such things as Animal Spirits, where he enumerates all their known Properties: That some of these Spirits are contain'd in every minute Fibre : That they flow from the Brain as Rays from the Sun, and that the Brain is as it were their great Cistern, and the Nerves the Pipes by which they are convey'd to the other parts : That they are the first Principle of Action, and do in divers manners agitate and operate upon the Humours : That they are intimately united to the Blood ; and here he takes occasion to prove by many Arguments, That the Blood in its Circulation passes through the Habit of the Body between the Extremities of the Arteries and Capillary Veins : That these Spirits may be several ways vitiated, without any antecedent Corruption of the Humours ; and tho the Blood out of which the Spirits are made should be antecedently corrupted, yet the universal Disease can't be said to be begun till the Spirits are infected : That the Blood and Humours are alter'd and corrupted by the Diseases of the Spirits, which he proves by several remarkable Instances, and shews how a Distemper in a particular part, as Consumption, &c. becomes an universal Disease. Then he proves by many cogent Arguments, that all universal Diseases, whether primarily such, or occasion'd by the disaffection of a particular part, do immediately arise from the Spirits, and that the Sympathy of one part with another, and the Translation of a Disease from one part to another can't otherwise be explained, and that some peculiar Dyscrasies of the Spirits are the Causes of the Distempers even of particular parts, and that the Specifics us'd in their Cure have

have not respect to the part affected, but to the particular Dyscrasy of the Spirits.

After a short Account of Universal Diseases in general, he treats of the Nature of Acute Fevers, and calls the Ferment which occasions them a Poyson, which he proves to be of a very subtile Texture, tho we can't have any perception of it by any of our Senses; and therefore he forbears to give any particular Description of it; but goes on, and shews how clearly the Symptoms of Acute Fevers (which all proceed either from the oppression of the Spirits, or a greater degree of Elasticity which They acquire from the Imitation of the Poyson) may be explain'd by his Hypothesis. Accordingly, he tells us how it comes to pass, that Coldness of the external Parts, a quick and weak Pulse, and irregular Respiration accompany the first Insults of Fevers, and that he once at least hath known the Blood Actually cold in the beginning of the Distemper. He also gives the Reason of the Drowsiness, Lassitude, Shaking, Trembling, Tossing, Yauning, Giddiness, Sickness at Stomach which accompany the first Stage, and why a new Fit of Cold and Shaking (if the Fever be not intermitting) should portend so much Danger as it doth. Then lays down the Indications which arise from these Symptoms, and treats of all the other Stages of the Distemper in the same manner. He takes notice how it comes to pass that Rheumatical Pains remove from place to place; and omits not those Symptoms which are in the Humours, namely, the Symptom of *Cholera Morbus*, *Diarrhæa*, Vomiting, Thirst, Dryness of the Skin, Redness and Thickness of Urine, &c. Now the Cause of this Fever being a Poyson from whence all these Symptoms have their Original, it ought to be cur'd by its proper Antidote. He informs us also what is to be done when the Antidote will not take place; and when he discourses of the Crisis of these Fevers, he observes that Sweats are not the Crisis its self, but a sign of

of the Crisis, and gives the reason why immoderate Heat is a great hindrance of Sweating as well as Cold.

He says but little of the *Febris Ephemera*, which is the only Fever which arises from an evident Cause alone, as Motion, Heat, Intemperance, &c. This may degenerate into an Intermitting or Malignant Fever, and hath no Pathognomonic Sign by which it is distinguish'd from other Fevers besides its Duration, and hath but one Indication.

When he comes to speak of intermitting Fevers, he gives us another Argument to prove their Cause is a Poyson, and that is, because it produces the same Symptoms which other Poysons do, to wit, Faintness, Vomiting, Universal Sickness, Spasmodick Pains, &c. But this is so mild a Poyson, that the Animal Spirits are rather vex'd and irritated, than destroy'd by it, and by their own Elasticity rid themselves of it in a short time. This Poyson, he says, cannot be lodg'd in any part of the Body, except in the Fibres, because the whole Body being vascular, the Blood circulating perpetually thro' all the parts, would otherwise be put into a continued Feverish Commotion; but in the Fibrous Filaments it is at liberty to put the Spirits into Periodical Explosions. Speaking of the Procatartick Causes of Intermitting Fevers, he acquaints us how they come to be Endemical in some places, and why those who seem equally liable to this Distemper from the evident Causes of it, are not equally seized with it. Then he solves the *Phænomena* of the Symptoms with great Perspicuity, discourses of the Duration of this Fever, and shews, that the *Cortex Peruv.* is not the occasion of the frequent Returns of this Disease, and proves that the Ferments of Quotidian, Tertian and Quartan Intermitments are not specifically different.

He thinks it not worth his while to enumerate the Diagnostics of this Disease when it is regular and genuine ; but because it is often so obscur'd by the Violence of some particular Symptom, that it is frequently mistaken for some other Disease, as Head-ach, Apoplexy, Colic, Pleuresie, *Cholera Morbus*, *Diarrhœa*, Dysentery, &c. He reckons up the several Distempers which it so exactly imitates, and teaches us how to distinguish it from them, which is chiefly to be done by the Colour and Contents of the Urine, and the Periodical Exacerbation of the Symptoms. In his Chapter of Prognostics he observes, that no body dies of an Intermittent but in the Cold Fit. That the Symptoms are often of more dangerous consequence than the Poyson it self. That an Emetick, or sometimes some slight Remedies given before the Third Fit often cure the Disease ; but if the Fever hangs long upon the Patient, it is often turn'd into a Continu'd Fever, or produces Chronical Distempers, which will not be cur'd without the use of the *Cortex Peruv.* with several other remarkable things, of all which he gives the Reason. In the Chapter of the Intentions of Cure, he lays down two Indications, one in the Fit, and another in the lucid Interval ; and tells us how and why Blood-letting, Emetics, Purges, Opiates, Diaphoretics are so often very injurious to the Patient. Then he describes the Method to be taken when Intermittents lie hid under the shaps of other Diseases. He observes by the by, that when this Fever is accompanied with an Efflorescens like that of an *Erysipelas*, or Scarlet Fever, it is also joyn'd with a *Periodical Diarrhœa*, or *Cholera Morbus*. He gives the reason how it came to pass, that the Ancients were so absurd in the Cure of this Fever, and how Specifics were brought in request ; and here he treats of all the known Specifics, as *Amulets*, *Pericarpia*, Infusion of *Crocus Metallorum*, Diaphoretic Antimony, Salt of Wormwood, Bitters, &c. and shews their

their uncertainty ; and communicates the Receipt of a Powder, with which he hath cur'd some Intermittents, which would not yield to the *Cortex Peruv.* which *Cortex* he considers in two whole Chapters.

In the first of which is contain'd the Natural History of this Bark, the Name of the Tree, the time of its coming into use in *Europe*, and how the *Europeans* came to the knowledge of it. It seems it met with great opposition when it was first brought into use at *London* ; and some Physicians cry'd it down because it perform'd the Cure (as they thought) too soon ; others, because they could not reconcile the manner of its Operation to their Hypothesis and Doctrine of Humours, declaim'd against it as a Medicine too hot or too dry, or some way or other not qualify'd for the purpose. Some Foreigners indeed defended it, and maintained that it had Qualities, such as Heat, Tenuity of Parts, &c. by which it might well enough effect the Cure of Agues : But our Author concludes, that it cures them, not as it is hot or dry, or possessed of any other Qualities ; to which purpose he gives an Instance of a Fruit in *Sardinia*, that hath the same degrees of Heat and Siccity with the *Cortex* ; which creates a Tertian as certainly as the *Cortex* cures it ; and therefore the Arguments for or against the *Cortex* taken from its manifest Qualities, are in his Opinion of no Validity. After he hath answer'd the Objections and Calumnies of abundance of Foreign Authors against this Medicine, he declares that he hath never in 25 years Observation seen any ill effect of the *Cortex*, only a small temporary Deafness, which vanish'd upon the Omission of the Medicine. But if the Patient hath a great Antipathy to the Bark, it sometimes causes Vomiting and Fainting, and so does Honey, and several other very innocent things when they meet with a peculiar Idiosyncrasie. The Author considers in the next place, how the *Cortex* performs this Cure, and makes it appear  
that

that the several Solutions which have been given of this *Phænomenon* hitherto, are insufficient ; then discourses of the Nature of Poysons and Antidotes, and the manner of their Operation ; and shews that Fevers have manifest Symptoms of Poyson accompanying them, and such as would be produc'd by Arsenic, Mercury, Colocynthis, or some other known Poyson, and then concludes that the *Cortex* cures Them, as other Antidotes do other Poysons, and waves any farther nice Speculations concerning the manner of its Operation, which he knows can be but meer Guesses and Conjectures, and is contented to give an undeniable Proof that it is an Antidote : Among other Arguments to that purpose, he thinks the smalness of the Dose in which he gave it when it came over unadulterated, before the Merchants were sensible of its Value, and before *Talbor* knew it or made use of it, may pass for One ; and the Performance of the Cure without any Evacuation, for another. He deduceth some Coralleries from what he hath said on that Subject, and by the by teacheth us how External Medicines conduce toward the cure of Fevers ; then proceeds in the next Chapter to give the Marks of the true and genuine Bark, because that of the Shops is generally adulterated, and sets down several Forms in which he gives it, with this Remark, That it must be given always in Substance, because the Chymical Preparations of it are scarce ever found to have any Efficacy ; and subjoins several Rules, which, if well observ'd, may prevent the return of the Disease.

The Histories in the 9th Chapter, which confirm all that he hath laid down in the preceding Treatise, are not of Regular intermitting Fevers cur'd by the *Cortex*, it being granted that Agues are daily so cur'd, but of such as were conceal'd under the Symptoms of other Diseases, as Colic, Apoplexy, Rheumatism, Peripneumony, Universal Spasm, &c. which is a Work of great moment

in the Practice of Physick, and was never undertaken by any other. Among those Histories is one very remarkable of an Intermittent, which was partly occasion'd by the Stone of the Kidneys ; and Three, of Patients which he cur'd with his own Specific when the *Cortex* would not prevail, and in these Histories he is very punctual and exact, and sets down all the particulars that were any way material in this method of Cure.

The Second Exercitation begins with a general Discourse of continued Fevers, whose Ferment is in a higher degree Venomous than the Ferment of the Intermittents, and therefore the Spirits cannot cast it off entirely at once, but are always in a Feverish Commotion. If the Spirits in every Conflict gain ground of the Poyson, tho never so little, the Fever is a Remittent ; but when the Poyson is in the highest degree venomous, the Spirits are siderated in some measure from the very beginning, and the Fever thereby occasion'd is continual, without any remission and malignant, because the Poyson is equal if not superiour to the Spirits. The Venom therefore of these Fevers differs only in degree, and Malignant Fevers often-times are changed into Remittent, and Remittent into Malignant : And it is very well worth Observation, that Epidemical Fevers, tho highly malignant, have a manifest Remission on the Third Day, sometimes also on the Fifth and the Seventh ; and when they draw towards a good Crisis, and the Spirits begin to be expanded, remit again at set times. Hence it is to be concluded, that a Remitting Fever is not fatal, unless it be accompany'd with some Symptomatical Inflammation or Colliquation. How the Poyson in the Remittent Fever comes to produce these Symptoms is here shewed by the Author. Continued Malignant Fevers he reserves for a Fifth Exercitation.

After this he comes to discourse of Remitting Fevers in particular, which he divides into Genuine and Spurious. By Spurious Remittents he means those which are accompany'd with some violent Symptom; then he gives a Description of the Disease, and its ordinary Symptoms, and a very good Reason why every Exacerbation of a Remitting Fever doth not begin with Cold and Shivering as the Paroxysm of an Ague doth. The Diagnostic of this Fever when it is regular are taken from the Exacerbations and Remissions, the Pulse, the Colour of the Urine and Periodical Sweats; but when it is Spurious, it is very difficult to discern what Distemper it is, for the Violence of the Symptoms make the Fever scarce perceptible. Here therefore the Author teacheth us how to distinguish it, and observeth that the Symptoms in this case are always such, as argue the strength and vigour of the Spirits, tho they are in part oppress'd with the Poyson; and particularly, that an Efflorescence like an Erysipelas about the Nose and Lips (when it happens) is a certain mark of this Distemper. Then he speaks of the Evident Cause of this Fever, which he finds to be the Atmosphere; and that therefore this Distemper is constant and Endemical in some places, and in almost all places Epidemical in the Autuma. The Prognostics are these which follow, and several others: The Remitting Fever before it becomes fatal is always turned into a continued Fever without Remission, and is very apt to degenerate into it about the state of the Disease, especially if the Symptoms are suppress'd rashly and without good Caution. The Spurious Remittent is not more fatal than the Simple in its own Nature, but on the Account of its Symptoms. A Remittent sometime after the state of the Disease turns into an Intermittent, which is very apt to return, and very hard to be cur'd. The Crisis of this Fever when left to Nature is tedious and uncertain. The *Cortex* makes as certain.

certain a Cure in the Remittent Fever as in the Intermittent, but in the Spurious Remittent it hath not its Effect so soon. This Fever cur'd with the *Cortex* is apt to return in the shape of an Intermittent; but when it is cur'd by Nature, the Patient seldom hath a Relapse. No critical Solution of this Fever is certain but Sweating and Salivating. The strength of the Pulse is always a good secure sign, tho the Symptoms seem terrible and dangerous. Almost all Epidemical; Autumnal and Camp-Fevers are either Genuine or Spurious Remittents.

There is but one thing Indicated in this Fever, that is the Correction, or rather Abolition of the Poyson, which occasions all the Tumult; unless the Spirits are put into Explosions, or the Humours colligated, or the Fever inclining to Malignancy; for in these cases there arise several Indications. But because this Poyson is not always extinguish'd by the same means, but sometimes by its proper Antidote, sometimes by the natural and repeated Expansion of the Spirits. Our Author shews what is to be done when the Distemper is left to Nature; and tho he looks upon that to be a very uncertain way of Cure, yet he lays down the Rules to be observ'd in this Rational Method, by which if a Physician be guided, he shall do nothing that is absurd or Emperical; and therefore gives a Description of the Disease, and its several Stages when it is left wholly to its self, and the Reasons of its Symptoms. For instance, Why the Lassitude, Soreness, Head-ach and Pains, whether fixt or moveable, vanish of their own accord in the state of the Fever, whatever its Event is like to be: How the several Stages come to be of an uncertain Duration, and longer and shorter as the Spirits are stronger or weaker, &c. He shews the Faults or Mistakes and ill Practice of three sorts of Men in this Rational Cure, namely, of the Ancients, of the Modern Chymists, of the Surgeons and Apothe-

Apothecaries; then lays down his own Scheme of Practice according to his own Hypothesis, and descends to every particular Symptom, and shews in what manner it is to be dealt withal: And here he takes occasion to discourse particularly of the use of *Alcalies*, *Vesicatories*, *Suppedanea* and *Pidgeons* or part of Animals apply'd outwardly to any part of the Body, of *Alexipharmicks* and *Opiates*. But tho' the Author hath done several Cures this Rational way, yet considering its tediousness and uncertainty, and the Proclivity of the Fever it self to degenerate into a Malignant, and the several other Inconveniences of this Method, he hath treated it for several Years after the other Method, which he is just going to describe.

When the Remittent is Genuine, the Antidote is to be given as soon as the Fever remits; and there is nothing else needful; for when the Poyson which is the Fuel of the Fever is taken away, the Flame must necessarily go out. But if the Fever be permitted to encrease till it is ready to turn malignant, or hath its Type almost lost and disguis'd by the violence of some Symptom; after Blood-letting, &c. the Spirits must be erected with Theriacal Bolus's and Vesicatories, and then the Antidote will take place. If the Patient is inclin'd to vomit, and cannot retain this unpalatable Medicine, the Tone of the Stomach must first be corroborated, and the Acrimony of its Ferment softned and rebated, and then some *Laudanum* must be mixt with the Antidote. The Author takes notice also how a *Symptomatical Diarrhæa*, or *Cholera*, and the Symptoms of Inflammation and Explosion are to be manag'd; and observes; That when this Fever is accompany'd with Inflammation, it will not be cur'd without quantities of the *Cortex* larger than ordinary; and that when it is joyn'd with Explosion of the Spirits, those Spasms will not be quieted with an ordinary Dose of *Laudanum*, but require

that it should be administred in great quantities, and be often repeated ; but the Fever it self must always be cur'd with the *Cortex*. When a Remitting Fever is turning Malignant, the *Cortex* is still to be us'd as long as the Patient can bear it ; but unless the Spirits are raised by Epispastics and Alexipharmicks to a degree of Vigour fit to actuate and guide the Antidote, the Antidote must needs be useles. To this Treatise the Author subjoins several select Histories of Spurious Remittents, some of which degenerated into Malignant Fevers, the better to illustrate his Hypothesis, and to confirm the admirable use and vertue of the *Cortex*.

He concludes his Book with a Compendious History of this Remitting Fever from the Year 1658. to the Year 1692. in which it is very observable that the great Plague in 1665. (of which here is a brief Account) did not quite obliterate this Fever ; and that when Dysenteries reign'd so much in *London* from 1666. till 1672. the Flux and the Gripings were only Symptomatical, but the Disease it self a Remitting Fever, and was successsfully cur'd by the *Cortex* mixt with *Laudanum*. Here is likewise an History of the Measles, which were Epidemical in the *Autumn* 1672. which very much resembled a Remitting Fever, and in some cases admitted of the use of the *Cortex* : But he says little upon that Subject, designing, as soon as his other Employments will give him leave to publish an entire Treatise of the Measles, Scarlet Fever, Small Pox, and other Inflammatory Fevers; in which he hath already made good Progress.

*Catalogus Plantarum Horti Academici Argentinenfis, in usum rei Herbariae Studiosorum, Adcurante Marco Mappo Med. Doctore & Professore Seniore, & Archiatro Argentinenfi Argentorati apud Jo. Fredericum Spoor, 1691. in 12°.*

**T**HE Author in his Preface tells us, that Physicians have been obliged of late very much to enlarge their Enquiries, beyond what in times past was customary with them: So that it is now required of them not only to make a more exact Search into the Mysteries of the Parts and Humours of Humane Bodies by Anatomy into Cosmetics, they being frequently advised with on their uses, but also to remedy the Body even after Death, by teaching to embalm and preserve the same. Amongst these Studies is the knowledge of Exotick Plants, which has receiv'd very considerable Accessions by Physitians and Apothecaries, whom Necessity forcing to the knowledge of the parts of their own, and Exotic Plants in common and ordinary use, they are thereby help'd to judge of the Virtues of others of the same kind coming from abroad: And seeing this Study is very large, those who are addicted to it ought to be very thankful to any, who by their provident Care and Charges furnish their Gardens with the most elegant Plants of *Asia, Africa, America*, or distant places of *Europe*, amongst which this Garden of *Strasbourg* our Author gives the Catalogue of, is one.

He publishes this Catalogue on two Accounts; the first and chief of which is for the keeping a mutual Commerce between the Author and those who keep

Gardens of the same kind, for the furnishing others with what he has, and being supplied with what he wants from them. The other reason is, the use of those who design to attain to the Knowledge of Plants, on whose Account he has only given (for the most part) one single Name, he observing that the multitude of Names given the same Plant by several Authors, in differing Kingdoms, having respect to their various Properties, Forms, Virtues and lesser Accidents, has given great disturbance to the Learners: On which score this Author almost only uses the Names of *Caspar Baubin* in his *Pinnax* and *Dr. Herman's* Catalogue of the Garden of *Leyden*, preferring the Names given by *Caspar Baubin*, being now commonly used by most Herbalists, even before those very long Names who are since given them, for very small reasons, in place of his. For the Plants not known in *Baubin's* time he uses the Names in *Dr. Herman's* Catalogue, as well as for those whose Names are to be reform'd, to which he subjoins *Baubin's* Name likewise.

The Book it self gives the Names of the Plants in the Garden Alphabetically, wherein are some curious Plants gathered from near home and from far, amongst which are few Non-descripts, or such as have not been taken notice of by other Writers, some of which may perhaps be Varieties, as may be seen more at large in the Book.

Stephani Chauvini *Lexicon Rationale, sive Thesaurus Philosophicus*, &c. Rotorodami, in Folio, 1692.

**T**His *Philosophical Dictionary* is contrived in an Alphabetical Order, and is intended by the Author as a Key to *Philosophy*, discovering what may be known by the Light of Nature, expounding the Philosophical Terms, and their various Acceptations according to the Ancient and Modern Opinions: It will be sufficient to inform the Reader, that he explains Words relating to Logic, Natural and Moral Philosophy: especially such as cause the greatest Contests in the Schools both of the Ancients and Moderns.

Amongst them are interspersed Astronomical, Optical, Mechanical, Chymical, and Physico-Mathematical Words, chiefly such as explain Bodies and their several Affections; the whole is rendred the more intelligible by several Schemes contained in 30 Folio Plates, exhibiting to the Readers view the several *Hypotheses*, with the Structures of very many Instruments and Machines, as Barometers, Thermometers, Hygrometers, Telescopes and Microscopes, made use of by the late Inquisitive Age in searching deeper into the nature of Bodies. As a *Specimen*. I shall present the Reader with an Abstract of what he writes of the Telescope. First, He gives the Definition, Use and Effects thereof; proceeding to several sorts, he describes the common one made with a Convex Object Lens and Concave Eye-glass, the Astronomical Telescope, with two Convex Lens's, another  
with

with two Convexes and a Concave. The Terrestrial Telescope, with three Convexes, and two others with four Convexes; of each of these he gives the Schemes and demonstrates their Effects.

---

*E R R A T A* in some former Numbers of these Tracts.

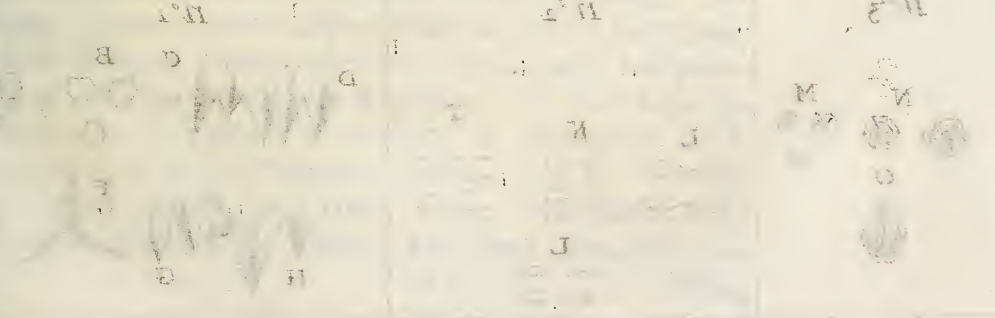
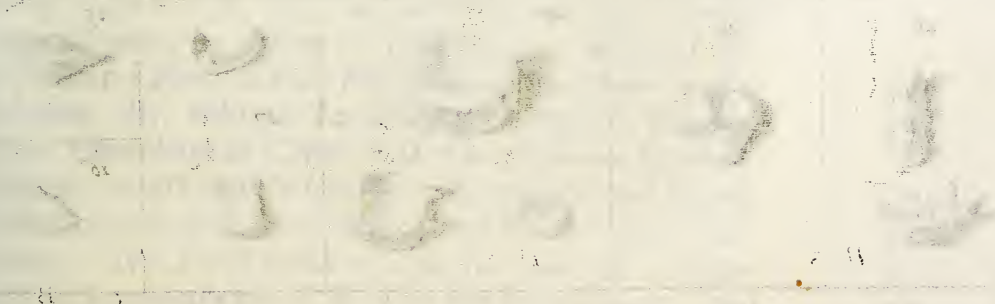
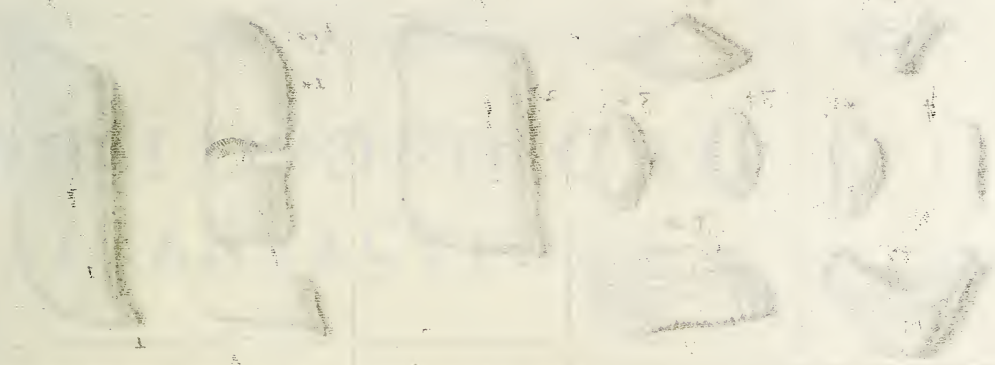
**N**umb. 192 Page 462. line 4. dele *five*. p. 489. l. 26. dele *him*. N<sup>o</sup>. 194. p. 544. l. 5. r. *sepe*. p. 554. l. 6. for *Breast* r. *Back*. N<sup>o</sup>. 195. p. 565. l. 12. r. 162. p. 568. l. 13. for *more* r. *move*. N<sup>o</sup>. 196. p. 584. l. penult. r. *Chartula*. p. 587. l. 4. r. *notu*. p. 589. & 590. in Marg. r: Fig. 3. p. 593. l. 6. r. *Animalcules*.

---

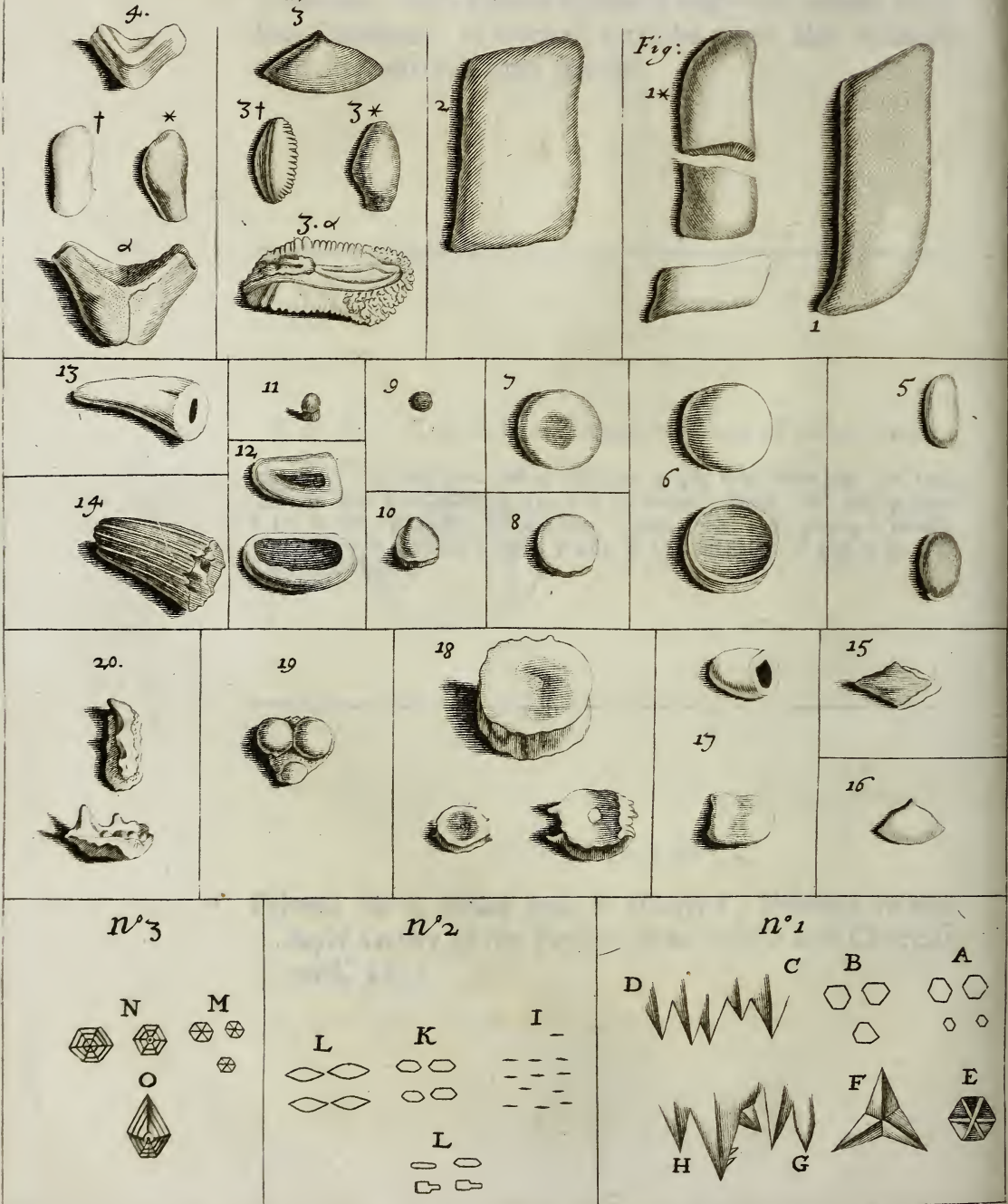
L O N D O N :

Printed for S. Smith and B. Walford, Printers to the Royal Society, at the Princes Arms in St. Paul's Church-yard, 1693.

Handwritten text at the top of the page, possibly a title or date, which is mostly illegible due to fading and bleed-through.



*Philosophical Transactions. N<sup>o</sup>. 200*



---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of May, 1693.*

---

## The CONTENTS.

- I. **T**HE Method, Manner and Order of the Transmutation of Copper into Brass, &c. by Thomas Povey, Esq; S. R. S. II. Two Letters concerning several Copper Mines, in Answer to some Queries proposed by Dr. Martin Lister, S. R. S. who communicated them to the Publisher. III. *Edvardi Lvidii* apud Oxonienses Cimeliarchæ Ashmoliani ad Clariss. V. D. *Christophorum Hemmer* Epistolâ, in quâ agit de lapidibus aliquot perpetuâ figurâ donatis, quos nuperis annis in *Oxoniensi* & vicinis agris adinvenit. IV. The Extract of a Letter from Mr. Anthony Van Leeuwenhoek, S. R. S. to the Royal Society, containing several curious Observations on Native Cinnabar, and the firing of Gunpowder, with its Contents, and quantity of Air produced by the Explosion. V. The Description of the American Tomineus, or Humming Bird, communicated by Dr. Nehemiah Grew, S. R. S. VI. An Account of Books. 1. Horti Indici Malabarici, Pars Septima, Octava, & Nona, with some Remarks upon  
B b
them,

them. 2. *A Collection of Curious Travels and Voyages, in two Tomes: The first containing Dr. Leonhart Rau-  
 wolff's Itinerary into the Eastern Countries, &c. The Se-  
 cond taking in many parts of Greece, Asia minor, Egypt,  
 Arabia Fœlix, and Petrea, Ethiopia, the Red Sea, &c.  
 from the Observations of Monsieur. Belon, Vernon, Greaves,  
 Dr. Spon, Smith, Huntingdon, &c. Lond. Printed for  
 S. Smith and B. Walford, in 8°. 1693.*

I. *The Method, Manner and Order of the Transmutation of Copper into Brass, &c. By Thomas Povey, Esq; brought into the Royal Society, of which he is a Fellow.*

WE have in the North parts of *England* much *Copper*, which places, though as they now lie, are barren and poor, might be rendred rich and useful, if a sufficient Encouragement were given to the Digging and Raising thereof, and the Poor thereabout might be put in a good way of Livelyhood, as well as several other Advantages to be brought thereby to the Publick.

The *Calamine* is digged out of certain Mines, of which there are several in the *West* of *England*, (as See Num<sup>b</sup>. 198. of these Tracts about *Mendip*, &c.) which lie about 20 Foot deep, as as these Tracts Coals do, thence brought up by Sea. It is burnt or calcin'd in a Kiln or Oven made red hot, then ground to Powder, and sifted into the fineness of Flower, and mixt with ground Charcoal, because the *Calamine* is apt to be clammy, to clod, and not so apt or capable of incorporating: Then they put about 7 *l.* of *Calamine* into a Melting Pot of about a Gallon Content, and about 5 *l.* of the *Copper* uppermost, the *Calamine* must be mixt with as many Coles as will fill the Pot. This is let down with Tongs into a Wind-Furnace 8 foot deep, and remains 11 hours therein. They cast off not above twice in Twenty Four Hours, one Furnace holds Eight Pots. After melting it is cast into Plates or Lumps. Forty Five Pound of raw *Calamine* produces Thirty Pound burnt or calcin'd.

*Braß Shruff* serves instead of so much *Copper*; but this cannot always be procured in quantities, because it is a Collection of pieces of Old *Braß*, which is usually to be got but in small Parcels.

The best *Guns* are not made of malleable *Metal*, and cannot be made of pure *Copper* or *Braß*; but it is necessary to put in courser Metals to make it run closer and foundier, as *Lead* and *Pot-metal*. *Bell-metal* being *Copper* and *Tin*, *Pot-metal* *Copper* and *Lead*. About 20 l. of *Lead* is usually put into 100 l. of *Pot-metal*; but about 6 l. is sufficient to put into 100 l. of *Gun-metal*.

The *Calamine* Stones were heretofore fetch'd from *Poland*, but since fetcht from hence by the *Dutch*.

The Manufacture of *Braß* was privately kept in *Germany* for many hundred years, wherein thousands were employed and well maintained, some having thereby raised themselves to great Estates.

The *Dutch* may not import (an Act of Parliament expressly forbidding them) the *Copper* nor the *Calamine* Stone; but contrary to the Ends, and perhaps the meaning of the said Act, and more to the Publick Disadvantage, they mingle and manufacture those two Ingredients (which are of Foreign Growth to them) and by that Evasion import them hither: And the great Manufactures of *Wire*, and several other Commodities arising of those important Materials.

II. *Two Letters concerning several Copper Mines, in answer to some Queries proposed by Dr. Lister, S. R. S. who communicated them to the Publisher.*

L E T T E R I.

S I R,

According to your desire I have given you an Answer to the Questions about the Copper Mines to the best of my knowledge, which are as followeth.

The First Query is, *What quantity of unwrought Copper Ore is left upon the place, and where it is, and in whose hands, and what is the reputed value of a Tun of unwrought Copper Ore?*

To which I answer, *That there is a heap of Ore by Darwent near Kefwick; and I suppose no body lays Claim to it, but it is not worth any thing; for being there so long, the Weather hath eaten out all the Copper that was in it. And for the value of a Tun of Copper Ore unwrought, I know not what it is worth, neither is there any in this Country that can tell; neither can any Man know, except there were Ore got, that the Goodness or Badness may be seen by the more or less mixture of Stone that is in it, or by other Symptoms of kindly Ore.*

The Second Query is, *What use can be made of the Slaggs of Copper Ore? and whether they can be washed over again, as is practised in Lead-works?*

The only Answer that I have to this Question is, *That I do not know any thing of it, neither can it be known*

in this Country, all the Ancient Men that wrought at the Smelting of it being dead ; but it may be Mr. *Hex-techer's* Book will give some Account of it. That Book is in Mr. *Anglionby's* Custody at *Carlisle*.

The third Question is, *What Thickneß and Goodneß the Vein of Copper Ore is reputed to be of ?*

In Answer to which I say, It is reported that the *thickneß of the Vein at Gouldscope in Newlands was six Foot* ; but for the goodneß it cannot be known without comparifon of divers forts, to fee which is best ; and no Comparifon can be made in things unfeen.

The fourth Question is, *What number of Shafts and Addits are at the Work ? and what the great Addit cost ? and when was it finished ? and if it be yet finished ? if not, what will it cost to clear and perfect it ?*

To which I answer, That I have divers times viewed and well considered both of *Caldbeck* and *Newlands* Mines, and know that there is no Shafts in being neither at *Caldbeck* or *Newlands* ; and if there hath been any, they are filed up, and will be of no use for any that sets the Work on again, by reason that the Copper is wrought away from under them. There are divers Addits finished, which will be of no use, being that they will not clear the Work of Water : For the old Workmen have wrought down the Ore far below the Addits by the benefit of Water Engines and Pumps ; so that there can be no good done without new Addits. There is part of an Addit wrought at *Caldbeck*, but how much it wants to be finished I know not, neither can I tell what it will cost the finishing : For the Stone may be harder or softer ; for some Stone may be wrought for 20 s. per Fathom, and some of it may prove so hard, that

that it may cost 10 *l.* per Fathom, besides many Inconveniences which now lie hid, will in the working of it appear, as the sinking of Air-Shafts, or other Engines for that use.

The fifth Query is, *What quantity of Copper Ore was usually landed out of Caldbeck Mines in a Year, and what quantity of Lead in the same place? and whether more Copper might not be wrought out of the same Mine alone, if more Hands and a greater Fund had been provided ready to defray the Charges?*

To the first part of this Question I cannot answer, but shall refer you to *Hextecher's* Accompts, which will give you some light in it. And to the latter part of the Query I answer thus, That no doubt a greater quantity of Copper might be got out of the same Mines, if more Hands and a greater Stock were provided.

The sixth Query is, *What Men are yet alive about Keswick, or elsewhere, in the County of Cumberland, that have actually wrought in the Copper Mines; and what Ability of Body to work again, or to direct other Miners in the same Mine.*

To which I answer, That I have made Enquiry, and cannot hear of any that is alive that did actually work in those Mines; and if there be any, they are so old, that they are not capable to direct others.

The seventh Query is, *Whether 1000 *l.* Stock or Fund will sufficiently set on foot the Caldbeck Mines, and bring the rest in some years to perfection?*

To which I answer, That 1000 *l.* Stock will be enough to begin with to get Ore; and when there is Ore gotten, there must be Smelting-Houses built, which will cost 500 *l.* or more, if they are well built; so that

it will take up a long time before the Work be brought to Perfection. That is to say, before Copper be made ready for sale at the Market, it will be 6 or 7 years at least, and by that time 10000 *l.* will be Stock little enough: Though it will be laid out gradually, yet in that time before the Work come to pay it self, it will require the afore-mentioned Stock.

And this is the best Answer that I can make to the Queries; but *there are Questions of greater Importance than those, which ought to be well answered before the Copper Mines be set on work.*

What I have referred you to Mr. *Hextecher's* Book is not because I admire his way of Working the Mines, especially towards the latter part of the management of it; for I know the Ill Management was the destruction of it in the working of the Mines only: For I know that the Mines might have been wrought with one third of that Money to better purpose, as I can sufficiently demonstrate, if required: But for the Smelting Part I am ignorant of it: Nothing else, but due Respects from your humble Servant.

*Brathwaite, Jun. 28.*  
1684.

*David Davies.*

LET-

## L E T T E R II.

*An Account of the Names of the several Copper-works, or Mines, in Coniston-fells, which were wrought in, when the Smelt-Houses were up at Kefwick; and of those places discovered since, which were never wrought in; taken from three old Men hereafter named, who were Workmen in the said Works, and are all of those Workmen who are now living in this County of Lancaster.*

**T**HE first Work that was found and wrought in by the Dutch-men in Coniston-fells, is called *Low-work*. It hath a Stulm or Shaft to draw Water from the Mine. When the Smelt-Houses were up at *Kefwick*, and when they left off working, this Work was left good, and had been wrought from the Day to the Evening-end of the said Work Forty Fathoms, or thereabouts; the Seam or Vein of Copper-Ore then was left above three quarters of a yard thick of good Ore, which Seam or Vein did go from the Evening-end to the Morning-end of the said Work, and was esteemed two hundred Fathoms betwixt, wrought as the Vein went; and was, when left, all near of a Breadth or Thickness. The Copper Ore in this Work was mixt with some Silver, or Lead-Ore. The three Workmen hereafter named do judge, that about Two Hundred Pounds will recover this great Work.

The Second Work is called *White-work* or *New-work*, about Forty Fathom from the first; which was found a little before the Works were given over, being wrought about

about Ten Fathom deep ; the Seam then left was about 22 Inches of good Copper Ore, and may be recovered by these Men for Forty Shillings.

The Third Work is called *Young-Brow*, a little distant from the last, being wrought about Thirty Fathom, and the Seam about two Foot thick of like Ore ; and may be recovered with Three Pounds.

The Fourth Work is called, *God's Blessing*, or *Thur-dle-Head*, being wrought about Twenty Fathom, and being from the last Mine about a Mile ; the thickness of the Seam of Ore above a Yard when left off ; and thought by these Work-men much of it to be Gold-Ore, it having been highly prized by their Masters at *Keswick*, and may be recovered with about Three Pounds.

The Fifth Work is called *Hen-Cragg*, a Mile from the last, wrought about two Fathoms ; a small Seam, but excellent Ore, and hopeful to prove a large Seam. A small thing may recover it.

The Sixth Work is called *Summy-work* at *Levers Water*, at the Water-side, and a little above that *Hanch Clockers-work*, a little above that *George Towers* and *William Dixon's Work*, *Bartle Clocker's Work*, near the last *Richard Towers's Work*, then *John Sackloc's Work* and *Hanch Mire's Work*, being all Seven Works, and lie all together, and about a Mile from the Fifth Work above-said, and wrought about 10 or 12 Fathom, the Seam of Ore about 16 Inches thick, the Stone very soft, and the Ore very rich, and much of the said Ore green, and was very much prized by the Head Masters at *Keswick*. All these Seven Works may be recovered with about 20*l.* the Seams of them all being near alike in thickness.

A little before the Smelt-Houses left working at *Keswick*, Mr. *Hecstetter* had intended to have drawn a Shaft or Sump, to have drained a Tarn which all the Seven Works do shut into. He then, if the Works had con-  
 tinued,

tinued, could have had it done for about Sixty Pounds. It was thought then by the Workmen, that if the Tarn had been drained; that all these Seven Works would come into one, and that it would be the best Work that ever was in these parts.

The Seventh Work is called *Gray-Cragg-beck*, found by *William Dixon*, wrought but a little, the Seam about Eighteen Inches thick, of as good Ore as any of the other Works, and very hopeful to have a good Seam. A little will recover it.

The Eighth Work is called *John Dixon's Work* in *Brumfell* then newly found, and wrought about two Fathom, the Seam about 24 Inches thick, and esteemed the best Ore, except *God's Blessing*. A small thing will recover it, it being half a Mile from the last Work.

The Ninth Work is called the *Wide Work*, or *Thomas Hix's Work*, wrought about Threescore Fathom, and left a Seam above 26 Inches thick when the Work was given over, of very good Ore, and may be recovered with about 30 *l*. It has a Shaft or Sump to draw the Water away, and it is from the last Work about Two Miles.

The Tenth Work is called *Three Kings* in *Tilburthwait*, being 3 Works, and wrought above Forty Fathoms apiece, the Seam being above 14 Inches of very good Ore, but a little troubled with Water, having no Sump to draw it away. There is Fall enough to make one, and is near the last Work, and may be recovered with about 40 *l*. These are all the Works that have been wrought in *Coniston-fells*. Most of the Works here mentioned have small Seams near the Copper, of a Grey sort of Ore in small Threds.

The *New Places* discovered lately, and never wrought in, and several found this Year, Three in *Torverwel*, and about Ten in other places, and all near within

two Miles of the first Work in *Coniston-fell*, and as hopeful as those that have been wrought in.

These three Work-men do acquaint me, that the Works in *Coniston-fells* were found a long while after the Works at *Newlands* and *Caudbeck*. When the Ore which was gotten at *Coniston* came to be smelted at *Keswick*, they found it so much to exceed the Copper Ore of either *Caudbeck* or *Newlands*, that they let fall the Works of both those places, and sent the Workmen from thence to *Coniston-fells*, and little or none of the other Ore was made use of: So that there was above Seventy Work-men kept constantly at the Works in *Coniston-fells*. The Ore which they got there did sufficiently furnish and supply the Smelt-houses at *Keswick*.

They do further acquaint me, That they have heard Mr. *Jos. Heckstetter* say several times, That if ever he should be employed as the Head of the Works at *Keswick*, he would have caused new Smelt Houses to have been set up at *Coniston*, near to where the Ore was got, which would have saved a great deal in Carriage, it being above Twenty Miles from *Keswick*, and none of the way Cartable, and that both Wood and Peates are near, and very plentiful at *Coniston*, and Stone Coals cheap enough by Sea to help to smelt the Ore with; *Penny-Bridge*, our next Sea-Port, being Seven Miles off, two of which Miles are by Land, and Cartible, and the rest by Water up *Coniston Meere*.

The Rate that was given for getting of Copper-Ore was according to its Goodness, from 8 s. a Kibble to 2 s. 6 d. every Kibble being near a Horse-Load in weight, it being first beaten very small, washed and sifted thro' an Iron Sieve, then measured or weighed.

*An Answer to the Seven Enquiries, as to  
Coniston.*

To the First : No Copper Ore is already got in *Coniston*.

To the Second : All Copper Ore is knocked, washed and sifted ; the finest at one Rate, and courser at another, having a Rate according to the richness of the Ore.

There was near the first Work a *Stamp house*, which went by Water, and several persons were employed to bring the Refuse from each Work, that the Miners did throw away, to the Stamp-house, where it was stamped, washed and ordered, and they had 2 s. 6 d. a Kibble for their pains.

To the Third and Fourth Question: which are answered in the Description of the several Works aforesaid.

To the Fifth : Here is Copper Ore enough to be got with Men and Money.

To the Sixth : Here are only left alive 3 Workmen ; the Names of them are, *George Towers, William Towers,* and *Henry Dover* ; all able yet to work, and they all live in *Coniston*.

To the Seventh : A Thousand Pound will get a great quantity of Ore ; but what the Charge will be in making the Smelt-houses, they cannot judge, but believe they may be made here at *Coniston* far cheaper than in any other place in the North, by reason of the great Cheapness and Plenty of Wood, Stone, and Ground to build on, there being Water sufficient to supply any such great Work ; and there being now an *Iron Forge* upon the said Water, not half a Mile from the first Work. This is as exact an Account of these Mines as can be got.

*Coniston* April, 15.

1684.

*Tours, &c.*

D d

III. Ed.

III. *Edvardi Lvidii* apud Oxonienses Cimeliarchæ Ashmoleani, ad Clariff. V. D. Christophorum Hemmer, *Epistola* ; in qua agit de lapidibus aliquot perpetuâ figurâ donatis, quos nuperis annis in Oxoniensi & Vicinis agris, adinvenit.

**L**ubenter accepi (Vir ornatissime) quas ad nos per Clariff. *Lodbergium* dedisti literas ; jam antea eisdem responfurus, si vel id res postulasset, vel per otium faciliè licuisset. Gratias habeo quàm maximas, cùm ob multa alia, tum præcipuè quod circa *fossilia*, annotata quædam dum in Gallia peregrinatus sis nobiscum communicare volueris : speròque in patriam reducem, quid solum cimbricum ferat aliquatenus edoctorum. Nos etiam ex quo huic nostræ Academiæ valedixisti, hanc naturalis Philosophiæ partem non penitus neglectui habuimus : quanquam nosti, Vir Amicissime, quàm ad arctos limites damnatus sim, quamque (longè aliter ac vellem) ad naturæ opera investiganda, mihi parùm otii hæctenus obtigerit. Quare neque spolia longinqua expectes, neque propinquiora admodum multa. Quædam tamen ex hisce quæ occurrebant, rariora & magis elegantia (quoniam id rogas) in medium proferam : lapides nempe aliquot quibus numero pluribus, figura perpetuò eadem ; non minùs ac plantis & animalibus. Inter quos primum locum dabimus *Siliquastro*, utpote quod toto genere novus sit (quantùm nobis saltem innovit) idèmq; rarissimus, nec inelegans lapis. *Siliquastrum* autem appellare placuit, quod siliquæ lupini vel alterius cujusdam leguminis, valvulum alterum [cavitate tamen repletâ] non parùm referat. *Siliquastri* notæ ge-

mericæ.

nericæ sunt, quod sit lapis figurâ plerêque ad Siliquæ valvulum ( sublato concavo ) accedenti ; ex parte altera semper convexior ; & ( si marmoris instar fortuitò expolitos excipias ) minutè admodum rugosus, seu ut explicatiùs loquar, crebrò & eleganter malleolatus : facie quasi oleo obductus, resplendenti : texturâ si comminuitur Belemnitis ferè adinstar striatâ. Hujus lapidis plures dantur varietates quarum præcipuas solummodo nunc vacat recensere.

Fig. I. Siliquastrum ad Phaseoli valvulum quodammodo Vide Fig. accedens ; seu Siliquastrum Phaseolatum. Figuram titulus guras. indicat ; magnitudinem quod attinet, fescunciali est longitudine, dimidium uncix latum, vix quadrantem crassum. Quoad periferiam, aliud latus quodammodo falcatum est, aliud ( quod etiam magis acclive est ) rectum : extremum alterum lineâ obliqua cum duobus angulis clausum ; alterum non item. Ex parte pronâ superficies rectilateris striata est, cæterùm leviter rugosa ; & color anthracinus, nisi quod ad utrûmque extremum, paululum virescat. Ex parte supina, accretione quadam lapideâ foedatur, coloris rubiginosi. Inveni in lapidicina Witneiensis, septimo ab urbe lapide ; sed rarissimè occurrit. Triplo aut quadruplo minores aliquot, in quibusdam à jam descripto differentes, habeo, è fodinâ Stunsfeldensi, in hac provinciâ. I. \* Eiusdem lapidis varietas altera.

2. Siliquastrum lupini : Siliquam nennihil referens : seu veniam dabis sic loqui, Siliquastrum lupinatum. Phaseolato subinde brevior est, at semper latior : colore incerto sed ut plurimum à pronâ parte nigro, vel ad nigridinem accedenti ; à supinâ rubiginoso. Sed & utrinq ; variat quoad colorem & superficiem. A parte gibbosâ lineolis albis & maculis nescio quibus distinctum vidimus ; quod & Bufoniis lapidibus & Glossopetris quibuscûnque aliquando accidit. Sed & inveni unum aut alterum cui à parte aversâ nescio quid ; appendicis adnasceretur ; in

qua Virgulæ aliquot transversæ conspiciuntur, quasi amissi cujusdam ignoti vestigia. Differt hic lapis à præcedente præcipue, quòd sit latior magisque rectus, à neutro latere falcatus. In Anglia Mediterranea non admodum rarus est hic lapis. Vidimus in Latomia Garvordienſi in Bercheria, Witneix & Charltonix apud Oxonienses, ad pagum Rance in comitatu Northamptonix, Honey-comb Lash apud Waltonienses, &c.

Dantur etiam & in hoc genere lapides, quos pisi vulgaris & vicix filiquas æmulari dixeris: verum istos impræsentiarum missos facimus.

3. *Siliquastrum minus, triangulum*; seu *minus conchæ adinstar rostellatum*. Colore & superficie cum reliquis convenit, ac figuram obtinet ab iis prorsus alienam. Telineam enim aliquam vel (mavis) concham parvam Anglicanam *Listeri*, magis refert quam Siliquam. Verum ex facie cum externâ tum interiori siliquastrum se prodat. Stunſfeldix habuimus in agro Oxoniensi. (3 \*) Siliquastrum Officulum è capite Afelli minoris referens (3 †) Os ipsum è capite Afelli minoris. (3. α.) Os ex capite Afelli majoris cum fluore adnato.

4. *Siliquaastro congener Punctularia gibbosa, quandoque tortilis, superficie marmoreâ*: seu *Siliquastrum gibbosum, marmoreum*, argutè admodum plerèque punctulatum. Superioribus magis tersum & expositum est hoc siliquastrum: ex pronâ parte nunc magis, nunc minùs gibbosum; & colore ut plurimum nigricanti, aliàs subviridi, exalbido, &c. Ex parte aversâ seu interiori, nescio quâ offeâ appendice munitur, coloris nigri vel rufescentis: sed hoc in plerisque desideratur. Utrinque in mucronem magis obtusum desinit quàm priora. In multis quæ videre contigit exemplaribus, pars gibbosa foli obversa, minutula admodum & creberrima ostendit punctula; quæ hujus lapidis elegancia est non contemnenda. Passim occurrit in comitatu Bercheriano & Oxoniensi. Inveni in Lapidinis ad pagos Marcham Garvord & Stunſ-

Stunsfield. (\*) *Punctularia*, &c. minutis punctulis con-  
 sperfa Stunsfield. (†) *Punctularia tortilis*. (α) Ejuſdem  
 lapidis major varietas.

5. *Siliquaſtro accedens Ricinus* ; ſeu *Siliquaſtrum mi-  
 nimum inſtar Seminis Phaſeoli*. Ricinus lapis, ſiliqua-  
 ſtrum eſt omnium quotquot haecenus videre contigit,  
 minimum ; quod Ricini herbæ, vel etiam phaſeoli cu-  
 juſdam minoris ſemen, quadantenus exprimat. Supernè  
 ſcaber eſt, planè ut ſiliquaſtra propriè ſic dicta ; colore  
 aut fuſco aut atro-nitenti. Infrà vero decolor eſt, & in-  
 formis. Witneix inveni inſtar Scarabæi, atronitentes ;  
 Stunſfeldix autem & ex atra nitentes, & fuſcos.  
 Atque hæc dicta ſint de ſpeciebus ſiliquaſtri. Si verò  
 anxius interrogas, quid exiſtimem de horum lapidum  
 origine : utrum ſcilicet ſint lapides prorfus minerales, &  
 in ipſa terra nati ; an potiùs extraneo alicui hanc for-  
 mam & elegantiam debeant ? Reſpondeo nondum ſatis  
 maturas eſſe noſtras obſervationes, ut id decernam.  
 Conjiçio tamen quòd hos lapides quos nos craſſa igno-  
 rantia laborantes ſiliquaſtra diximus ; poſteri ad mini-  
 mum (ſi non hujus ſæculi Philoſophi) piſcium Dentes &  
 Officula, tuto appellerint. Certè quod ad ſiliquaſtrum  
 minus, triangulum attinet ; vidimus aliquot ſpecimina,  
 offiçulis iſtis vulgo notis ex *Aſellorum* capitibus non pa-  
 rùm conſimilia. Atque ut id obiter moneam ; iſta offiçula  
 in capſulâ penes me aliquandiu aſſervata, fluorem ſeu parti-  
 culas cryſtallinas emiſſiſſe comperi, vide *Fig. 3. a.* Quòd ſi id  
 fecerint in capſulis incluſa ; certè multò magis in viſceribus  
 terræ idem fieri æquum eſt judicare. Ut vero illud expe-  
 rimentum, ad explicandam marinorum metamorphoſin  
 lapideam, non parum conferat : quibus tamen mediis  
 tot ignota, eadèmq; maximi ponderis conchyliã, in  
 Britanniam Mediterraneam adveçta ſint ; aut quo impel-  
 lente tam altè in viſceribus rupium condita ; nobis ha-  
 ctenus

Genus incompertum, fatemur. Sed omiffis abditis rerum caufis, ad effectus redeamus.

6. *Bufo* *majufculus atrorubens* *inftar capfulæ glandis quercinæ* : *lapidis Bufo* *varietas prima apud Anfelmmum Boetium delineata*. Colore eft undiquaque ex atro fubrubente ; quoad cætera, omnino convenit cum figura Boetii, p. 301. *Numb.* 1. Inveni in lapicidinâ Faringdonenfi, apud Bercherianos ; fed rariùs occurrit.

7. *Bufo* *medius rotularis alveolo utrinque donatus*. Color in ambitu fub-pallidus eft ; alveolus ab utràque parte rubiginofus. Cum priore, habuimus.

8. *Bufo* *medius Orbiculatus*, feu *Bufo* *vulgatior Anglicus*. Majufculo atro rubenti triplo aut quadruplo minor eft. Colore insigniter variat ; aliàs anthracino, aliàs fuſco five hepatico, aliàs alio. Sed & nonnunquam cæruleis maculis & lineolis notatum vidimus. Unicum habeo craffiufculum, & cæteris minùs deprefum, colore pallido aut exalbido ; atro limbo aut fafciola fimbriatum. In latomiiis & fabuletis Angliæ Mediterraneæ, paſſim obviam habuimus : at ſpecimen noviffimè dictum, in lapicidinâ Faringdonenfi. Paſſim inveniuntur & minores & minimi Orbiculati, & forma quaſi, in plano ovatâ.

9. *Bufo* *minimus à convexori parte rugofus*. In Agro Gloceſtrenſi & Oxonienſi cum reliquis, fed rariùs.

10. *Bufo* *minor, trochili adinftar faſtigiatus*, feu *Bufo* *Trochilus dictus*. Coloris eft ex anthracino fub-cærulei, & fimbriâ nigra donatus. E fabuleto Faringdonenſi.

11. *Bufo* *minimus Trochilo affinis, calyculo ſtriato longiuſculo donatus*. Caliculus ſtriatus caſtanei coloris eft : umbonis idem ferè color ac præcedentis. In Sabuleto Faringdonenſi aliquoties obſervavimus.

12. *Bufo* *Scaphoides, extremo altero latiore*. In lapicidinâ Marchamiæ & Garvordix, & ad Faringdoniam non admodum rarus. Omnes *Bufo* *nites* ut id ſemel dicam,

dicam, variant colore ; at Anglicani ut plurimum ad nigrum, fuscum, & hepaticum accedunt. Hos lapides in Anglia, ante hac inveniri non constat : nam Bufonites D. Plot in Historia Oxoniensi, hujus loci non est. Bufonites D. Christophori Meret (silocum memini) lapides non erant ; sed ipsissimi lupi piscis dentes, &c. Quod quidem satis feliciter sive ab ipso sive à quovis, alio, excogitatum. Quippe hi lapides aliud non sunt, me Judice quam luporum aliorumque piscium dentes, habitu & vestitu lapidum personati. In fodinâ Garvordienfi septimo ab Academia milliari, (ob rariores quos habet lapides, diutiùs à me frequentatâ) tandem incidi in maxillæ piscis ut videtur fragmentum ; cui tres bufonites triangulari quodam ordine, arcè in hærebant ; bini scilicet *Fig. 19.* orbiculati minores, & minimus tertius. Sed de Bufonitibus hæc dicta sufficiant, quos si id magis placeat Ichthyodontes Scutellatos in posterum jure merito appellare poteris.

13. *Plectronites lævis mucrone paulò acutiore.* Plectronites non aliud est quàm lathydos quidam tereti-formis, plectrum gallinaceum referens, radice Bufonitis instar, excavatâ. Colore, superficie & magnitudine, ut reliqui Ichthyodontes variant. Passim in lapidinis Bercherianis, cum Bufonitibus & Glossopetris inveniuntur. Striato periosteo denudatos suspicor quotquot marmoris adinstar politos cernimus.

14. *Plectronites major altiusculè striatus, mucrone magis obtuso.* Hujus lapis non nisi duo exemplaria hætenus videre contigit. Quid à priore differat ex Titulo colligere possis. E fodina Stunsfeldienfi.

15. *Rhombus minor sive medius.* Quem rhombum appellare placuit, compressior est quidam lapis ; præterpropter cucumerini seminis magnitudine ; formâ ad rhomboidem accedenti. Ab uno latere convexior est, & colore ut plurimum nigro : Ex altero planior, & testaceâ quadam lamella obductus ; quæ mirè splendet, colore.

cōlore anthracino vel ex atro rubenti. Hæc testula five testacea lamella figuram rhomboidalem constituit, margine quandoque leviter inclinato; & quoad materiæ elegantiam, elmatum Testudinis exuvium quàm proximè similat. Invenimus in lapicidinis Marchamensibus & Charletoniæ. Dantur etiam & majores & minimi, & quidam figurâ à rhomboidali multùm discrepantes. Rhombum quoad materiæ & coloris elegantiam excipit.

16. *Scalpellus*. Est autem Scalpellus, lapis figurâ ab omnibus huc usque notis prorsus alienâ. Quod ad magnitudinem spectat & colorem, cum rhombo aliquatenus convenit. At figurâ est omnino sibi propriâ. Scalpellum nominare volui, quoniam cultelli mucronem quodammodo mentitur. Nam lamellatus est lapillus; figurâ tamen trigonali, cum alio quodam angulo minus eminenti. Facies altera omnino plana est & sessilis; sed altera ob demissum marginem, seu mavis transversas quasdam lineas eminentes, undiquaque leviter acclivis. Charletoniæ habui cum priore.

17. *Bufoniti Congener Gibbus lapis: seu Bufonites gibbus cognominatus*. Rarioris hujus lapelli de Bufonitibus agens, oblitus sum: iis siquidem adnumerare debui quantumvis aliâ gaudeat figurâ. Gibbus autem lapis, ex re nomen habet; nam Bufonites est non ut reliqui planè sessilis, sed omnino arcuatus: adeo ut si in plano posueris, lucem subtus recipiat. Atque hinc à dorso elatiori, apud nos gibbi nomen fortitus est. In parte gibbosâ, foramen obtinet ad basim latiore; ei prorsus simile quo cæteri donantur Bufonites minores. In arenosis Marchamiæ Lapicidinis invenit optimæ spei juvenis D. Joannes Archer è Collegio Reginenfi: qui inter alios lapides aliquam multos; ejusdem duo vel tria habet specimen. Nos postea in sabuleto Faringdonensi observavimus. Hactenus dictos lapides ut & alios aliquam multos, quos in Anglia Mediterraneâ inveni; pro  
piscium

piscium dentibus aliisque capitum ossiculis aut habeo, aut vehementer suspicor. Cæterum & eorundem vertebrae non paucas undiquaque in agris Glocestriæ Bercheriæ & Oxonii sparsas, observare licuit; quos omnes generali nomine.

18. *Ichthyospondylos* appellare consuevimus. Sunt autem ii variò pro conditione loci, tincti: alii nigri, fusci alii; quidam sublutei aut cinerei. Magnitudine etiam & formâ non imminùs variâ sunt quàm *Ichthyostea* superiùs dicta. Invenimus qui latrunculos luforios magnitudine exuperent; atque etiam viciæ femine minores. In arenosis fodinis Marchamensibus sine ullâ ferè (ut mihi visum est) materiæ ossæ jacturâ conservatos vidimus. Porrò *Ichthyospondyli* aut raro aut nunquam inveniuntur pluribus simul junctis; ut piscium vertebrae: Magno quidem indicio me judice, has non esse lapides spontaneos ad imaginem (cognatæ quantumvis materiæ) ossium, formatos. Nam si *natura subterranea*, quod *marina* perficit, præstare conatur; quidni eodem opere ac labore quo singularem piscis vertebram; integrum saltem Sceleton ut cætera nequeat, conficeret? Sed hanc quaestionem satis strenuè ventilatam habemus, a viro, si quis alius Naturæ operum, peritissimo *D. Joanne Raio*; in tractatu quodam Physico-theologico nuper edito; qui nescio an ad manus tuas hactenus pervenit. Quamvis & majorem adhuc speremus lucem à *D. Joanne Woodward*, Prof. Phys. Greshamensi, Viro siquid rectè sentio, non diligenti solùm & industrio; sed & ingenio perspicaci, & multimodè erudito. Is enim majorem Angliæ subterraneæ partem quâ patet, invisit; & exinde opima fatis retulit spolia: Thesaurum Philosophicum, quem (irridente quantumvis populo) *jam contemplatur in arca*: brevi (si Deus dederit) *Æconomix subterraneæ studiosis impertiturus*. Quin & Clariss. Vir, *D. Joannes Beaumont*, cujus urbanitatem una cum desideratissimo Seerupio experti sumus; in Dissertationem contra Burnetium editâ,

Historiam lapidum singulari figurâ insignium, quos in sua provinciâ nasci comperit ; expectare jussit.

19. Maxillæ piscis fragmentum lapideum cum adnatis *Bufo nitibus*. Garvordiæ inventum.

20. *Glossopetra* exigua cum mandibulæ fragmento lapideo adnato. Faringdon.

At vero ad metam inopinatò pervenimus, jam nihil amplius adjiciendi est locus ; & te forsàn diutiùs quam par est, hoc uno argumento detinui ; quamvis gratissimum esse jamdudum comperi. Vale (vir Ornatissime) amicorum quacunq; terrarum non immemor.

Oxonii, 20 Aprilis,

1693.

IV. *The Extract of a Letter from Mr. Anthony Van Leuwenhoek, S. R. S. to the R. Soc. containing several Observations on Cinnabar and Gunpowder.*

HAVING with the greatest niceness examined native *Cinnabar*, I could discover therein nothing worthy noting; wherefore I gave it a very strong Fire, upon which it soon began to move, many small Particles separating themselves from the rest, till they had crept into a cooler place ; and notwithstanding the great Weight of the *Cinnabar*, yet several considerable Particles as big as Pins Heads rose up from the Fire, and got into cooler places. When the Heat was encreas'd, the *Cinnabar* began to evaporate, a black Smoak arising, made up of  
small

Small Globules : Examining this *Cinnabar* when cold, I found therein several six-sided Figures, such as is represented No. 1. *A*, of which some were very regular, others not ; they were of different sizes, some of the bigness of a small Sand, others an hundred times less ; some were of the *Fig. B.* shaped like an Equilateral Triangle with the Three Points cut off. I never found any of these Figures in the *Cinnabar*, till it had been exposed to a strong Fire, which separated them from it, notwithstanding, which it still retained its red Colour, only was somewhat browner.

Some part of the *Cinnabar* that lay next to the fire appeared as *CD* ; some Particles also were like *E*, others like *F*, and some with several Points and solid Angles, as *GH*. Besides these Figures, there was a blackish matter, which like Smoak had been separated from the *Cinnabar*, where I found a great number of exceeding small Globules of *Quicksilver*, and admired at the great quantity thereof contained in the *Cinnabar* : Amongst these Globules lay some, which I judged to be Salt Particles ; but for their extreme minuteness I could not discern their Figure.

When I burnt the *Cinnabar* in the open Air, there arose a Flame very like that of *Brimstone* ; but upon examination I could not find that the inflammable parts thereof were true *Brimstone*. Then I caused the Flowers of *Brimstone* to arise, which I viewed, and found, amongst several irregular parts, some Globules transparent like Oil ; and the higher they rose from the Fire, the smaller were these Globules, till in the end they became undistinguishable. The Volatile parts of *Cinnabar* could not be driven very high, tho' with a great Fire, whereas those of *Brimstone* were raised much higher with a small Heat. I observed in the *Brimstone* several Salt-Particles, constituted, as I guess'd, of many small united Globules. For I suppose they were raised in a round

Figure, which subsiding shoots into Angles, especially if they meet with any Moisture.

Powdering some *Cinnabar*, I exposed it to the Fire as before, and found therein six-sided Figures, with some triangular ones; whereof some had one, others more Angles broken off; with other differing Figures with one acute Angle, but there were no Squares or Oblongs. I often found amongst them a considerable quantity of Oil, with some transparent parts which I took for Salts; this Oil lay farthest from the Fire: and I judged the Flame which I sometimes observed, might be from the burning of these Oily parts.

I then poured Rain-water on some of this *Cinnabar* that had been raised by the Fire without flaming; and when it had stood in the Air till part was evaporated; I found a great number of Salt Particles of a longish Figure, as are represented N<sup>o</sup> 2. *I*. And tho' some of these were bigger, yet I judged them to be formed of the smaller ones united together. Amongst the rest some were pyramidal, constituted on a six-sided Basis, and ending in a point like little Diamonds. There were Salts of some other Figures, as Oblongs, &c. So that no estimate can be made of these Salts. It is true Rain-Water affords a Salt, but it is in so small a quantity as not to be considered in this Experiment.

Then I poured Rain-water on beaten *Cinnabar*, and after some Weeks settling, and in part evaporated, I found therein an inconceivable number of Salt Particles, of which I could not discern the Figures they were so small, my best Microscope shewing them no bigger than a Sand appears to the Naked Eye; only I fancied some were Sexangular. Boiling some of this Water, and evaporating part of it, the aforementioned Salts were to be seen in greater quantity; some of the largest are represented, magnified, N<sup>o</sup> 2. *K. L. L.*

Having

Having therefore thought that the Salt Particles which were raised up by the force of the Fire, must necessarily be of a Spherical Figure, as being softened and melted by the Heat, I was willing to be satisfy'd herein; and remembring some Remarks I had formerly made on Gun-powder, I took several clean Glass Vials from 3 to 6 Inches long, these I heated to dry them, and rarify the Air, and then put therein one or more of the largest Corns of *Gunpowder*, and closed them up to exclude the common Air, and placed them in so great a Heat that the Powder took Fire, filling the Glass with a white Smoak, some of the Cole and Brimstone sticking to the sides; but putting in more Corns, they were carried up much higher, so that I could very distinctly discern the Brimstone from the Nitre; for it lay so thick in some places, as to exhibit a yellow colour, and might, by a good Microscope be seen moving circularly in the white Smoak, which was the *Nitre*; tho' the Particles thereof were very small, which, when moving, appeared perfect Spheres, which leisurely subsided to the bottom of the Glass: Wherefore I laid the Glass along, that the Particles of the *Nitre* might be distinct from those of the Coal and Brimstone; and then I found those Particles which before seemed Globular, were, when fixed on the sides of the Glass, all shot into six-sided Salts. Some were like N<sup>o</sup>. 3. *M. N.* with others irregular as *O*, and some of these ended pyramidally like little Diamonds. Some of the Salt-peter Particles which lay mixt with the others were long and slender, and looked like little bundles of Arrows.

Besides the forementioned parts, I observed a Moisture in the upper part of the Glass upon the first firing of the Powder, which I guess'd might come from the *Nitre*, and therefore shall call it Oyl of *Nitre*, tho' possibly there might be some Oyl of *Sulphur* mixt therewith; for further Satisfaction I put some refined

*Nitre*

*Nitre* by it self in a Glass, leaving a small hole in the top to prevent its bursting, and gave it so great a heat, that the *Nitre boyled*, and found in the upper part of the Glass a very transparent fluid matter, or Oyl, which at another time was curdled together in irregular Figures, and stuck to the Glass.

Not fully satisfied herewith, I repeated the Experiments with the powder, and immediately after its blowing up, I viewed the Glass with a Microscope, and could then discern the very suddain change or shooting of the Globular Particles of the *Nitre* into Sexangular Salts, and that all at once. The number of these Salt-Peter Particles afforded by one Corn of Powder, is inconceivably great, besides those of the Sulphur and Coal. These were best seen when I fired but one Corn; for when there were more fired, the greater quantity of *Nitre* blew up so much of the Sulphur and Coal, that the change and shooting of the Salts could not be so well seen. If I fired the Powder with Heat from below, the Coal and Sulphur would be blown up; but if with Heat from above, but few Particles of the Coal, and yet fewer of the Sulphur would be forced up.

Next I fired one, two, and three Corns of Powder in several closed Glasses, and suffering them to cool, I opened them (some after 4 or 5 days) and found always compressed Air therein, which flew forcibly out. That I might know the quantity of this generated Air, I opened some of them after such a manner, that the Air contained therein issued into a Bolt-head with a narrow Neck, which was filled with Water, which, as the Air rushed in, was forced out; by which Experiment I found the Air compress'd eight times what it was before; or, which is the same thing, when at liberty took up eight times the room it did before.

Not fully satisfied herewith, I put one Corn of Powder in a Glass, and closing it up with a very small hole only at the narrow end, which end I placed under the Water in the glass Vessel as before, and firing the Powder, so great a quantity of Air was thereby generated, as forced out 160 Grains of Water. Now 13 Corns of Powder weigh but one Grain; wherefore multiplying 160 by 13, which makes 2080, we find that Gunpowder fired expands it self 2080 times, or takes up so many times the Space it did before.

I observed likewise that the Glass wherein the Powder was fired would be always filled half full of Water immediately after the Explosion, the reason of which I conceived to be the great rarefaction of the Air, by the Heat of the Fire and stroke of the Powder, which upon cooling takes up less Space, and the Water enters in to fill up the rest to prevent a Vacuity.

From this last Observation, I concluded that a Bullet cannot be shot with so great a Force out of a very long Canon, or other Gun, as out of one something shorter: And discoursing since with a certain Commander upon this Subject, he told me he was once present when upon a Wager a Cannon of 14 Foot threw a Ball much farther than one of 18 Foot.

As to the Reason, how so great a quantity of Air comes to be generated, tho' I thought of several Solutions, yet I could not satisfy my self; I sometimes thought that the Particles of the Air were by the violent motion broken and comminuted into smaller, and so between each Particle a much finer Substance might be placed, but this did not answer so great an Expansion. Upon the whole, I concluded that the greatest Improvement that can be made in shooting, is, if possible, so to order the matter, that all, or the greatest part of the Powder be fired at once; and when this is effected, a much less quantity will serve than is now used.

To examine yet farther this matter of new-made Air, I took one Grain weight of Crabs Eyes, to which I poured Wine Vinegar, and in 4 hours as much Air was generated as filled the space of 44 Grains of Water; and 3 Grains of Crabs-Eyes produced about three times as much. This new-made Air kept its Expansion for 12 hours that I observed it, whence it appears to have been true Air.

V. *The Description of the American Tomineius, or Humming Bird, communicated by Nehemiah Grew, M. D. and Fellow of the Royal Society.*

There is in most parts of *America* a Bird called by the *English* the *Hum Bird*, by the *Spaniard* *Tomineius*. He is of a most excellent shining green Color, and very resplendent; the Colour doth something resemble some of our *English* *Drakes-heads*. It doth inhabit in some of the colder parts of *America*, as well as in the hotter. It is the least of all Birds that I have seen there or in *England*; her Leg and Foot together is but half an Inch, the other parts answerable, the Trunk of her Body not an Inch. I did weigh one (in those parts) as soon as ever it was kill'd, whose Weight was the tenth part of an Ounce *Avoirdupoize*, which I take to be about the Weight of a Coined Six-pence. And I have weighed here in *England* a *Tit-mouse* (which I take to be the least Bird here) and it weighed above Two Shillings, and some Half a Crown. I saw one of their Nests made of Cotton-Wool, in form and bigness of the  
Thumb

Thumb of a Man's Glove, with the Taper end set downwards, wherein were two Eggs of the bigness of a Pea, of oval Form. Who can but admire to see the whole Body, and all the parts of a Bird folded up in an Egg, little bigger than a Pepper-Corn? They feed by thrusting their Bill and Tongue into the blossoms of Trees, and so suck the sweet Juice of Honey from them; and when he sucks he sits not, but bears up his Body with a hovering Motion of his Wings: But for the relation that he is a curious singing Bird, I think it untrue. God in many of his Creatures is bountiful, yet not lavish; for I did observe them several years, but never heard them sing; and the Peacock and Jay, though they be of a fine Plume, yet no Singers; and so I think this Bird is so beautiful to the Eye, as not at all to please the Ear. An *Indian Soggamore* is not in his full Pomp and Bravery without one of these Birds in his Ear for a Pendant. He is call'd the *Hum-bird* or *Humming Bird*, because some say he makes a noise like a Spinning Wheel when he flies, which I think rather an Imagination than real; for I have been many times very near them, both when they hover'd and when they did fly, and I never heard any Noise; besides, their Body and Wings are too small to strike Air enough to make any Noise. But of this I shall not be positive, because some Authors are opposite to me. It is a Solitary Bird: I never saw but two at a time together, *viz.* the Male and the Female, they being easily known when together, the Male being somewhat bigger than the Female.

If one take a small Birds Wing, and stand 4 or 5 yards from a Candle (when dark) and open the Wing, and look thro' it at the Candle, he may see a most elegant Colour of red and green, which green doth something resemble the Colour of this Bird.

## VI. An Account of BOOKS.

I. *Horti Indici Malabarici.*

Pars Septima, Octava, & Nona ; with some  
Remarks upon them.

THE Six first Tomes being abbreviated in the *Philosoph. Transact.* N. 145, and N. 198. This proceeds with the 7th, 8th and 9th, the fruitful Product of that great *Mæcenas* of the Botanick, and other Natural Studies, the Noble *Heer Van Rheed*, whose vast Designs being not confin'd to *Asia* alone, have already survey'd and describ'd the most luxuriant part of *Africa*, which he intends to publish (after the finishing of these his *Oriental Discoveries*) with the same Fidelity, Exactness and Magnificence that we see in the admirable Work before us.

The 7th Part treats of Scandent and Bacciferous Shrubs, the greatest part whereof were never taken notice of by any Writer, or else but very imperfectly touch'd upon : As the *Natsjatam* or *Battavalli*, which is the *Cocculus Indicus* of our Shops, us'd in Ointments or Pastes for the intoxicating of Fish, and driving away Lice and Vermine. It is semper-virent, and grows in sandy places up and down the Kingdom of *Malabar*, and other Eastern Countries : The Leaves are thick set, of the shape of a Heart, and of a bitter taste. The Flowers come out in Clusters, are monopetalose, with five *Lacinix* or Incisures, all reflected, like those of the *Nightshade*, sending forth an Odour like that of *Eldar*. To these

these succeed the Fruit, resembling Grapes, only 'tis *monococ*; first green, then white, afterwards red, and lastly (when ripe) black. The *Indians* beat the whole Plant up with Ginger, spread it upon Flanel, and so take off their Corns, and soften their Feet; sometimes they use only the Fumigation of the Root burnt with *Bufalo's* Excrements and the *Bambou Reed*. After the History of the *Coculus Indicus*, the Publisher gives us 4 sorts of *Canniram*, all a-kind to the *Nux Vomica* of our Shops, of which more in the next.

*Schembra-valli*; and *Vallia-Pira Pitica* seem to be two wild Vines, climbing up the Trees in thick Woods; they (as also many other Plants in the hot Climates) are never divested of Leaves and Fruit, (of which there will be both green and ripe at the same time) always flowering and bearing through the whole year under a kind Sun, whose Influence is not so bountiful to the *European* Regions.

*Malago-Codi* is our round, black and white Pepper, which are the same, only the latter is decorticated. *Cattutirpali* is the long Pepper of the *Indians*, which they chew with *Calx* and the Nut *Taufel*, (the Fruit of a Palm named *Arequa*) colouring their Spittle with a red Tincture. These three Species of Pepper, with two more of the same Family, are all fully describ'd, and exactly figur'd in this 7th Tome.

*Cari-villandi*, a sort of *Sarsaparilla*, for which 'tis us'd by the Natives of *Malabar*; 'tis not unlike the *American Smilax*, call'd *Jupecanga* by *Margrave* and *Piso*, and *Macapatli* by *Hernandez* and *Recchus*, who make 4 Species of *Sarsa*, all bacciferous.

*Mendoni*, or the *Lilium Superbum Zeylanicum*, one of the choicest Ornaments of the *English* and *Dutch* Gardens, growing up to a very high stature. The *Gentiles* ascribe strange Vertues to the Root in Sympathy, Incantations, and other Magick Operations. The Fruit

(or rather Excreſcence) ſticking to the Root, ſtops and curbs the proud Fleſh of Ulcers, and is ſucceſſfully given in difficult Births.

To theſe we might add many other rare Plants contain'd in this 7th part: As 4 ſorts of *Indian Ivy*, not unlike our *Trifoliate* and *Quinquefoliate Creepers*: Several Exotick *Night-ſhades*, one reſembling our *Dulcamara*; great variety of *Battata's*, or *Ricophora's*, very near a-kin to our *Potatoes*, being alſo of general uſe in the Kitchens of *India*. A curious ſort of *Cuscuta* or *Dodder*, running up and choaking the Boughs of Trees. A beautiful Scandent Reed like the *Rotang*, with many others.

---

## Horti Malabarici.

### Pars Octava.

THE 8th Tome deſcribes and figures 51 herbaceous and arboreſcent Plants, the greateſt part of them pomiferous or leguminofe.

The firſt 23 Species may be all refer'd to the Pumpions, the Coloquintida's, the Cucumbers, the Baſſom Apples; the Paſſion Flowers or Maracocks, of all which there are great Varieties in both the *Indies*.

*Modira-caniram*, Tab. 24. pag. 47. contains in its Fruit the round flat Stone or Seed, commonly call'd in our Shops the *Nux Vomica*: The Wood of this Tree is ſaid to be the True *Lignum Colubrinum*, a-kin to the *Caniram* of the Firſt Tome of this Work, Fig. 37. pag. 67, 68. which is the Famous Antidote or Specifick againſt the Bitings of that Indian Serpent, call'd by the *Portugueſes*.

*gueses Cobra Copello*, whose flat Head is mark'd with the Figure of a pair of Spectacles. This Viper or Serpent I have seen in Mr. *Charlton's* excellent *Museum*. The Juice of the Leaves (though poysonous) apply'd externally, drives away the Gout call'd *Valvida* by the Indians of *Malabar*. *Breynius* in his Second *Prodromus* makes the *Caniram*, and *Modita-Caniram* to be Tree Night-shades, *Solanum arboreum Indicum maximum foliis Oenoplæ sive Nepeçæ, &c. pag. 92, 93.* But whether the *Nux Vomica* is properly the Seed of a *Solanum*, I leave to the more nice Botanists to determine.

Amongst the Leguminose Plants of this 8th Part, the *Perim-kaku-valli* is remarkable, which bears a prodigious large Lobe, containing 30 great flat Beans, out of each whereof they make entire Purses and Snuff-boxes: These Seeds are call'd by some *Cor Sancti Thomæ*, and by others *Fabæ purgatrices*. They are so common and plentiful in the Islands and Continent of *India*, that whole Ships may be loaded with them.

*Nai-Coranna* is the *Phaseolus Surattentis Siliquâ hirsutâ pungente*, or our *Couage*, whose blistering or pricking is soon cur'd by the Herb call'd *Thumba*. The Pod and Seed of this Kidney-bean are esteem'd high provocatives to Venery, (perhaps by the same reason that *Cantharides* are) and a successful Medicine in Dropsies. There is another Species of this pungent *Couage* in *Malabar* call'd *Kaku-valli*, a-kin to, if not the same with the *Maccouna* of *Brasil*, describ'd by *Margrave* and *Piso*.

*Schanga-Cuspi* is the *Flos Clitorius* of *Breynius*, the Juice is Vomitive, and the root Purgative. *Konni* a sort of *Abrus* or *Liquorice*, whose Bean is commended in the *Hæmorrhoids*. *Ana-Mullu*, call'd by the *Portugueses* *Hasticanto* and *Fabas Turquesca*, remarkable for its many Galls or Excrescencies full of Insects, as also for its strong sharp Prickles, with which the *Indians* bore their Ears for the hanging of their various Pendants of Gold and Precious

Precious Stones. *Paeru* and *Katu Paeru*, call'd by the *Chineses* *Lak Goetum*, two most delicious *Phaseoli*, or Kidney-beans, cultivated by the Orientals with extream diligence as the best sort of nourishment. *Penarvalli*, resembling the *Abovai* of *Thevet* in its Fruit, hanging down like *Bandaliers*, hence call'd *Fruita Bandoliera* by the *Portugueses*. This Plant is us'd as a powerful Anti-spasmodick by the *Indians*. The rest of the Herbs in this 8th Tome may be referr'd to the *Halicacabum*, *Aristolochia Clematitis*, and the *Phaseolus*, of the last of which there are many Species in this Volume.

## Horti Malabarici.

### Pars Nona.

THE 9th Part gives us the full History of 87 Plants with their lively Icons. The first 17 are all *Apo-cynum's*, some creeping, others scandent, and some arborescent, resembling *Neriums* or *Oleanders*; of these there is a wonderful Variety in *Malabar*, differing in their Lanigerous or Cotton-like Seed Vessels; their milky Juyces are generally corrosive and poysonous.

The *Todda-vaddi* of our Author, *Tab. 19.* is the *Herba Viva* of *Acosta*, which grows in many Provinces of *Persia*; 'tis esteem'd as a great Traumatick and Lithonthriptic.

*Coletta-Veetla*, call'd by Dr. *Herman* *Eryngium Zeylanicum febrifugum, floribus luteis*. The *Indians* chew the Leaves instead of *Betel* with the *Faufel* or *Arequa*, and give the Juice in the *Apthæ* or *Thrush*.

There are also in this 9th Volume several sorts of Trifoliate and Quinquefoliate *Sinapistrums*, many papilionaceous and winged Plants referable to the *Ferrum Equi-*  
*num,*

num, *Astragalus*, *Onobrychis*, to the *Æschynomene*'s, *Herba Casta*, *Mimosa*'s, to the *Sensitive* and *Humble Plants*, to the *Genistella Tinctoria*. Of the *Crotalaria* (call'd so from the rattling of the Seed, which the little *Indians* play with) there are 5 or 6 different kinds. The rest are a-kin to the *Euphrasia*, *Pulmonaria*, *Verbascum*, *Persicaria*, *Digitalis*, *Hedera terrestris*, *Lysimachia*. Of the *Sesamum* we have two distinct Species in this part, as also of the *Teucrium*, &c. with accurate Descriptions, Figures and Uses; for all which the Work it self may be consulted.

---

II. *A Collection of Curious Travels and Voyages, in Two Tomes. The first containing Dr. Leonhart Rauwolff's Itinerary into the Eastern Countreys, &c. The Second taking in many parts of Greece, Asia Minor, Egypt, Arabia, &c. from the Observations of Monsieur Belon, Mr. Vernon, Dr. Spon, Dr. Smith, Dr. Huntingdon, Mr. Greaves, and others. To which are added Three Catalogues of Plants growing in the Levant.* By John Ray, S. R. S.

THIS Work contains the Observations of so many curious and learned Travellers, that it may justly be esteemed the most Judicious and Choicest Collection that ever was yet publish'd of the *Levant*, and some other adjacent Countries.

The first Itinerary is that of Dr. *Leonard Rauwolff* who under the Protection and Encouragement of the House of *Austria*, travel'd into many of the Eastern Parts of the World, where he made it his principal business to visit all the Shops, Ware-houses, Exchanges, Gardens, Woods, &c. in order to learn their Drugs, Merchandises, Arts, Sciences, Trades, and the Products of Nature, most of which he brought home with him. The late *Isaac Vossius* kept 4 large Volumes of *Rauwolff's* Collections, as one of the rarest *Cimelium's* in all his Library. These are now preserv'd with great Care at  
*Leyden*

*Leyden*, and shewn to Strangers amongst the many Curiosities of that flourishing University.

*Rauwolff* begins his Voyage at *Auspurg*, from whence he travel'd to *Marseilles*, and there embark'd for *Tripoli*, touching in his Passage upon many Islands of the *Mediterranean Sea*, as *Scicily*, *Malta*, *Candy*, and *Cyprus*. He describes with great exactness the City of *Tripoli*, with its Fruitful Neighbourhood and Trade; he is very particular in his Account of the stately *Bagnio's*, of the *Caravanzeries*, the *Batzars*, the *Fundiques*, and indeed of all their publick and private Buildings: He tells us the ways how the *Turks* prepare their *Rusma*, their Soap and Pot-ashes, and afterwards enumerates the Trees, Shrubs and Herbs growing in the adjacent Countrey: He doth not omit the common Observations of other Travellers relating to Offices, Employments, Manners, Customs, Habits, Religions, Diet, &c.

From *Tripoli* he proceeds to *Aleppo*, the greatest *Emporium* of all the East, laying down very minutely the *Rout* he took. I need only take notice here, that the Author shews the same Exactness and Diligence in describing *Aleppo* as he did before in *Tripoli*; but the Traffick here being much more considerable, he therefore is the more industrious about the Drugs and Merchandize.

From *Aleppo* he travels to *Bir*, and so down the *Euphrates* to old *Babylon*, describing in this Passage the City of *Racka*, *Deer*, and *Ana*, with many Observations upon the *Arabians*, and upon several places of *Chaldæa*, especially the Ruines of *Old Babylon*: He afterwards gives a full Description of *Bagdet*.

His Return from *Bagdet* is through *Assyria*, the Confines of *Persia*, and the Province of the *Curters*, to the River *Tigris*, and to *Mesell*, the old *Nineve*; then he continues his Journey through *Mesopotamia* by the way of *Zibin* and *Orpha* to *Bir*, and so to *Aleppo*, and *Tripoli*

again. Here he gives us a most accurate Account of *Mount Libanus*, which he survey'd with that diligence, as never any Traveller did before him.

From *Tripoli* he goes to *Joppa*, and so to *Jerusalem*, viewing the greatest part of *Palæstine*, and describing all the Holy Places, with the several Sects of *Christians* inhabiting there; he never omits the Plants he observ'd growing up and down. Afterwards he embarks at *Tripoly* for *Venice*, and so from thence he returns into *Germany*, loaded with the Spoils of the East.

The Second Tome of these Collections contain great Variety: As First, Several of Monsieur *Belon's* Itineraries and Voyages, to *Candy*, *Mount Athos*, from thence thro' *Macedonia* to the Silver and Gold Mines, and so thro' *Ihrace* to *Constantinople*, and from thence into *Ægypt*. This curious *French-man* was sent with *Petrus Gyllius* to Travel, and write the History of Quadrupeds, Birds, Fishes, Insects, Plants and Fossils, at the Expence and under the Patronage of that great Restorer of Learning, *Francis the First*, of immortal Memory.

Secondly, Mr. *Vernon's* Travels thro' part of *Istria*, *Dalmatia*, *Peloponnesus*, *Attica*, and *Asia Minor*. This worthy Gentleman always carried along with him several useful Mathematical Instruments, and was exact in his Latitudes: Great things might have been expected from him, if he had not been unfortunately kill'd in *Persia*.

Thirdly, The Plants observ'd by Sir *George Wheeler* in *Greece*.

Fourthly, Several Miscellaneous Observations made by Dr. *Smith* during his Travels in the *Turkish* Empire.

Fifthly, Mr. *Greaves* his Accounts of the Latitude of *Constantinople*, and of the *Ægyptian* Pyramids. This Learned Mathematician seems very exact in his Calculations and Measures, being furnished in his Travels with all things necessary for Observation.

Sixthly,

Sixthly, The *Ægyptian* Observations of *Prosper Alpinus*, who resided and practised Physick several Years at *Grand Caire*, and afterwards for his great Merit was appointed Botanick Professor at *Padua*, by the particular Order of the Commonwealth of *Venice*.

To these we find added in this Second Tome some curious Remarks of *Dr. Huntingdon*; as also several Itineraries and Voyages into many parts of *Arabia*, as to *Mecha* and *Medina*, to *Moha*, *Aden*, *Zenan*, *Doffar*, &c. and also into *Æthiopia* or *Habessinia*, with the several ways of getting into that Kingdom, extracted from Authentick Instructions. Amongst these are inserted some Observations upon the *Red Sea*, for all which the Book it self may be consulted, as containing many things not commonly known, and therefore the more to be valued.

At the end are inserted three Catalogues of such Trees, Shrubs and Herbs, as have been observed to grow wild in *Greece*, *Syria*, *Ægypt*, *Candy*, &c. The Names given by *Rauwolfff*, *Bellonius*, *Honorio Belli*, &c. being either *Arabian* ones from *Avicen*, *Serapio*, *Mesua* and *Rhazas*; or *Greek* from *Theophrastus* and *Dioscorides*; or else *Barbarous* from the present Inhabitants: 'Twas thought therefore convenient to add the new Names of late Writers, which do much illustrate the whole. For this Addition of Catalogues the Publick is wholly oblig'd to the Pains and Skill of *Mr. Ray*.

## E R R A T A.

**N**umb. 196. p. 584. l. penult. r. *chartulam*. p. 586. l. 3. r. *quadrabili*. l. 17. r. *impatenter*. l. 21. r. *hominum*. p. 588. l. 6. r. *Hippocratis*. l. 9. r. *diviso*. p. 589. l. 22. r. *parallelum*. p. 590. l. 24. r. *absolvitur*. l. 32. r. *superficii*. p. 591. l. 17. r. *equabit*. l. 19. r. *autem*. p. 592. l. 8. r. *idem*. l. 13. r. *exstibat*. l. 17. r. *utramque*. Numb. 197. p. 625. l. 4. r. *stuck*. p. 635. l. 27. r. *Quantity*. p. 638. l. 9. dele *are*. p. 659. l. 14. r. *extrusion*. p. 660. l. 4. r. *afsen*. p. ult. l. 27. r. *lancinating*.

---

Printed for S. Smith and B. Walford, Printers to the  
*Royal Society*, at the *Princes Arms* in *St. Paul's*  
*Church-yard*, 1693.

Vertical text on the left margin, possibly bleed-through or a separate column of text.

Faint, illegible text in the upper middle section of the page.

Faint, illegible text in the lower middle section of the page.

Faint, illegible text at the bottom of the page.

1  
 זכרון יונת ודונן יצאנו  
 זכרון יצאנו זכרון יצאנו  
 זכרון יצאנו זכרון יצאנו

TOYTOY POCYTON MACΛACNOY  
 ΘEOYAPZA . . . . . CIAΩCBACIAEΩN

2  
 APIANΩN . . . . . CΘCΩNYIOY  
 ΘEOYMANA . . YBA . . EΩC . .

3  
 بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ  
 بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ  
 بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

4  
 ΖΗΤΗΝ ΤΟΥΤΟ ΠΡΟCΩΝΟΝ ΔΙΟCΘΕΟΥ  
 TOYTOY ΠPOCΩNON ΔIOCΘEOY

5  
 א. ב. ג. ד. ה. ו. ז. ח. ט. י. יא. יב. יג. יד. טו. טז. יז. יח. יט. כ. כא. כב. כג. כד. כה. כו. כז. כח. כט. ל. לא. לב. לג. לד. לה. לו. לז. לח. לט. מ. מא. מב. מג. מד. מה. מו. מז. מח. מט. נ. נא. נב. נג. נד. נה. נו. נז. נח. נט. ס. סא. סב. סג. סד. סה. סו. סז. סח. סט. ע. עא. עב. עג. עד. עה. עו. עז. עח. עט. פ. פא. פב. פג. פד. פה. פו. פז. פח.פט. צ. צא. צב. צג. צד. צה. צו. צז. צח. צט. ק. קא. קב. קג. קד. קה. קו. קז. קח. קט. קכ. קכא. קכב. קכג. קכד. קכה. קכו. קכז. קכח. קכט. קל. קלא. קלב. קלג. קלד. קלה. קלו. קלז. קלח. קלט. קמ. קמא. קמב. קמג. קמד. קמה. קמו. קמז. קמח. קמט. קנ. קנא. קנב. קנג. קנד. קנה. קנו. קנז. קנח. קנט. קס. קסא. קסב. קסג. קסד. קסה. קסו. קסז. קסח. קסט. קסז. קסח. קסט. קסז. קסח. קסט.

2  
 adyela  
 Holo  
 6  
 Holo



*Crystalli quedam, sive Echinitæ pellucidj Anglicanij ex Silicium  
genere, vel Sphærici, vel ad Dimidiatam Sphæram aliquomodo accedentes.*



---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of June, 1693.*

---

## The CONTENTS.

I. **A** *Letter from F. A. Esq; S. R. S. to the Publisher, with a Paper of Mr. S. Flowers, containing the exact and curious Draughts of several unknown Characters, copied from the Ruines at Persepolis.*

II. *An Account of certain transparent Pebbles, mostly of the Shape of the Ombriæ or Brontia. By Martin Lister, M.D. and S.R.S.*

III. *Two Letters from Mr. John Clayton Rector of Crofton at Wakefield in Yorkshire, containing many curious Remarks made by him in Virginia, and his Voyage thither.*

IV. *An Account of a Book, by R. H. M. D. R. S. S. Archaeologia Philosophicæ ; sive Doctrina antiqua de Rerum Originibus. Libri duo. Auth. Thoma Burnet. S. T. D. Londini Typis R. N. Impensis G. Kettilby ad insigne Capitis Episcopi in Cœmiterio Paulino. 1692. in 4to.*

I. *A Letter from Mr. F. A. Esq; R. S. S. to the Publisher, with a Paper of Mr. S. Flowers containing the Exact Draughts of several unknown Characters, taken from the Ruines at Persepolis.*

S I R,

I Here send you some Fragments of Papers put into my hands by a very good Friend, relating to antique and obscure Inscriptions, which were retrieved after the Death of Mr. Flower, Agent in *Persia* for our *East-India* Company; who, while he was a Merchant at *Aleppo*, had taken up a Resolution to procure some Draught or Representation of the admired Ruines at *Chilmenar*, pursuant to the third Enquiry for *Persia*, mention'd in the *Philosophical Transactions*, pag. 420. viz. *Whether there being already good Descriptions in Words of the Excellent Pictures and Basse Relieves that are about Persepolis at Chilmenar, yet none very particular, some may not be found sufficiently skilled in those parts, that might be engaged to make a Draught of the Place, and the Stories their pictur'd and carved.* This Desire of the Royal Society, as I believe, it hinted at a Summary Delineation, which might be perform'd by a Man qualify'd in a few days, taking his own opportunity for the avoiding much Expence, (which you know they are never able to bear :) So I cannot but think Mr. Flower conceived it to be a business much easier to perform than he found it upon the place, where he spent a great deal of Time and Money, and dying suddainly after, left his Draughts and Papers dispersed in several hands, one part whereof you have here, the rest its hoped may in some time be recovered, if Sir *John Char-*

*din's* exact and accurate Publication of the entire Work do not put a period to all further Curiosity, which I heartily wish.

*An Exact Draught or Copy of the several Characters engraven in Marble at the Mountains of Nocturestand and Chahelminar in Persia, as they were taken in November 1667. By Mr. S. Flower.*

N 1. N 2. These two Characters are engraven on the Breast of two Horses cut out of the Mountain of Black Marble at *Nocturestand*, distant a League from *Chahel-manare*, or the ancient *Persopolis*, one whereof is said to be *Alexander's*, the other *Rustram's*, (a Famous Hero supposed to have lived about the time of *Cambyfes*.)  
Mr. *F.*

N 1. This Character hath some Similitude with the Ancient Hebrew, but the *Persians* would have it their own, tho' they understand not a Letter. Mr. *F.*

N 2. In these Lines the places are prickt where the Letters were defaced and not perceptible. Mr. *F.*

N 4. These two Lines were writ entire on *Rustram's* Horse. Mr. *F.*

N 3. This is the (*Arabick*) *Persian* Character engraven at *Persopolis* not above 500 years since, and is little different from the Writing us'd at this day. Mr. *F.*

N 5. This Character, whether it be the ancient Writing of the *Gaures* or *Gabres*, or a kind of *Telesmes* is found only at *Persopolis*, being a part of what is there engraven in white Marble, and is by no Man in *Persia* legible or understood at this Day.

A Learned Jesuit Father, who deceased three years since, affirmed this Character to be known and used in *Ægypt*. Mr. F.

It seems written from the Left Hand to the Right, and to consist of Pyramids, diversly posited, but not joyned together. As to the Quantity of the Inscriptions, *Herbert* reckon'd in one large Table Twenty Lines of a prodigious Breadth. Of this sort here are distinct Papers, each of several Lines.

N 6. This Character is likewise engraved at *Persepolis*, of like Antiquity with the former. It has some Affinity with the *Syriack* and *Arabick*, and has been pretended to be understood by some of the *Padres*. Mr. F.

II. *An Account of certain transparent Pebbles, mostly of the shape of the Ombræ or Brontæ : Wherefore I have called them Brontæ Læves, Pellucidæ, Resplendentes, Adamantum Æmulæ.*

THE Figures are taken from certain very clear and transparent Stones found in *England*, of a constant Shape. They are called in some ancient Leases of Royal Mines Rough or Mineral Pearl. They understanding, as I guess, by the Word Pearl, any thing that was resplendent and bright, and particularly figured like a Drop of Water, which these Stones have of themselves naturally, and without any Artifice; some of them being exactly Spherical, others like a Half Globe, others like a Half Oval, with an edge raised on the top: And in these general Figures great Varieties are to be observed.

As for the Esteem the Ancients had of them, it was not without Reason; for besides that, their natural Figure and Beauty, where they have been well preserved, is commendable. Their Natural Polish is moreover not to be counterfeited, but very easie to be distinguish'd by a Microscope, from the Artificial Polish of Glass and Crystals. Now Gold, Silver, Diamonds and Pearl are for no other reason estimable, but because they have certain indelible Characters, which all the Subtilty and Wit of Man hath not yet been able to Counterfeit, notwithstanding the many Pretences thereunto. As Gold, for Example, for that it will endure the drowning in Antimony; Silver, that it abides the Test of Lead; Diamonds, for that of themselves, even without a Foil, they cast a Lustre.

Lustre. Pearl is valued because of it's Figures and peculiar Brightness not to be imitated.

These Stones are of the *Pebble kind*, that is, not to be calcin'd by simple Fire; whereas most other figured Stones are calcinible with a very easie Fire.

These Stones are, as I said, naturally polish'd and very hard and solid, and do not consist within of *Laminae* or Flakes, but brake every way with great Difficulty; and naturally throughout smooth.

As for their Figure, it comes nearest that of the *Ombriæ*; and many of them are very *Ombriæ* in shape. Other transparent *Ombriæ* I have seen, which yet are either very Flints, or of a flaky and soft Contexture, of the nature of *Selenites*; and such are to be found about *Filobriggs*, a noted Set of Rocks near *Scarborough*.

As these Stones are of a very different Nature and Texture from all other *Ombriæ* I ever yet saw, and having no *Vestigia* of any *Spinæ* in any part of them, I may reasonably enough conclude them to be Stones of their own kind: And they are in shape like some of the *Ombriæ*, yet for the Reasons above-said, they will not come, I think, within the suspicion of having been Animal Substances.

For the rest, I am not averse to think, after so manifest and considerable Discoveries of this kind, as *Augustino Scilla* had made in *Sicily*, that most of the *Ombriæ* have been *Echini*; and yet some of the Prickled, which Naturalists have hitherto called *Lapides Judaici*, may have belonged to some of those *Ombriæ*. But I perswade my self it will never be found, that any of them have ever belonged to any of the Stones in the present Table.

I shall conclude with one Remark, and that is, to incite the Industry of the Curious, to a more narrow search into these matters. There are but two or three *Echini* yet discover'd, either in ours or the *Mediterranean*

Sea.

Sea. But of the *Ombria* of *Europe*, besides these present Anomalous Stones, there are at the least Twenty Species figur'd and describ'd by *Aldrovandus*, *Angustino Scilla*, *Dr. Plot*, &c. and in vast quantities in most Counties of *England*: And I doubt not many more Species will yet be found out. All which are to be accounted for; as to the natural places, in what Seas they are to be found at this day. And if not in the *European*, as I think they will not, how and whence they came hither into this Island in such Plenty. But enough of this.

*Yours, &c.*

---

III. A

III. *A Letter from Mr. John Clayton Rector of Crofton at Wakefield in Yorkshire to the Royal Society, May 12. 1688. giving an Account of several Observables in Virginia, and in his Voyage thither, more particularly concerning the Air.*

HAVING often times been urged to give an Account of *Virginia*, by several of the worthy Members of the Royal Society, I cannot but, as far forth as I am able; obey Commands whereby I'm so much honour'd, and show my Respect by my ready Compliance; tho' I am so sensible of my own Weakness and Incapacity to answer your Expectations, that before-hand I must Apologize for my self. And indeed by Sea I lost all my Books, Chymical Instruments, Glasses and Microscopes, which rendred me uncapable of making those Remarks and Observations I had designed, they were all cast away in Captain *Wins* Ship, as they were to follow me; and *Virginia* being a Country where one cannot furnish ones self again with such things, I was discourag'd from making so diligent a Scruteny as otherwise I might have done, so that I took very few Minutes down in Writing; and therefore, since I have only my Memory to rely on, which too has the Disadvantage of it's own Weakness, and of the distance of two years since now I left the Country, if future Relations shall in some small Points make out my Mistake, I thought this requisite to justifie my Candor; for I ever judg'd it villanous to impose in matters of Fact; but Descriptions of things that depend on memory may be liable to Mistakes, and yet the Sincerity of the Person that delivers them intire.

But hereof I shall be as cautious as possible, and shall rather wave some things whereof I have some Doubts, and am uncapable now of satisfying my self, than in any sort presume too far. The Method I design is, First, to give an Account of the Air, and all such Observations as refer thereto, then of the Water, the Earth and Soil; the Birds, the Beasts, the Fishes, the Plants, the Insects; and lastly, the present state of the Inhabitants: But at present I shall neither trouble you nor my self with any more than an Account of what refers to the Air alone, being conscious the Honourable Society may receive such a Glut with the Imperfection of this, as to excuse me from a farther Relation.

But before I begin, perhaps it may not be impertinent to acquaint you with some things that happen'd in our Voyage. We Sail'd in the Ship *Judith*, Captain *Trim* Commander, 'twas Fly-boat built, about 200 or 250 Tuns; she sprung a considerable Leak. When the Captain had made long and diligent Search, had tried all Methods that Sea-men use upon such occasions, or he could think of all in vain, and that the Leak encreas'd, he came pensively to consult me. Discoursing with him about it, and understanding that the Ship was Seeled within; so that though the Leak might possibly be in the fore-part, it would fill the whole Cavity betwixt the Seeling and the Planks, and so run into the Hold at all the Crevices of the Seeling up and down: I thereupon conceived, that where it burst in betwixt the Seeling and the Planks, it must needs make some Noise. He told me, they had endeavour'd to find it out that way, and according to custom had clapt Cans to their Ears to hear with; but the working of the Ship, the Tackle and the Sea made such a noise, that they could discover nothing thereby, I happily bethought my self of the Speaking Trumpet; and having one which I had contriv'd for some other Conveniences, of a differing shape

shape from the common sorts, I bid him take it and apply the broad end to the side of the Ship, the narrow end to his Ear, and it would encrease his Hearing as much as it augmented the Voice the other way, and would ward the Ear too from the Confusion of Foreign Noise. Upon the first application, accordingly they heard it, tho' it happen'd to be at a considerable distance; and when they removed the Trumpet nigher, they heard it as if it had been the Current of a mighty River, even so distinctly, as to have Apprehensions of the bigness and Figure of the Hole that the Water came in at; so that cutting there the Seeling of the Ship, they immediately stopt the Leak.

In the Sea I saw many little things which the Seamen call Carvels; they are like a Jelly or Starch that is made with a Cast of Blew in it; they swim like a small Sheeps Bladder above the Water, downwards there are long fibrous strings, some whereof I have found near half a yard long. This I take to be a sort of Sea-Plant, and the strings its Roots growing in the Sea, as Duck-weed does in Ponds. It may be reckon'd among the Potential Cauteries; for when we were one day becalm'd, getting some to make Observations thereof, the sportful People rub'd it on one anothers Hands and Faces, and where it touch'd it would make it look very red, and make it smart worse than a Nettle. In my return for *England* we struck a Hawksbill Turtle, in whose Guts I found many of these Carvels; so that it's manifest they feed thereon. 'Tis commonly asserted by the Seamen, that they can smell the Pines at *Virginia* several Leagues at Sea before they see Land, but I could receive no satisfaction as to this Point; I could not discern any such thing when at a moderate distance, I fear much of this may be attributed to Fancy; for one day there came three or

four full sent to tell me they were certain they smelt the Pines ; but it afterwards prov'd that we were at that time 200 Leagues from the Shoar, so that I was satisfied that was therefore meer Fancy. Indeed we thought, by the general Accounts of the Ship, that we had been just on the Coast, but all were deceived by a Current we met with, that at that time set about South-East, or East South-East, which when once becalmed we tried thus : We hoisted out a Boat, and took one of the Scuttles that cover'd one of the Hatches of the Ship, tying thereto a great Weight, and a strong long Rope, we let it sink a considerably Depth, and then fastning it to the Boat, it serv'd as an Ancor, that the Boat could not drive ; then with the Glass and logg Line we found the Current set, as I say, Eastward, at the rate of a Mile and a half an hour. This Current is of mischievous Consequence, it does not always run one way, but as it sets sometimes as we proved Easterly, so does it, as they say, set at other times Westerly, whereby many Ships have been lost ; for then the Ships being before their Accounts, they fall in with the Land before they are aware. Thus one year many Ships were lost on Cape *Hattarasse*, and thereabouts.

### *Of the Aire.*

**T**HE Cape called *Cape Henry*, lies in  $36\frac{1}{2}$  of the Northern Latitude. The Air and Temperature of the Seasons is much govern'd by Winds in *Virginia*, both as to Heat and Cold, Driness and Moisture, whose Variations being very notable, I the more lamented the loss of my Barometers and Thermometers, for considerable Observations might be made thereby, there being often great and suddain Changes. The Nore and Nore-West are very nitrous and piercing, cold and clear, or else stormy.

stormy. The South-East and South hazy and foultry hot: Their Winter is a fine clear Air, and dry, which renders it very pleasant: Their Frosts are short, but sometimes very sharp, that it will freeze the Rivers over three miles broad; nay, the Secretary of State assured me, it had frozen clever over *Potomack* River, over against his House, where it is near nine Miles over, I have observed it freezes there the hardest, when from a moist South-East, on a suddain the Wind passing by the Nore, a nitrous sharp Nore-West blows; not with high Gusts, but with a cutting brisk Air; and those Vails then that seem to be shelter'd from the Wind, and lie warm, where the Air is most stagnant and moist, are frozen the hardest, and seized the soonest, and there the Fruits are more subject to blast than where the Air has a free Motion. Snow falls sometimes in pretty quantity, but rarely continues there above a day or two: Their Spring is about a Month earlier than in *England*; in *April* they have frequent Rains, sometimes several short and suddain Gusts. *May* and *June* the Heat encreases, and it is much like our Summer, being mitigated with gentle Breezes, that rise about Nine of the Clock, and decrease and incline as the Sun rises and falls. *July* and *August* those Breezes cease, and the Air becomes stagnant, that the Heat is violent and troublesome. In *September* the Weather usually breaks suddenly, and there falls generally very considerable Rains. When the Weather breaks many fall sick, this being the time of an Endemical Sicknes, for Seasonings, Cachexes, Fluxes, Scorbutical Dropsies, Gripes, or the like, which I have attributed to this Reason. That by the extraordinary Heat the Ferment of the Blood being raised too high, and the Tone of the Stomach relaxed, when the Weather breaks the Blood palls, and like over-fermented Liquors is depauperated, or turns eager and sharp, and there's a crude Digestion, whence the named Distempers may be supposed.

posed to ensue. And for Confirmation, I have observed the Carminative Seeds, such as warm, and whose Oil sheaths the acid Humours that ever result from crude Digestions. But Decoctions that retain the Tone of the Stomach, as I suppose, by making the little Glands in the Tunicles of the Stomach, squeeze out their Juice, (for what is bitter may be as well offensive to the Stomach, as to the Palat) and then Chalibiates that raise the decayed Ferment, are no bad Practice; after which, I conceive, Armoniack Spirits might be very beneficial. But their Doctors are so Learned, that I never met with any of them that understood what Armoniack Spirits were: Two or three of them one time ran me clear down by consent, that they were vomitive, and that they never used any thing for that purpose but Crocus Metallorum, which indeed every House keeps; and if their Finger, as the Saying is, ake but, they immediately give three or four spoonfuls thereof; if this fail, they give him a second Dose, then perhaps purge them with 15 or 20 Grains of the Rosin of Jalap, afterwards sweat them with Venice Treacle, Powder of Snake-Root, or *Gascoins* Powder; and when these fail *conclamatum est*. But to return, 'Tis wonderful what Influence the Air has over Mens Bodies, whereof I had my self sad Assurances; for tho' I was in a very close warm Room, where was a Fire constantly kept, yet there was not the least Alteration or Change, whereof I was not sensible when I was sick of the Gripes, of which Distemper I may give a farther account in it's proper place. When a very ingenious Gentlewoman was visited with the same Distemper, I had the opportunity of making very considerable Observations. I stood at the Window, and could view the Clouds arise: For there small black fleeting Clouds will arise, and be swiftly carry'd cross the whole Element; and as these Clouds arose, and came nigher, her Torments were increased, which were grievous as a labouring Womans; there

there was not the least Cloud but lamentably affected her, and that at a considerable distance; but by her Shrieks it seemed more or less, according to the bigness and nearness of the Clouds. The Thunder there is attended often with fatal circumstances: I was with my Lord *Howard* of *Effingham* the Governour, when they brought word that one *Dr. A.* was killed therewith, after this manner: He was smoaking a Pipe of Tobacco, and looking out at his Window when he was struck dead, and immediately became so stiff, that he did not fall, but stood leaning in the Window, with the Pipe in his Mouth in the same posture he was in when struck: But this I only deliver as Report, tho' I heard the same Account from several, without any contradicting it. These things are remarkable, that it generally breaks in at the Gable end of the Houses, and often kills Persons in, or near the Chimneys Range, darting most fiercely down the Funnel of the Chimney, more especially if there be a Fire, (I speak here confusedly of Thunder and Lightning) for when they do any Mischiefe, the Craze and Lightning are at the same instant, which must be from the nearness of the Cloud. One time when the Thunder split the Mast of a Boat at *James Town*, I saw it break from the Cloud, which it divided in two, and seem'd as if it had shot them immediately a Mile asunder, to the Eye: It is dangerous when it Thunders standing in a narrow passage, where there's a thorough passage, or in a Room betwixt two Windows; tho' several have been kill'd in the open Fields. 'Tis incredible to tell how it will strike large Oaks, shatter and shiver them, sometimes twisting round a Tree, sometimes as if it struck the Tree backwards and forwards. I had noted a fine spreading Oak in *James Town* Island, in the Morning I saw it fair and flourishing, in the Evening I observed all the Bark of the Body of the Tree, as if it had been artificially peel'd off, was orderly spread round the Tree, in

a Ring, whose Semidiameter was Four Yards, the Tree in the Center; all the Body of the Tree was shaken and split, but its Boughs had all their Bark on; few Leaves were fallen, and those on the Boughs as fresh as in the Morning, but gradually afterwards withered, as on a Tree that is fallen. I have seen several vast Oaks and other Timber Trees twisted, as if it had been a small Willow that a Man had twisted with his Hand, which I could suppose had been done by nothing but the Thunder. I have been told by very serious Planters, that 30 or 40 years since, when the Country was not so open, the Thunder was more fierce, and that sometimes after violent Thunder and Rain, the Roads would seem to have perfect casts of Brimstone; and 'tis frequent after much Thunder and Lightning for the Air to have a perfect Sulphureous Smell. Durst I offer my weak Reasons when I write to so great Masters thereof, I should here consider the nature of Thunder, and compare it with some Sulphureous Spirits which I have drawn from Coals, that I could no way condense, yet were inflamable; nay, would burn after they pass'd through Water, and that seemingly fiercer, if they were not over-power'd therewith. I have kept of this Spirit a considerable time in Bladders; and tho' it appeared as if they were only blown with Air, yet if I let it forth, and fired it with a Match or Candle, it would continue burning till all were spent. It might be worthy Consideration likewise, whether those frequent Thunders proceeded from the Air's being more stagnant, the Motion of the Winds being impeded by the Trees, or whether the Motion of the Winds being obstructed by them below, the Motion might not be more violent aloft; and how far that may promote Inflammability, for Stacks of Hay or Corn that ferment with Moisture, never burn, unless when brisk Winds blow, that agitate and fan the little fermenting Sparks, and

and oft kindle them into an actual Fire. An Observance of the Meteors there might perhaps not be impertinent, as both what are more rare, and what are more frequent, as of *Gosmore* in great abundance, and of those small Cobwebs in a Morning, which some have supposed to be Meteors. *Ignes fatui*, tho there be many boggy Swamps and Marshes, are seldom, if any are seen there. There be frequent little sorts of Whirl-winds, whose Diameter may be sometimes not past two or three Yards, sometimes Forty, which whisking round in a Circle, pass along the Earth, according to the Motion of the Cloud, from whence they issue; and as they pass along with their gyrous or circular Motion, they carry aloft the drie Leaves into the Air, which fall again often in places far remote. I have seen them descend in a calm Sun-shine Day, as if they had come from the Heavens in great Showers thereof, so that all the Elements seem'd filled therewith. And I could perceive them to descend from on high as far as I could possibly discern a Leaf. I remember a roguish Expression of a Seaman, otherwise silly enough, who wondering thereat, cry'd out, *Sure now 'tis manifest there is a World above!* and now with them 'tis the Fall of the Leaf. But to proceed, I thought this made it manifest, whence many preternatural Showers have happen'd. I remember at Sir *Richard Atherton's* in *Lancashire*, some few years ago, there fell a great number of the Seeds of Ivy-berries; at first we admir'd what they were, for they were cover'd with a thin skin that was red, and resembled the Figure of a small Wheat Corn; but afterwards they fully manifested what they were; for many sprouted and took Root. I suppose they were carry'd aloft by some such Whirl-wind, and let fall there. I have purposely gone into the place where I perceiv'd this Gust, which is notorious enough (by the noise it makes, with rattling the Leaves as it carries them aloft, and have found a fine sharp Breeze of Wind.

*Tours, &c.*

K k

*Mr.*

Mr. Clayton's Second Letter, containing his  
farther Observations on Virginia.

BEING honour'd with the Thanks of the Society for my last, and receiving by my worthy Friend Dr. *Moulin* their Commands to proceed, I have added here my Observations of the Waters, and part of the Earth and Soil. I shall wave both Complements and Apologies, since I have greater Respect and Honour for the Society than I can possibly express, and have no reason to suspect their Favour, whose Candidness I so signally proved in my last.

Of the Waters.

TWIXT the two Capes, the Southern, call'd the *Cape Henry*, the more Northerly call'd *Cape Charles*, there runs up a great Bay, call'd the Bay of *Cheesepeak*; Nine Leagues over in some places, in most Seven, lying much West, Nore and South, dividing *Virginia* into two unequal parts. On the East side of this Bay there lies a narrow Neck of Land, which makes the Counties of *Northampton* and *Accomack*. On the West side of the Bay there branches forth four great Rivers, *James River*, *York River*, *Rapahanack* and *Potomack*, that rise from a Ridge of Mountains, whereof more in the Sequel. These Rivers plentifully water all the other parts of *Virginia*, emptying themselves into the great Bay. The Mouth of *James River*, which is the most Southerly of them, to the Mouth of *Potomack*, which is the most Northerly, may be a hundred Miles distance: But as I have been credibly inform'd, that the Falls of *James River* are not past Thirty Miles from *Potomack*, which is

a vast large River Nine Miles over in many places. I have been told it was Navigable nigh Two Hundred Miles, much higher than any of the other Rivers: Whence I conclude in future times, it will be the most considerable for Trade when the Country comes to be inhabited further up into the main Land. The other Rivers are much about Three Miles over apiece. And *James River* is Navigable at least Eighty Miles. Within Four or Five Miles of *James Town*, *James River* and *York River* are not past Four or Five Miles asunder. Yea, Sloops of considerable Carriage may Sail up the Branches of the two Rivers, till they come within a Mile the one of the other; for I take it to be no more from Col. *Bollard's* to Major *Troop's* Landing; and I believe they may come much what as near again as Col. *Coles*, and several other places. *York River* is distant from *Rapahannack* in some places not past Ten or Twelve Miles, *Rapahannack* from *Potomack* not past Seven Miles in one place, tho' it may be Sixty in others. The Heads of the Branches of the Rivers interfere and lock one within another, which I think is best expressed after the manner that an *Indian* explained himself once to me, when I enquired how nigh the Rivers of *Carolina*, *Virginia* and *Maryland* arose out of the Mountains, from those that ran West-ly on the other side of the Mountains, he clapt the Fingers of one Hand 'twixt those of the other, crying, they meet thus; the Branches of different Rivers rising not past a hundred Paces distant one from another: So that no Country in the World can be more curiously watered. But this Conveniency, that in future times may make her like the *Netherlands*, the richest place in all *America*, at the present I look on the greatest Impediment to the Advance of the Country, as it is the greatest Obstacle to Trade and Commerce. For the great number of Rivers and the thinness of the Inhabitants distract and disperse a Trade. So that all Ships in general

gather each their Loading up and down an hundred Miles distant ; and the best of Trade that can be driven is only a sort of *Scotch* Pedling ; for they must carry all sort of Truck that trade thither, having one Commodity to pass off another. This (*ie*) the number of Rivers, is one of the chief Reasons why they have no Towns ; for every one being more sollicitous for a private Interest and Conveniency, than for a publick, they will either be for making Forty Towns at once, that is, two in every County, or none at all, which is the Countries Ruine. But to return, The Tides in these Rivers regularly ebb and flow about two foot perpendicular at *James Town* ; there is there, as they call it, a Tide and half Tide, that is, it flows near two hours along by the Shoar, after that it is Ebb in the Channel, and again it ebbs near two Hours by the Shore, after that it is Flood in the Channel. This is great advantage to the Boats passing up and down the River. I suppose this is caused by many Creeks and Branches of the Rivers, which being considerable many, tho' only three or four Miles long, yet as broad as the *Thames* at *London* ; others Ten Miles long, some above Twenty, that have little fresh Water which they carry of their own, but their Current primarily depending upon the Flux and Reflux of the Sea. So that after the Tide is made in the Channel, it flows by the Shoar a considerable time afterwards, being that those Creeks are still to fill, and therefore as it were draws a Source upwards by the Shoar ; and likewise when the Tide returns in the Channel, the Creeks that could not so readily disburse their Water, being still to empty themselves, they make an ebbing by the Shoar a considerable time after that it is Flood, as I say, in the Channel. So far as the Salt Waters reach the Country is deemed less healthy. In the Freshes they more rarely are troubled with the Seasonings, and those Enderical Distempers about *September* and *October*. This being very remarkable,

remarkable, I refer the Reason to the more piercing Genius of those most judicious Members of the Society : And it might perhaps be worthy the Disquisition of the most Learned to give an Account of the various Alterations and fatal Effects that the Air has on humane Bodies, especially when impregnated with a Marine Salt ; more peculiarly when such an Air becomes stagnant : This might perhaps make several beneficial Discoveries, not only in relation to those Distempers in *America*, but perhaps take in your *Kentish* Agues, and many others remarkable enough in our own Nation. I lately was making some Observations of this Nature on a Lady of a delicate Constitution, who living in a clear Air, and removing towards the Sea-Coast, was lamentably afflicted therewith, which both my self and others attributed to this Cause, she having formerly upon her going to the same been seized in the same manner. But to return : There is one thing more in reference to this very thing very remarkable in *Virginia*, generally twice in the year, Spring and Fall, at certain Spring Tides, the most of the Cattle will set on gadding, and run, tho' it be twenty or thirty Miles, to the River to drink the Salt Water, at which time there's scarce any stopping of them ; which the People know so well, that if about those times their Heards are stray'd from their Plantations, without more sollicitation they go directly to the Rivers to fetch them home again. As for the Waters in the Springs in general, they are, I think, somewhat more eager than those in *England*. In that I have observed, they require some quantity more of Mault to make strong Beer than our English Waters, and will not bear Soap. I have try'd several by infusing of Galls, and found little difference in the Colours, turning much what the Colour of common Sack in Taverns. I tried two Wells at Col. *Bird's*, by the Falls of *James River*, several Wells near *James Town*, some Springs in the *Iste*

of *Wight County*: There's a Spring in the *Isle of Wight* or *Nanzamond County* vents the greatest Source of Water I ever saw, excepting *Holy Well* in *Wales*, but I had not opportunity to make experiments thereof. I tried likewise some Springs on the Banks of *Tork River*, in *New Kent* and *Gloucester County*, but found them vary very little as to Colour. I could not trie any thing as to their specifick Gravity, having neither Aquapoise, nor those other Glasses I had contrived peculiarly for making such Experiments, they being all lost with my other things. I had Glasses blown would hold about Five Ounces, others about Ten Ounces, with Necks so small, that a Drop would make a considerable Variation; with these I could make much more critical and satisfactory Observations as to the specifical Gravity of Liquors, having Critical Scales, than by any other way yet by me tried. I used this method to weigh Urines, which Practice I would recommend to the inquisitive and critical Physicians. I had made many Observations hereof, but all Notes were likewise lost with my other things. Yet I have begun afresh; for there are more signal Variations in the Weights of Urines than one would at first imagine; and when the Eye can discover little, but judge two Urines to be alike, they may be found to differ very much as to Weight. By Weight I find Observations may be made of Affections in the Head, which rarely make any visible Alterations in the Urine. I have found two Urines not much unlike differ two and twenty Grains in the quantity of about four or five Ounces: But let them that make these Essays weigh all their Urines when cold, lest they be thereby deceiv'd. But to return to the Spring Waters in *Virginia*. There's a Spring at my Lady *Berkley's*, called *Green-Spring*, whereof I have been often told, so very cold, that 'tis dangerous drinking thereof in Summer-time, it having proved of fatal Consequence to several. I never tried any thing of what nature it is of.

There

There be many petrefying Waters; and indeed I believe few of the Waters but participate of a petrefying quality, tho' there be few Pebbles or paving Stones to be found in all the Country. But I have found many Sticks with crusty Congelations round them in the Runs of Springs, and Stones figured like Honey-combs, with many little Stars as it were shot in the Holes. And nothing is more common than petrefy'd Shells, unless you would determine that they are parts of natural Rock shot in those Figures, which indeed I rather think; but thereof hereafter. Mr. Secretary *Spencer* has told me of some Waters participating much of *Alome* or *Vitriol* towards *Potomack*. Up beyond the Falls of *Rapahanack* I have heard of Poysonous Waters. But these I only mention as a Hint to further Enquiry of some others, for I can say nothing of them my self.

*The remainder of this Letter being his Observations on the Earth and Soil of Virginia shall be reserved for the next Transaction.*

## IV. An Account of a B O O K.

*An Account of Dr. Burnet's Book, Entituled, ARCHEOLOGIÆ Philosophicæ, five Doctrina Antiqua de Rerum Originibus. Libri duo. Londini, Typis R. N. Impensis Gualteri Kettilby ad Insigne Capitis Episcopi in Cœmeterio Paulino. 1692.*

**I**N this Treatise he endeavours to discover what were the Sentiments of the Ancients concerning the Origin or beginnings of this visible World, of which he conceives Men in all Ages have had a true, if not a Divine Knowledge, as well as of a Divine Power, and of the intermediate Order, Vicissitudes and Ends of all things. And that *Pythagoras* was not the Inventor of the Mundan System ascribed to him, but the Conveyer only of it from the Orientals, ἀπορρηζα, to the *Grecian* Schools, where yet it received lesser Improvement as to particular Explications, then it has by the Modern Inquisitions, (as he conceives) though yet he grants that our Histories of their Opinions are very imperfect, yet as the Magnificence of a Structure may be judged of by its Ruines, so in general we may have some Idea of their Doctrines by the Fragments of them which are yet to be found in the *Grecian* Writers, as well Historical as Fabulous, or Muthical and Poetical. By all which he endeavours to prove, that most of the Ancients held very  
much

much the same Notion concerning the beginning of things with that delivered by *Moses* in the beginning of his Writings, with which, he conceives, also that his already publish'd Theory is consonant. It was his Design also to have written a general Body of Philosophy, but the sense of his Age and approaching Death seems to have made him desist, and to satisfy himself with what he hath hitherto performed in the preceding Books, and in this which he seems to make the Seal and Consummation of the former.

He divides the whole Discourse into two Books. In the first he endeavours to discover what were the most antient Doctrines of all Nations concerning the beginnings of things, in general. But in the Second he endeavour'd to collect all such Passages amongst them as seemed most consonant to, and confirming of the Doctrines delivered in the first part of his Theory where he had omitted taking notice of them, though in the Second Part he hath intermixed them with the Theory throughout, which therefore did not need any such a Supplement.

In the First Chapter he enquires whence this Knowledge is to be fetcht, which he conceives to be all from the Postdiluvian Records, which were all convey'd by *Noah* from the Antidiluvian, and dispersed amongst his Posterity. Next he enquires where any Footsteps are to be found of it among these. And since he finds the Ancients divided the Nations of the World into Four Heads, comprehending the whole Race of Mankind, to wit, the *Scythians* towards the North, the *Celti* towards the West, the *Æthiopians* towards the South, and the *Indians* towards the East. He follows the same Order in his Enquiry. And amongst the first he finds no ancient Footsteps of their Philosophy, and doubts whether ever they had any: Tho' *Abaris* is said by *Suidas* to have written a *Theogonia*; and a Septentrional Mythology hath been of late published, favouring much of Antiquity.

Amongst the *Celti* he finds Philosophy to have been all along, viz. among the *Druids* and *Semnothei*; of whom yet we have but a dark Account, that they profess'd to understand the Order and Motions of the Heavens, and the Will of the Gods; and that *Strabo* says, they taught the Worlds Periods by Water and Fire, and held a transmigration of Souls, as the *Pythagoreans*; tho' they are thought to have much preceded him, and to have been the most ancient for Mythologick Theology. Of this Class were what Philosophers were to be found anciently among the  *Germans, Britains, Spaniards and Italians*; of some of which *Strabo* affirms, that they had Poems of their Laws, &c. of 6000 years standing. Those among the *Hetrusci*, *Diodorus Siculus* says, studied Philosophy: And *Plutarch* says, they had the Notion of the *Annus Magnus*, or Periods of Revolutions, and that the *Romans* had their Sacred Rites from them.

Among the *Aethiopians* the *Gymnosophists* were famous; but we can find very little information what their Philosophy was. They were Celebrated indeed for their Laws, Government and Converse with the Gods, and had a very ancient use of Letters; and had Colledges of Priests which taught Philosophy and Theology. These are said by *Lucian* to have been the first Astronomers, and to have taught the *Egyptians*. But as to the Theory of the Earth, there is nothing of theirs to be found. And indeed, most of the Ancient Authors that writ purposely of them are now no more to be found.

Having pass'd over these three Heads without making much Discovery to his purpose, he in the Third Chapter comes to the *Oriental* or *Indians*, comprehending all the *Asians*; and some of their Neighbours, as the *Egyptians* and *Greeks*. He begins then with the most Eastern Nation, the *Seri* or *Chineses*. *Celsus* and *Dionysius* call them Atheists, because they had no Idol-Temples or Worship; and Barbarians, because they had no Commerce with other Nations. So that it seems little of their Learning was known to the Ancients; though of late years they have been much better known, to have very ancient Histories, and some that mention the Flood and the beginnings of things. But by what we can learn, their Physiology is much inferiour to what was known in the Western Parts, as was also their Mathematicks, being all of their own Production, and not borrowed from any besides. Contrary to that of the *Greeks, Romans*, and other *Europeans*, who derived all from others. Passing from these to the South, he meets with the *Brachmans*, Philosophers celebrated in all Ages for their Devoting themselves wholly to Contemplations, of unknown Original, but yet worthy to be more diligently enquired into, both for their Eminency in Physiology and Astronomy, though both were wrapped up and veiled under Mythology: Yet they had some Notions concordant with the *Greek*. *Strabo* also says, That they held the World to have been generated, and was corruptible; That it was form'd out of Water, but the rest of the Universe from other Principles. The chief of these were most honoured, and absolutely free, neither Governing, nor Governed by any. This is the Sum of what can be found amongst the Ancients concerning their Natural Philosophy.

In the Fourth Chapter he enquires concerning the *Assyrians* and *Babylonians*, who were the first Empire after the Flood: These are accounted the first who cultivated Literature and had Publick Schools at *Babylon*, which continued so till the time of *Nebuchadonoxer* and *Daniel*. These Learned Men were

were call'd *Chaldeans* and *Magi*; and the chief of them were Physiologers and Astronomers, and studied lawful Arts, as may well be concluded; for that *Daniel* accepted the Prefecture of them: These excluded the Astrologians and Diviners from their Habitations. To these *Pythagoras* resorted to learn the Motions of the Heavens, and the Original of the World, saith *Justin*. Κοσμοῦσαντες καὶ κοσμογονήσαντες. These were then under the *Persians*, but the remainders of the *Chaldeans* and *Babylonians*. However, nothing is left of their Opinions but what *Diodorus* has hinted, That they believed the Matter of the World Eternal, but its Form, Order and Ornament to be constituted by Divine Providence. And further, That they believed the Earth to be of the Form of a Schiff or Tray: Only he speaks of their Antiquity, and of making Astronomical Observations many Ages before *Alexander*. This is all that is intelligible: All the rest concerning their Oracles of *Zoroaster*, &c. is nothing but Canting, and a Jargon of Scraps of we know not who. 'Tis pity we have lost the Works of *Berosus*, who had written their Opinions.

In the Fifth Chapter he speaks of the *Persian Magi*, who cultivated Physiology as well as Theology. These had a *Theogonia* like the *Greeks*; and from these *Pythagoras* learnt the Origin of the World, and the Motions of the Heavens. These taught likewise the Periods and Renovation of the World. The Prince of these *Magi* was *Zoroaster*, of which he judges there were two. The *Persians* held the Elements, Stars and the Heavens to be Gods; and worshipped most the Sun among the Stars, and the Fire among the Elements: And under the Nature of *Jupiter* they comprehended the whole Circuit of Heaven. They, as well as the *Greeks*, *Romans* and *Hebrews*, continually nourish'd the Fire. And the *Egyptians* as well as other Nations much honoured it. The *Persians* supposed this Fire to have fallen from Heaven; and the Stoicks call'd it *Jupiter*, into which all things resolved. Thus their Theology was Physiology, and all their other Rites may be in the same manner resolved; of which *Herodotus* has given a plain Account: In which he particularly takes notice, that in their Sacrificing they sung their *Theogonia*, which our Author conceives to be of the Origination of things. Of *Zoroaster*, *Pliny* relates that he left Two Millions of Verses, expounded by *Hermippus*. The *Arabians* mention Twelve Volumes, each filling a whole Bulls Hide of the Writings of *Zoroaster* to be left to the *Magi*. *Suidas* mentions divers Books of the same, concerning Dreams and Astronomical Productions, and Four Books of Natural Philosophy; but all are lost; and what goes under his Name are all Fictitious, except one Fragment preserved by *Plutarch* out of *Theopompus*; another by *Porphyrius* in *Antro Nympharum*, out of *Eubulus*; and a third by *Eusebius*, out of a *Persian* Book, which he will have *Zoroaster's*. As the beginning of these *Magi* was unknown, so was their end; yet some remained to the time of *Alexander*; and 'tis believed they fell with the *Persian* Empire; and all that had been written concerning them is also perish'd. Such were *Hermippus Smyrnaeus*, *Pallas*, *Orphanes*, *Eubulus*, *Theodorus Mopsuestenus*, *Hermodorus Platonicus*, *Antesphenes* or *Rhadonius*, *Zantbus Lydus*, *Sotionus*, *Dion*, *Theopompus*, *Eudemus Rhodius*, and *Clearchus Solensis*.

In the Sixth Chapter he enquires after what is to be met with among the *Arabians* and *Phœnicians*. The First is *Job*, whom he makes an *Arabian*, before the time of *Moses*, who had the knowledge of Letters, and of the Heavens, and many other parts of the Creation, besides that of the Worship of the true God. This Knowledge lasted to the time of *Solomon*, as appears by the Queen of *Sheba*: Nay, till the Birth of Christ, as appears by the *Magi* that came to Worship him. The *Zabii* he makes to be some of the ancient *Arabs*, among whom *Abraham* was bred. These boast of having the Religion of *Noah*. To these, *Porphyry* says, *Pythagoras* went: And *Pliny* affirms the same of *Democritus*: But these since that time have degenerated, and have taken up the *Grecian* Learning; though they had also translated into their Language the Ancient Learning of the *Egyptians*, *Persians* and *Chaldeans*; but these were burnt by the *Sarazens*. What Writings yet remain among them are thought not older than Eight or Nine Hundred Years. The *Debrites* among the ancient *Arabs* held the World Eternoal, and the Soul mortal. Hence their Proverb, *Uteri pariunt, Sepulchra deglutiant*, The Womb makes, the Tomb takes. Next for the *Phœnicians*, he finds them very ancient, and early knowing in Letters, Arithmetick, Astronomy, Physiology, Navigation, Foreign Trade and Planting. *Thales* and *Zeno* were *Phœnicians*, and to them went divers of the *Greek* Philosophers. *Stabo* says, that *Mosebus* found the Hypothesis of *Atomes* before the *Trojan* War. The Philosophy before the *Trojan* War was all by Tradition, but after that came in the Rational and Disputative. Nothing remains of *Sanchoniathon's* Philosophy, but that he had studied the *Kosmogonian* of *Taautes*, deducing the World from the ancient Chaos, and a precedent *Ἰδὸν* or Matter. He wrote also divers other Philosophical things; but they, as well as all the other Authors that wrote of the *Phœnicians*, as *Theodoros Hysicrates* and *Mochus*, *Hesticus*, and *Hieronimus Egyptianus* are wholly lost.

In the Seventh Chapter he enquires what Footsteps of ancient Physical Learning is to be met with among the *Hebrews*, and in their *Cabala*. First he notes, that *Lactantius* wonder'd why *Pythagoras* and *Plato* went to the *Egyptians* for Knowledge, but not to the *Hebrews*; which is an Argument they were not then considerable for that kind of Knowledge; that is, Physical and Mathematical. What they had was contained in their *Cabala*, which they pretend to have received from *Moses*. But whatever it were at first, it hath been much depraved with Rabbinical Fignents and Chimera's: Such are the Mystical Numeration by the Letters of Words; such are the Magical Spells derived also thence; such the expressing common Notions by a sort of Mystical Words, or Characters, or Numbers, to make it more wonderful to such as do not understand it. Which was a trick made use of also by *Pythagoras* in his Symbols, by the *Egyptians* in their Hieroglyphicks, and by the *Hermeticks* in their Cant: All which, if the Veil were removed, would appear empty Nothings, being of no other use, but to amuse the Ignorant and conceal their own Defects and Emptiness. They divided their *Cabala* into Nominal and Real. The Nominal was Triple, *Gemmatvia*, *Notaricon*, and *Themura*, plainly Modern and Barbarous Names. All consisted in shuffling the Letters of Words mixed with Number. *Réuclin* yet says, that the *Jews* affirm, that thereby may be found out all the Knowledge of *Moses* and *Solomon*,

as well Divine as Humane, and that *Solomon* himself received all his Knowledge thereby.

The real *Cabala* they make Two-fold, i. e. The Doctrine of *Sephiroth*, and the Doctrine of the Four Worlds. They make 10. Cabalistical *Sephiroth*, viz. the Crown. 2. Wisdom. 3. Prudence. 4. Magnificence. 5. Severity. 6. Pulchritude. 7. Victory. 8. Glory. 9. Foundation. 10. Kingdom, by which what they mean the Author understands not. They pretend they are Emanations from God, and that they are Numbers emanating from the Infinite Verity. He spends some time in examining each, and their branchings out into divers other Subdivisions. But upon the whole he concludes, That the further he proceeds the more Obscurity and Confusion he meets with. Next he examines the Doctrine of the Four Worlds, to wit, *Azilath*, *Briah*, *Fetzirab*, *Ashiah*, i. e. the Worlds of Emanation, Creation, Formation and of the Fabrick; before all which they put the *Ensophick*, or Infinite World, from which all the other do spring. Upon a more diligent Enquiry into the Contents of these mystick Doctrines the Author seems to think them all Cheats, and concludes with the Words of Christ, *Men love Darkness rather than Light, because their Deeds are evil*. Every one that doth Evil hateth the Light, lest he should be discovered; but he that doth Truth, cometh to the Light, that his Deeds may be manifest; suspecting all those affected Obscurities to be devised by them to conceal nothing else but their own Ignorance and Deceit. The Author proceeds further with examining other parts of the *Cabala*: But upon the whole he finds nothing rational, or containing any real Knowledge. But he conjectures, that the most ancient *Cabala*, before it was confounded and defiled with Fables, might contain somewhat of the Origination of things, and their Gradations; but as it has been in time chang'd and augmented by imaginary Fables, and blinded with impertinent and nonsensical Explications, it is now become a confused Mass of Incongruities and Absurdities. But by examining these Dregs, he conceives that the Ancients might hold, That before the Creation all things had their being in God; and that from him they flowed or emanated when first made, and that they will all flow back into him when they are destroyed, which he conceives was also the Opinion of the most Ancient Philosophers; and that there would succeed other Emanations and Regenerations, and other succeeding Destructions and Absorptions to all Eternity, as it had been from all Eternity; that Nothing was produced out of Nothing; and that the things produced never return to Nothing, but always have their Subsistence in God. Which Sence, if it doth not contain, he conceives it may be look'd upon as Salt that hath lost its Savour, which is good for nought, but to be thrown out of Doors. But if it contains any solid Knowledge, it ought to be manifested or condemned otherwise to perpetual Darkness. But lest it might deceive the Ignorant, he cautions them to be lead by no Authority that is not Divine, nor by any Reason that is not clear and manifest. Before he leaves this Head, he enquires concerning the *Esseni*, a Sect among the Jews, not unlike in their Manners to the *Indian Brachmans*. All that these had of Philosophy, says *Philo*, was of God, and of the Generation of things: But what that Knowledge was does not appear; but he conceives it is to be learnt from the *Brachmans*, with whom they agreed.

From

From these he passes on (in the Eighth Chapter) in his Search for the ancient Learning amongst the *Egyptians*, where he finds it very ancient, and much celebrated by the *Hebrews*, who extol both *Moses* and *Solomon*, the one for knowing, the other for excelling it; and by the *Greeks*, as from whence they had derived their Knowledge. Upon a stricter Enquiry into it, he finds it to be first Geometry, as old as the overflowing of the *Nile*, upon which account it was invented; but he thinks they were but Land Meters; and that the *Greeks*, as *Thales* and *Pythagoras* did make it Speculative. 2. Astronomy. But this the *Chaldeans* knew; nor doth it appear which were the first; but he conceives both were very ancient, but rude and imperfect, and much improved afterwards by the *Greeks*. However, he believes they had a true Knowledge of the System of the Heavens, and understood the Motions of the Planets, &c. Yet he thinks that they did not understand them so well, as to reduce their Motions to Calculation. They are said also to have cultivated Musick and Physick, but these also without Theories, and only by Tradition. And tho' *Herodotus* says, they had for every Disease a particular Physician: Yet both these were much more improved by the *Greeks*. They are said by others to be the Inventors of Chymistry. Lastly, That they were knowing in Physicks or Natural Science; that is, the *Cosmogonia*, *Theogonia*, or *Theologia*, which they look'd upon as the same Science. They held the Earth to be formed out of the confused Mass of the Four Elements, or out of the Chaos; and a two-fold Destruction of it one by Fire, another by Water; That the Earth was of an Egg form; and that we call the *Pythagorick* System was the oldest of all others, but kept among their *Arcana*. Their most Celebrated Philosopher was *Hermes Trismegistus*; though when he lived, or what he thought and writ is not known. Those that bear his Name are fictitious. But among the multitude of his Writings, his *Cosmologia*, mentioned by *Philo Bibius*, is lost. The *Egyptians* preserved their Learning by their Priests, who had Colledges in divers parts of *Egypt*. They had it inscribed on Obelisks, and written in Books. The *Babylonians* had Cœlestial Observations for 720 Years inscribed on burnt Tyles. *Democritus* transcribed his *Mora's* from a *Babylonian* Column. The Columns of *Hermes* in *Egypt* are famous, on which were inscribed his Doctrine. From these the *Greeks* and *Phœnicians* had much of their Knowledge, and *Manetho* his Sacred History. *Amianus Marcellinus* says, these Columns were placed in subterraneous Vaults, and were there before the Flood. *Manetho* and *Josephus* assert the same of theirs, both possibly the same. In their Books were written their Laws, their History and their Philosophy. Some things were communicable, others were *Arcana*, not to be divulged. They had also a two-fold way of Writing, one Common, another Sacred. This was written with *Hieroglyphicks*. The *Brachmans* have not only a different Character, but a different Language to preserve their Philosophy. These Priests were strict Concealers of their Secrets, as many Authors complain of them. Nor was *Pythagoras* admitted without being first Circumcised, and otherwise qualified. The *Esseni*, and others of other Nations, as *Persians*, *Syrians*, and *Indians*, administered Oaths, &c. of Secrecy. They further obscured their Knowledge by Symbols, Enigma's and Fables, in which the *Greeks* also follow'd them, as did also most other Nations in the Histories of their Gods, of which kind he gives divers Instances. Among these are  
the

the Mythologies of the Prophets in the Old Testament, and the Parables of Christ in the New. This Mythologick Genius *Salustius* calls Divine; and 'tis plain Mythologies were made use of by the Ancients to conceal their knowledge from the Vulgar, and yet preserve it safe for the Learned. Nay, Divine Providence doth so conceal both Divine and Natural Knowledge, that this or that part becomes known to this or that Man in one Age, which hath lain absconded to all preceding. This Mythologick was the most ancient Learning among the *Greeks*, as he proves by several Testimonies; yet was it first received from the *Egyptians*. This causes him to enquire whether the Works of *Hermes* were so writ, and he finds by a place quoted by *Eusebius*, that they were first written plain, then turned by the Son of *Thabim* into Allegories, and then transcribed into *Greek*. So that plain Writing was before Mythologick; and 'tis probable those that have it Mythologically, had it before pure; and that the Additions that have been added to the first Fables, have obscured, if not quite obliterated the concealed Sense. He propounds and answers two Objections, by which he shews the Inconsistency of Men's Actions with their Knowledge, and so Apologizes for the *Egyptian* Idolatry, and their Astrologick and Magick Practices. Last of all, he enquires how the *Egyptians* came to lose this Learned State they had kept for so many Ages, which he shews to have proceeded from their being conquered and overrun by divers Nations; as by the *Persians* under *Cambises*, and some succeeding Kings, by whom it began to decay. And by the *Romans*, who burnt the *Alexandrian* Library, with which their Learning was also much destroyed; and by the Conquest of the *Saracens* totally extinguished. Amongst the lost Historians of the *Egyptian* Learning, *Manetho* was the chiefest, as appears by Testimonies now extant, next *Sanchoniathon*, then *Asclepiades*, *Petofiris*, *Hecattus*, *Paliphatus*, and *Cheremon*, and many others. These are Lostes, but nothing to be named with the loss of the Library of *Ptolomus Philadelphus*, wherein many Myriads perished in a moment, containing the Sum of all *Egyptian*, nay, and all Oriental Learning too, in all probability.

In the Ninth Chapter he enquires concerning the *Grecian* Philosophy, of which, that he may the more fully give you the History, he produces sufficient Proof to shew it derived from the *Egyptians*; not that he denies the *Grecians* to have much improved several parts thereof: That they learn'd their Geometry, Astronomy and Arithmetick from the *Egyptians*, *Chaldeans*; and *Phonicians*, *Herodotus*, *Plato*, *Aristotle*, *Diodorus*, *Strabo*, *Laertius*, *Achilles Tattus*, and others their own Authors do testify. 'Tis said, *Semiramis*, who lived Eight Hundred Years before the *Trojan* War, built a high Tower in *Babylon*, on the top of which the Astronomers made their Observations, at which times the *Greeks* had not the use of Letters. Moreover, *Calisthenes* sent into *Greece* from *Babylon* Celestial Observations for 1900 Years before *Alexander's* time. And *Epigenes* found Observations at *Babylon* for 720 years, and others were brought of 480, as *Pliny* relates; these were inscribed on baked Bricks: Whereas the *Greek* Observations began with *Hipparchus* and *Ptolomy*. Yet though the Histories were furnish'd by the *Barbari*, the reasons of their Motions were invented by the *Greeks*. But though they improved the Mathematick Arts, yet they vitiated the Physicks, which they also received from them. That the *Greeks* had these from the *Barbari*, *Clemons Alexandrinus* and *Eusebius* both testify; as doth also *Porphyrius* and *Jesephus*.

*Jephus*, and *Diodorus Siculus*, who affirm the *Greeks* most eminent for this Learning. As *Orpheus*, *Thales*, *Pherecydes*, *Pythagoras*, *Solon*, *Plato*, *Eudoxus*, all fetcht it either from the *Egyptians* or *Phœnicians*. Nay, the very knowledge of Letters was first brought into *Greece* by *Cadmus* not long before the *Trojan War*. Whereas Learning flourish'd in *Affyria*, *Egypt*, *Phœnicia*, *Arabia*, *Ethiopia*, *India*, and among the *Celti* long before that time. There were two states of *Grecian* Philosophy. The first, which was the oldest, most of which was wrote in Verse, treated of the *Cosmogonia*, or Origination of things, by *Thamyras*, *Linus*, *Orpheus*, *Museus*, *Hesiod*. Also *Thales*, *Zenophanes*, *Empedocles*, *Parmenides*, and some others, whose Fragments are collected by *Steevins* in his *Poesis Philosophica*: All which Poëtick Writers did mythologize the *Cosmogonia*, *Homer* only excepted. This the Author proves by several Testimonies; and adds, That *Orpheus* was the first that brought Learning into *Greece*; that asserted the Oval Form of the Earth, the Form the Author assigns to his Antidiluvian Earth: That he lived not long after the time of *Moses*; and was the Founder of the *Grecian* Theology, as *Moses* of the *Hebrew*; and that both accommodated the Ceremonies to the Capacity of their respective People. That is, *Orpheus* instituted such a Religion as he could, not what he would, wanting the Divine Assistance of Miracles which *Moses* had. He was feign to make use of Musick and pleasing Mythologick Stories to allure his People from Barbarity to Government and Society. For which purpose it was of very great benefit, and generally made use of not only by Poets, but Legislators and Physiologers. *Orpheus* excelled in all these, and first taught the *Grecians* Religion, and the Rewards and Punishments of another Life, which he proves by Heathen and Christian Testimonies. But among these must be distinguished what he taught the Vulgar from what was his Secret Doctrine, for that he had both the *ἑρμῆδος* καὶ *ἀπόρρητον*. *Suidas* says, he held the Heavens to be formed of the *Æther*, and the Earth out of the Chaos, before which he placed Time as the measure, but he makes them both coeval; whereas others of the Ancients separate them by a multitude of Ages. *Empedocles* makes all the Stars to be Fires, but *Orpheus* to be Worlds; the Author supposes the Planets were meant. As the Moon was therefore called *ἀρτίχθον*, which *Orpheus* first asserted Habitable, proved by *Proclus*, as also that the Oval Earth was to be destroyed by Fire, and then to be renewed. Before he leaves this Head, he answers the Objections of *Cicero*, and more especially *Gerard Vossius*, who would perswade that there never was any such Men as *Orpheus*, *Museus* or *Linus*, whose Arguments the Author thinks no ways cogent or to be regarded, since there are so many positive Proofs to the contrary both in Heathen and Christian Writers.

In the Tenth Chapter he enquires among the *Greek* Philosophers that succeeded *Orpheus*: And first amongst the *Ionicks*. These are the Second kind of Physiologers, who wrote expressly and in Prose, not in Verse and Mythology, as the former. These were *Thales* and his *Ionicks*, *Pherecydes*, *Pythagoras*, *Zenophanes*, *Parmenides*, *Leucippus*, *Democritus*, *Empedocles*, *Plato*, and others, to *Epicurus* and *Aristotle*, in whom ended Philosophick Antiquity; except some Fragments among the *Stoicks*. *Thales* was a *Phœnician*, but received his Knowledge from *Egypt*, and was famous for *Geometry*, *Astronomy* and *Physick*, and asserted the Immortality of the Soul; and first writ a Discourse of Physicks, without Mythology or Theology. Nothing of his Assertion

fections remains but only that all things were generated out of Water. Which is agreeable to *St. Peter* and *Moses*. Possibly more particulars of his Doctrine may be found among his Followers, *Anaximander*, *Anaximenes*, *Anaxagoras*, *Archelaus*. *Anaxagoras* then makes a mind to Regulate Matter, and move it, and was therefore called *Nūs*. He ranges the four Elements by Gravity, and is said to have introduced Vortices. As for the Heavens, the *Ionians* much promoted the Knowledge of them; *i. e.* They held the Heavenly Spaces to be *Æther*; the Stars, Fire; the Planets opaque Bodies: That the Moon had Hills and Vales, and was Habitable, and that it was enlightened by the Sun, which was a most pure Fire. He held also the Rotation of the Earth, as *Theon Smyrneus* affirms. To shew the Reason why it is so difficult to find what were their true thoughts, He quotes this Passage of *Plutarch*. This Doctrine (that is, concerning the Heavens) was not celebrated and famous, but hidden and kept secret, and it was discoursed of with great Caution among a few under an Oath of Secrecy; for Philosophisings concerning the Heavens would not be endured, because those seemed to restrain and bind up the Divine *Numen* to Causes without Reason, and to blind Powers, and to involuntary Effects; upon which Account *Protagoras* was banished, and *Anaxagoras* put in Irons. *Socrates* also for the Name of a Philosopher was put to Death. Whence the Author observes, that in all Ages it has been very dangerous for Philosophers to speak plain Truth amongst the Vulgar.

In the Eleventh Chapter he enquires concerning the Doctrine of *Pythagoras* and the *Italic* Philosophy, where he finds that either *Pythagoras* wrote nothing, or if he did, even the History of them is lost: So that nothing of his Physiology is remaining save only his Theory of the Heavens, which is called the *Pythagorick System*; he placing the Sun in the Centre, and the Earth moving round it; the Moon as an Antithone or opposite Earth enlightened by the Sun, the Comets to be above the Air, or between that and the Planets; that the Heavens were fluid *Æther*, and the Stars so many Worlds. We know not his Sentiments about the *Cosmogonia*, or Terrestrial Productions, for he more busied himself about Cœlestial Speculations, and about Abstracts and Intellectuals, as did also his Followers, who treat of the *Anima Mundi*, consisting in Harmony indivisible and divisible the same, and an other (as they phrase it) and such other airy Notions as have no Foundations in Nature. But *Ocellus Lucanus*, another *Pythagorean*, makes the World Eternal, both for Matter and Form, as he does also the Race of Mankind. But indeed there is little in this Author that favours of *Pythagoras* his Doctrine; and *Plato* differs wholly from him, asserting the World to be made by God, and to be corruptible. Yet it must be granted that both the *Pythagoreans* and *Platonists* incline to make the Matter Eternal, but the Form Variable; and they had both their Vulgar Doctrines, and their Secret Doctrines. And though the Author cannot find any but common sense in his Mystical Numbers, yet he thinks there might be somewhat more, which is now lost to Mankind: The chief of these was his *Tetractis*, the Seventh was not Ignoble, but the Tenth the Noblest and most perfect of all. But of the Reason and Signification of these neither any of the Ancients nor Moderns give any Satisfactive Solutions or Explications. Yet all the Ancients assert this to be the Doctrine of *Pythagoras*. And therefore after having run over many of their thoughts, the Author thinks that Numbers will

M m

produce

produce nothing but Numbers, not Things; and that converting things all to Arithmetical Operations was in the *Pythagoreans* and *Platonists* a failure, not unlike that of the *Peripateticks*, of turning all into Logical terms. *Phericides* *Pythagoras* his Master, writ a *Theogonia*. And *Empedocles*, one of his Scholars, asserted the Sun to be a Mass of Fire, and the Stars to be fiery, and the Earth made of the four Elements, united by Love, and separated by Strife. 'Tis uncertain whether *Pythagoras* wrote or no, but certain that *Philolaus*, *Archytas*, and *Eudoxus* did. And 'tis said *Plato* bought three Books of *Philolaus*, whence he took his *Timæus*. *Archytas* is said to have written many things, but all are lost but a Fragment about Mathematicks. *Eudoxus* also, and *Empedocles*, but all are now lost. The Writings also of *Aristotle* concerning the four *Pythagorick* Elements are lost, and some others. So are the Writings of *Aristoxenus*, *Heraclides*, *Neanthes* *Hermippus*, *Syrianus* *Didymus*, and *Eudoxus*. Also *Moderatus* *Gabitanus*, *Alexander* *Polybistor*, *Azdrocidus*, and others.

In the Twelfth Chapter he enquires concerning the Opinions of the *Elastic* Sect, and of the *Stoicks*. This Sect was Founded by *Zenophanes* In the times of *Anaximander*, and consisted of a Mixture of various Nations and Opinions. The Doctrine he held was, that there were infinite Suns, and infinite Moons like ours, which he said was habitable, but that they were all Eternal. *Parmenides* held them to be formed out of Fire and Earth, and Men out of Clay. They agreed much with the *Ionick* Sect. *Leucippus* and *Democritus* were of this Sect, who introduced Atoms. *Leucippus* acknowledged the Motion of the Earth on its Axis, and that when the fluid Mass settled into a Globe, it was covered by a dry Skin, which growing thicker, formed the habitable Earth: He supposes the Axis also at first right, but altered afterward; both which are consonant to the Author's Theory. *Democritus* was an Auditor of *Leucippus*, and had travelled *Persia*, *Arabia*, *Ethiopia*, *Egypt*, and *India*, to improve his Knowledge among the Learned of those Countries, and has written many Books, though all lost. 'Tis said he affirmed the Moon to be a fired Body, but with Mountains, Hills, and Vales; but the Author supposes only fiery Mountains, such as are on the Earth. *Callimachus* wrote of his Opinions. The Opinion of the *Stoicks* is Famous for the Future Conflagration of the World. But little is to be found concerning the Production of it, yet they asserted God to be the Author of it; but to this they joyn Matter mixt and of it self without Motion. This was perishable by the Conflagration, but the Divine Principle Eternal, as they esteemed also the Matter it self, though the Form perished. So the unformed World they made Eternal, but the formed to have both beginning and end. They held moreover, of formed Bodies, the Fire to be first, and out of that to be made the other Elements, which again were resolvable into it. Concerning the Mundane Periods and the Fate of the *Stoicks*, little need be said in this Discourse, it being well known. Many Books have been written by and concerning them, but all lost; yet 'tis said there is one Ancient Book or Piece of *Apollonius* *Tyrinus* yet extant in some Library, but not published, concerning the Opinion and Works of *Zeno*.

In the Thirteenth Chapter he enquires among the *Platonicks*, *Aristoteliens*, and *Epicureans*. First, he finds the *Platonicks* like the *Pythagoreans*, to be most taken up in high Speculations of Abstract Notions, and in assigning Causes

of Things to Numbers and Geometrical Figures. Thus *Plato* in his *Timæus* makes nothing visible but Fire, nothing tangible but Earth, between these two for their own Union are placed Air and Water. The Solid Bodies he supposeth made up of Triangles; Fire he makes of Pyramids, consisting of four Triangles; the Earth of Cubes, consisting of six Squares, and each Square of four Triangles; the Air of Octedrons, each side divided into six Scalenes; then the Water of Isoaedrons, consisting of Twenty Triangles, each made up of Scalenes. To these he adds a Soul, consisting of Numbers and Proportions. The best Interpretations yet extant concerning it do not make Sense or Reason of it, and at best the Author thinks it but a *Lusus Ingenii*. Further, he makes God and Matter to be the two first Principles, to which he adds a third of Idea's. But *Plato's* Excellency was not for Physicks, but for Morals and Theology. Divers Writings of the *Platonists* are out, and some lost; but these he passes by, since we have the Works of *Plato* himself. And now comes to the Dregs of Philosophy amongst the Epicureans and Peripateticks. From *Plato's* time to the present Age he finds nothing of Philosophy, nothing of Discovery, nothing but a Chattering and fruitless Methods of Wrangling. Concerning the Origination of things, there is nothing found to be met with in *Aristotle* or his Schools. They would make the World Eternal, both for Matter and Form; Men also, and all things else to be so too. Besides, he does not agree with his own Principles, disposing the four Elements one above the other, but shews not how the Earth seems to be in some parts higher than the Water. Then for the Heavens he makes Adamantine Orbs, and the Stars like Golden-headed Nails fastned to them: These Orbs involved he makes to move round the Earth in 24 hours, that is every day. To this he introduces a contrary Motion for each Planetary Orb from West to East; the Matter of these he makes incorruptible, but below the Orb of the Moon he puts Fire Elementary, without Light or Heat. In the middle Region of the Air he puts the Milky Way and Comets. For the explicating of all other things on the Earth, he introduces Substantial Forms, and Specifick Qualities, as insignificant as the *Pythagorick* Numbers and Harmonics. Which being so, he wonders why it has been so long approved of by the Christian World. Then the Author giving a short Catalogue of his Errors, and bids adieu to him, as to a bad Astrologer, a worse Theologer, and the worst of all Physiologers. His Catalogue is this: 1. That the World is Eternal and Incorruptible. 2. The Heavens solid, and moved by contrary Motions. 3. The Matter of the Heavens Divine and Immutable. 4. The Stars to be denser parts of their Orbs, and the Planets to shine by their own Light. 5. Light neither a Body nor a Motion. 6. Elementary Fire under the Moon. 7. The Galaxi and Comets, Meteors. 8. The Earth immovable, in the Centre of the World. 9. Up and down to be founded in Nature immutably. 10. The Forms of Animate things substantial. 11. Sensation to be made by Intentional Species. 12. Rarefaction and Contraction to be made by the increase and decrease of Extension in Matter. 13. Providence not to descend below the Moon. 14. The Soul to be *ἐντελέχεια*, and of doubtful Immortality. Next he visits *Epicurus*, illiterate, yet of no vulgar Wit; he accommodated all things to his Senses, and so his Notions were for the most part absurd and vulgar. He corrupted only the Doctrines of *Democritus* and *Leucippus*. Upon the whole, the Author thinks his Doctrines not worth considering, but refers the Reader to *Gassendus*. He concludes this Enquiry with giving the Names of several that have written of the Opinions of these *Grecian* Philosophers, and of some that have written their *ἀπόρρητα*, or Secret Do-

Erines, as *Pythagoras Zacinthus*, *Perphyrius*, *Numerius*: He regrets the loss also of many Polyhistorians, as, *Theopompus*, *Phaverinus* and *Alexander Polyhistor*; also some of the Writings of *Diodorus Siculus* and *Varro*. Now whereas some alledge some few others that have been famous for Philosophy in other parts of the World, yet not what they knew, or maintained; and there being no Monuments remaining of such their Knowledge, the Author leaves them in the Obscurity he found them, and thinks he has performed his designed Undertaking to seek what there could be found worthy of preserving among the Ruines and Relicks of the most ancient Philosophers, more particularly relating to the Beginning of things, and has left no quarter unsearched, nor omitted any thing which he judged material to this purpose; though other Particulars not pertinent, whether bad or good, he has omitted, as being impertinent.

To end this Disquisition, in the Fourteenth Chapter he enquires concerning the Beginning of the Barbarick Philosophy; that is, whence the *Egyptians*, *Ethiopi-ans*, *Chaldeans*, *Phœnicians*, *Arabians*, *Indians*, and other Orientals obtained their first Knowledge. There are two Opinions concerning it: One, that they were invented by themselves; and the other, that they were taught by *Moses* or *Abraham*. The Author approves neither of these. Not the first, because he meets with no Mention of Experiments, or Observations, or Reasoning and Demonstrations, or Method, or particular Explications; but what was known was Traditional and Positive. Not the Latter, because this Learning was eminent long before those times; for that *Moses* was bred up in the Schools of *Egypt*, and for that the *Ethiopi-ans* were much preceding to the *Egyptians*. Besides the Instance of *Job*, who is thought by the Author to have much preceded *Moses*; for that he takes no notice of the Jewish Laws, Ceremonies or Sabbath, yet was he one that worship'd the true God; and for that the Age of his Life was above 200 years, and he offered his own Sacrifices without a Priest. Upon the whole therefore the Author thinks it was conveyed to Mankind by the Sons of *Noah*, and by him from the Patriarchs of the Antediluvian World. These are the principal Matters treated of in the First Book.

**I**N the *Second Book* the Learned Author designs to make use of such Testimonies as he can find amongst the Fragments of the most ancient Philosophy, to confirm the Doctrines of his Theory of the Earth, delivered in the *First Book* thereof, for that he has not therein alledged such Testimonies to confirm it, intermingled with the Discourse, it self, as he has done in the *Second*, but framed the whole from the Idea he had of the Nature of the things themselves. And whereas in the former Book of this present Treatise he has inquired after the Ancient Doctrines concerning the whole, or the Universe: In this he restrains his Search after such Doctrines as more particularly concern the Formation and Fabrick of the Earth only. In the first Chapter then he finds that the Production of this World out of a Chaos was the most general, and the most ancient Doctrine of all the Learned, both Theologers, Physiologers and Poets. He begins with *Moses*, and shews, that his *Tobu* and *Bobu* was the same that the Ancients called Chaos. And the Apostle, *Heb. II. 3.* does so interpret it, and most of the Christian Interpreters understand it so also, as do the *Hebrews*. As to other Nations, they either deliver it expressly, as the Philosophers; or Mythologically, as the Poets. The Philosophers differ only, for that some ascribe the Formation to a Mind, others to Chance: He brings several Proofs of it from *Phoenicians, Egyptians, Greeks Romans, Persians*, and from divers other Authors very famous among the Ancients; but others, as *Orpheus, Empedocles* and *Hesiod* made Strife and Love to Operate in the Separation and Union of the parts of the Chaos.

In the *Second Chapter* he enquires what Form they assigned to the Primogeneral Earth, and what Estates it was to undergo. *First*, For the Form, that it was differing from the present. Here first he proves, by the Testimony of *St. Peter*, that there was a three-fold state of the Earth, *viz.* the Past, Present and Future. By the Past he shews was meant the Antidivian, and by the Future the New Heaven and New Earth, which he proves by two passages in *Isaiab*, and one in the *Revelation*. This he shews also mentioned by *St. Paul* in the *8th* of the *Romans*, upon which Passage he insists much to prove; that the Apostle meant this three fold state of the Earth; and alledges the Judgment of the Fathers, *Tertullian, Irenaus, Origen, Hierom, Chrysostom*, and others to confirm it. And then endeavours to answer such as had assigned other Expositions of the Word Creation, of which there are three sorts. One would have the Fallen Angels to be understood, which he shews could not be the meaning, since they are not to be restored. Others would have by Creatures to be understood Men: But that cannot be the Sense, because the Creature and Men are distinguished in the very Text. *Thirdly*, Those that would have the *Gentiles* to be meant, are the farthest of all from the plain Sence which he makes to be (the formed World,) and that it is to pass thorough three States, a former, a present, and a future.

In the Third Chapter he brings Authority to prove the Primigenial Form and Situation of the Earth, and wherein it differ'd from the present, of which the Ancients had manifest Knowledge. The first he alledges is that of *St. Peter*, 2, 3, 6. where he says the Words are oppos'd to those who assert'd the state of the World to be the same as at first: And adds, that *St. Austin* in expounding these Words of *St. Peter*, doth so understand them; to wit, that not only the old Earth perished in the Flood, but the Heavens also. He next enquires wherein the difference is between the former and the present, and finds *St. Peter* there describing the first, to assert it to be out of the Water, and to stand by the Waters; that is, (says he) to be placed above the Waters, and be sustained by them. And by this he explains *Psal.* 136. 6. *Prou.* 8. 27. but brings no further Proof of his Doctrine.

In the Fourth Chapter he enquires concerning the Nature, Manner and Causes of Deluges, but chiefly of the Universal. Here he repeats what he has said concerning the quantity of the Water requisite in his Theory, and quotes also what *Isaiah* says in describing a general Deluge, who makes a kind of Earthquake to precede it, for the Eruption of the Waters out of their Womb, and several other places and Commentators upon them, who all seem to mean Earthquakes. Then he enquires what are the Causes of particular Inundations, which he makes Three. (i. e.) 1. The Irruption of the Sea upon the Low Countries. 2. Great Rains. 3. Eruptions of Waters out of the Body of the Earth by Earthquakes: Of each of these he brings Examples out of History. The first is *Strabo's* Description of the manner of making the Dead Sea where *Sodom* and *Gomorrhah* formerly stood by an Earthquake. Secondly, A passage in *Amianus Marcellinus* about the sinking and drowning of places. Another out of *Diodorus Siculus* concerning the City of *Atalantes*, and of *Strabo* for *Eubœa*. Another out of *Ziphiline* in the Life of *Antonius Pius*, of the loss of the City of *Cyzicum*. Another out of *Diodorus Siculus* about the loss of *Bura* and *Helice*. Another out of *Pausonius* of the Loss of the City *Idea*. Then he mentions the *Ogygian* and *Deucalion* Floods. Of *Deucalians* he remarks a notable passage out of *Lucian*.

In the Fifth Chapter he enquires whether there be any Record among the Ancients that may confirm his Conjecture about the right Situation of the Earth to the Sun. Whence proceeded a perpetual Equinox without differing Seasons: For this he looks for the Description of the Golden Ages, viz. in *Plato's Phædo*, where he says, under *Saturn* the Motions of the Heavens were uniform, but under *Jupiter* there was an ἀναρροσία of the Heavens to the posture they are now in, which was the Cause of all the Evil that followed. He speaks also of its Renovation, or being restored to its former state. Of these things we have an imperfect Account, by reason of the length of Time past; but these and greater, or more wonderful things have happened. Next for the Earth, *Plato* says it was equilibrate without Inclination, ἰσορρόπον ἔχει ἀκλίνας. Further, he makes the Seasons all temperate, which gave Men long Lives. He makes also an Abyss to receive the Water trajected through the Earth; but the Surface of it he makes smooth, and adorned with various Colours and Gems, as the Prophets and Sacred Authors do the *New Hierusalem*.

In the Sixth Chapter he enquires concerning the changed Position of the present Earth: For this he has a Cloud of Testimonies beside *Plato*, to wit, *Anaxagoras*, *Empedocles*, *Diogenes*, *Leuceppus*, *Democritus*, who all speak of the charged Situation of the Earth's Axis, whose Testimonies he has elsewhere mentioned. Among the Inventions of the Astronomers, the Obliquity of the Zodiack and the Seasons of the Year are ascribed to *Thales*; which is an Argument it had not been so from the beginning. But the Histories of the Progress of Astronomy, written by *Endemus* and *Theon Smyrnenus* have perished, which might have afforded more cogent Arguments. Here he mentions what *Ovid*, *Virgil* and *Homer* have said to this purpose, in describing the Golden Age and the Elizium of the Dead. From the Poets he passes to *Plutarch's* Description of the Fortunate Isles, which is a more modern Name for the Elizium, and agrees much with the Paradisical Earth. And another out of *Diodorus Siculus*, of the Island *Tabrobana*; which he supposes to be for the same purpose. From these Heathens he comes to the Jewish and Christian Writers, describing Paradise and the Garden of the Lord; who do much agree with the Heathen Descriptions of the Golden Age. He quotes *Is. Abarbanel* upon the 2d of *Genesis*, and *Aben Ezra*; also *Maimonides* upon the 10th Chapter of the *Sanhedrim*; *Manasseh Ben Israel* on the Creation, and *Abraham Echellensis* concerning the Testimonies of the *Jews* and *Arabians*. Then for the Christians he brings *Tatianus*: He quotes also *Suidas*, and sums up all with *Bellarmino's* Conclusion, That there was a perpetual Spring, and another Course of the Sun then at present. He adds, that *Aristotle* thought the short and uncertain Life of Creatures proceeded from the Oblique Motion of the Sun in the Zodiack: And that *Mantuan* says, it was the Opinion of the ancient Astronomers. He adds also a Passage of *Orpheus* preserved by *Proclus* to the same effect.

In the Seventh Chapter he discourses of the Description which *Moses* gives of Paradise, and of the state of Nature in the New World; which is in general, That *Moses* accommodated his History to the Capacity of those for whom he writ, and that all he has said is not to be taken in a strict literal Sense. Then in the Eighth Chapter he speaks of the manner of the Interpretations of the Expressions of *Moses* concerning the *Hexameron*, which is consonant to his Thoughts in the Seventh. And in the Ninth Chapter he endeavours to answer those who would have it to be literally understood. And in the Last Chapter he propounds what things are worthy to be considered in order to the making a right Judgment of the whole; and more particularly, of what he hath more freely delivered in the preceding Chapters. He desires his Readers therefore to consider the Use and Style of the Eastern Sages. 2. The mean and dull Apprehensions of the *Israelites* at the time when *Moses* writ. 3. What Learned Commentators have said of this matter. 4. What we are to think of the Great God; and what Thoughts concerning him are worthy, and what befitting. As to the First, These Orientals did for the most part deliver their Doctrines in Mythology, *ad Captum Vulgi*: But they had also a more Secret Doctrine, which they deliver'd only to such of their Schools as were of a more clear Understanding. So that though many vulgar Opinions have been ascribed to them, yet they were such as were deliver'd for the Vulgar, but that they had others reserved for the more intelligent. So *Iamblicus* and *Lactantius* relate some Notions of *Pythagoras*, which accorded with the  
Vulgar

Vulgar Opinion of the Heavens; yet 'tis plain he held the other Doctrine. The Jewish Doctors say, the Law speaks with the Tongues of Men; that is, with a Vulgar Style, yet they had their *Cabala* to conceal their Mysteries: Nor was this Foreign to the Christian Schools. Secondly, The People of *Israel* when *Moses* writ were of dull and uncultivated Understanding, not fit for Natural Speculations or Divine Contemplations. Thus much *Manasseh Ben Israel* says, and so does *Moses Maimonides*. This he conceives to be the reason why *Moses* so wrote the History of the Creation. Thirdly, Commentators both Jews and Christians have asserted, That many things in that History are not to be understood Literally but Allegorically: For this, besides *Philo Judeus*, who makes it all Allegorical; and the *Cabalists*, whom he passes by, he names *R. Moses Egyptianus* for a solid Author asserting it, and *Josephus*; as also *Aristobulus*, quoted by *Eusebius*, who is of the same Sentiment, as were many of the Christian Fathers which he cites at large. Fourthly, As to such as do not adhere to the Literal Sense, he admonishes them that they do not admit any thing unworthy of God or of our Religion.

---

Printed for S. Smith and B. Walford, Printers to the  
 Royal Society, at the Princes Arms in St. Paul's  
 Church-yard, 1693.

500. 3/4. 1848. 1848. 1848. 1848. 1848.



Fig: 1.

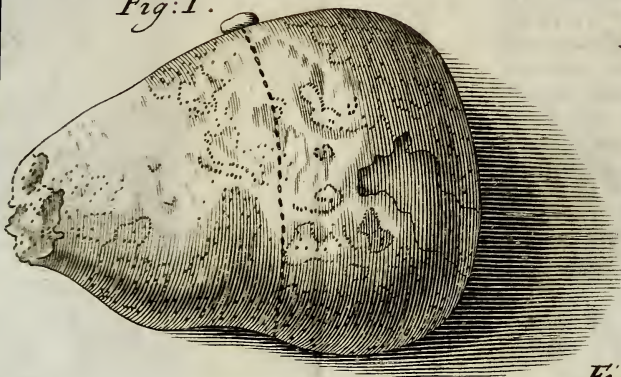


Fig: 2.

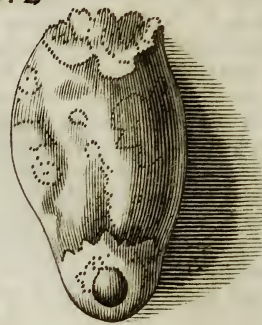


Fig: 3.



Fig: 1.

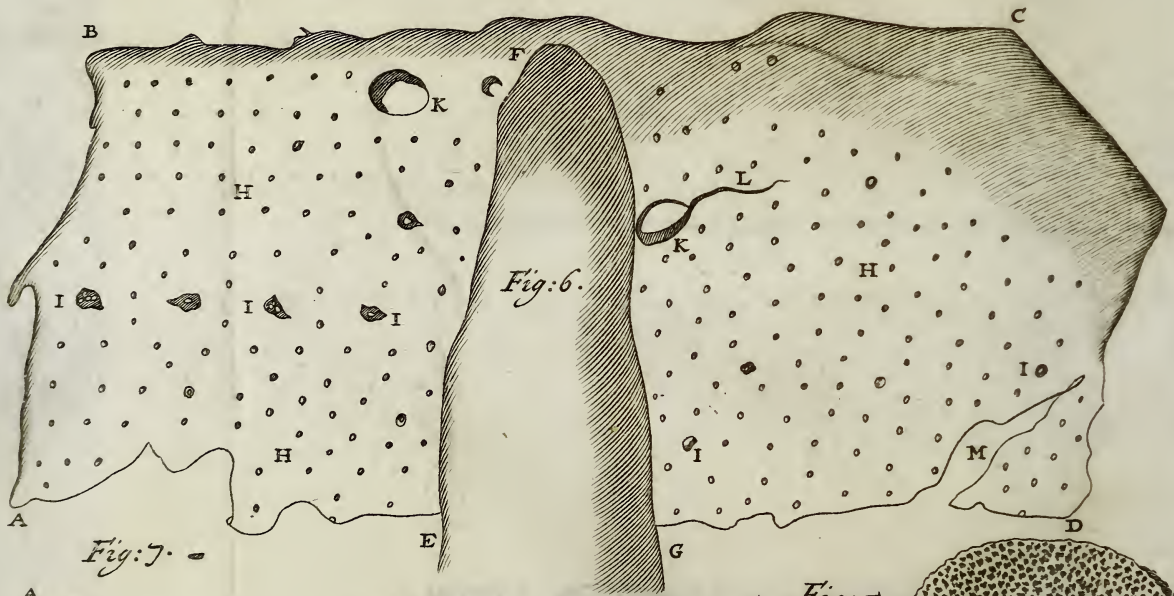


Fig: 7.

Fig: 5.

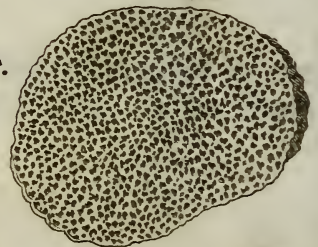


Fig: 9.

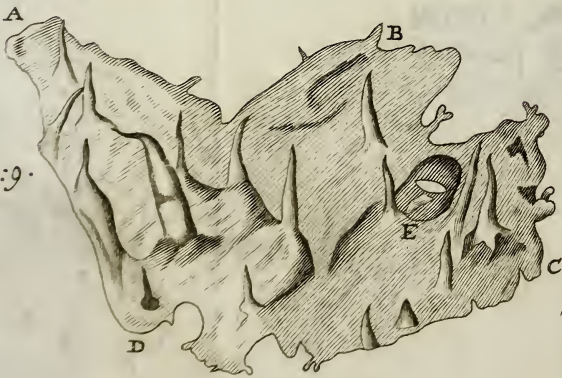


Fig: 4.

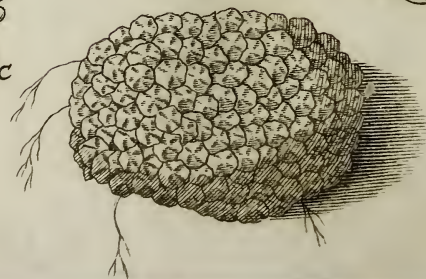


Fig: 8.

---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Months of July and August, 1693.*

---

## The CONTENTS.

- I. **A** Query put by Dr. N. Grew, S. R. S. Concerning the Food of the Humming Bird; occasioned by the Description of it in the Transactions, Numb. 200. II. Some Observations made by Mr. Paschall, on the Motions of Diseases, and on the Births and Deaths of Men and other Animals, in different times of the Νοχθήμερον. III. Dr. Mulinieux's Account of a Stone of extraordinary bigness, spontaneously voided through the Urethra, by a Woman at Dublin. IV. An Account of the Tubera Terræ, or Truffles found at Rushton in Northampton-shire, with some Remarks thereon by Tancred Robinson, M. D. and S. R. S. V. A Letter from Mr. Martin Hartop at Naples to the Publisher, concerning the late Earthquake in Sicily. VI. An Extract of an Account of the Earthquake mentioned in the foregoing Letter, taken out of an Italian Paper. Written by P. Alessandro Burgos. Printed first at Palermo, and afterwards at Naples, 1693. VII. An Extract of a Letter from Mr. Anth. Van Leeuwenhoek, S. R. S. containing several Observations on the Texture of the Bones of Animals, compared with that of Wood, on the Bark of
- N n
- Trees.

Trees. *On the Scales found on the Skin, &c.* VIII. *A Proposal concerning the Parallax of the fixt Stars in reference to the Earth's annual Orb: Being the Extracts of several Letters, dated May 2. June 29. and July 20. 1693. from the Reverend Dr. John Wallis, S. R. S. to William Molineux, Esq;* IX. *An Account of a Book, Entituled, Synopsis Methodica, Animalium Quadrupedum & Serpentina Generis, Vulgarium Notas Characteristicas, Rariorum Descriptiones integras exhibens: Cum Historiis & Observationibus Anatomicis perquam curiosis, &c. Auctore Joanne Raio, S. R. S. in 8<sup>o</sup> Lond. Impensis S. Smith & B. Walford.*

---

*An ADVERTISEMENT belonging to Page 826. of this Transaction.*

**F**IG. 4. represents one of the *Tubera Terræ* whole, the *Papillæ* and *Fibres* being observable thereon. *Fig. 5.* The same Truffle cut through the middle to shew the inside full of whitish Veins.

---

E R R A T A.

**N**umb. 198. p. 661. l. 14. for *Cartilages* r. *Tendons.* p. 670. r. *Gnaphalium,* p. 681. l. 1. r.  $Q = \frac{2}{3}$ . Numb. 199. p. 713. l. 23. r. *setting on of.* p. 714. l. 26. r. *Fig. 14.* p. 715. l. 17. r. *determine,* p. 716. l. 6. r. *Aqueus.*

I. *A Query put by Dr. N. Grew, concerning the Food of the Humming Bird; occasioned by the Description of it in the Transactions. Numb. 200.*

S I R,

Since I shewed you the Description of the *Humming Bird*, with the Letter in which it came to me: I learn, that Mr. *Hamerly* of *Coventry* is the Author of it. You see it is believed he feeds on some Juice he sucks off, or out of Flowers. It was believed for a long while, that the Bird of Paradise had no Legs. Whether may not this Bird rather feed on small Insects, whereon many Birds feed, some whereof lie in the bottom of most Flowers, and for which, this Bird hath a Bill? Whereas a Bee that sucks hath a Siphon or hollow Probe. In short, the Bird should be open'd: And so it will appear, either that he hath Entrails fitted only for Liquids; or the same sort of Stomachs and Guts as other Birds, containing the same sort of solid Food.

II. *Some Observations made by Mr. Paschall, on the Motions of Diseases, and on the Births and Deaths of Men, and other Animals in different times of the Nuxthuseev.*

Some Months since I fell into a Suspicion, that the Causes of *Tides* at Sea do also continually exert their Power in other places, though the Effects thereof may

may not be so sensibly perceived on the solid as the fluid parts of this *Terraqueous* Globe. That I might in the best way I could think of, make some tryal towards a discovery of the Truth herein, I took this Method. First, I divided the *Νυχθημερον* into four Senaries of Hours: The first consisted of three Hours before the *Southing* of the *Moon*, and three after the second of the six hours following, and so the third and fourth contained the two remaining Quarters of the Natural day. I next betook my self to observe Births and Deaths, in our own kind, as also in other Species of *Animals*, whether they fell out indifferently in any of these four Senaries: And I found none that were born or died a natural Death in the first and third Senaries, which I take liberty to call first and second Tides, but every one either in the second or fourth Senaries, which I call first and second Ebbs. I then proceeded to make Observations in the Motions of Diseases, which I could the better do, because I had some in my Family visited with Agues. Here I found that the tumult of the Fits generally lasted all the Tiding time, and then went off in gentle kindly Sweats in the Ebbs. I went on then to take notice of the *Sex res non naturales*, and alterations of the Weather, and such Accounts as I could meet with of *Earthquakes* and sundry other things: And I have yet met nothing to hinder me from laying down this as a Maxim; That Motion, Vigour, Action, Strength, &c. appear most and do best in the *Tiding Senaries*; and that Rest, Relaxation, Decay, Dissolution belong to the *Ebbing Senaries*.

III. *Dr. Mullineux his Account of a Stone of an extraordinary bigness, spontaneously voided through the Urethra by a Woman in Dublin.*

**W**omen are made by Nature of a more nice Composition, and weaklier Frame than Men, and are therefore liable to many Infirmities that Men are not the least subject to. Yet in one of the most painful that afflicts the Body, the Stone in the Bladder, they have much the advantage, and are more rarely troubled with it than Men.

For among the two vast Collections of Stones, that amount at least to several Thousands, kept together in the Hospitals at *Paris l'Hotel Dieu* and *la Charité*, cut out only of such as come thither to be cured, not one in an Hundred, I might safely say more, is taken out of a Woman.

This remarkable difference must certainly proceed from the Urinary Passage in this Sex, being shorter, larger, and more apt to dilate; so that for the most part, when Gravel, or a sort of viscid clay matter, which I take to be the chief Cause of the Generation of the Stone, falls into the Bladder, 'tis suddenly and easily discharged, ere it can cohere together and form a Stone of any large Bulk, which cannot so frequently happen in Men, by reason of the narrowness, crookedness, and length of the Passage of the *Urethra*.

However it sometimes comes to pass, that even in Women, either from a more depending, or less elevated Posture than usual in their Bladder, or that the matter forming the Stone adheres to some part of its Membranes, so that it cannot fall in the Urinary Passage, till

its own Bigness or Gravity forceth it thither, Stones of a very considerable Bulk are generated.

Of this we have lately had here in *Dublin* a very remarkable Example : One *Margaret Plunket* alias *Weldon*, to give her her Maiden Name according to the *Irish* way, the Mother of Five or Six Children, Cozengerman by her Mothers side, who was the Lord *Netherfield's* Sister, to my Lord *Tirconnell*, born in the County of *Meath*, about Sixty Years of Age, now living in *Church-street, Dublin*, on *May 29. 1691.* voided through her Urinary Passage, by the help of Nature alone, without the use of Remedies, or any forcible means whatever, a Stone of this Shape and Size, somewhat resembling a hard Pear a little press'd or flatted.

V. Fig. I.

Its Circumference measured the longest way is 7 Inches and  $\frac{1}{8}$ , round about where it was largest 5 Inches  $\frac{3}{4}$ ; its Weight at present, according to *Troy Pound*,  $\text{z}ij, \text{z}ij, \text{ij}$ , gr. 6. for it has lost considerably both of its first Bulk and Weight by many little Fragments breaking off from the smaller end *A*, where 'tis much softer, smoother, whiter, its parts more porous, and so incoherent, that the least force severs them : Whereas the bigger end *B*, as far, as the Stroke *ccc* passes, is of a very different Texture, much more close and compact, covered with a yellowish shining Crust, ruff, granulated, and as hard as the best *Portland Stone*.

This different Texture of Parts in one and the same Stone, observable in most of this kind if they be of a large Size, proceeds, I am apt to think, from the same constant Bed or settled posture of the Stone in the Bladder, whereby some parts of it are more exposed to imbibe the Moisture of the Urine as it falls or settles in the Bladder than others ; and by this sort of Maceration are kept soft, whilst those parts that lie higher towards the upper Region of the Bladder remain dry, harder, and gather a sort of gritty Crust, as we find most soft Stones do,

do, that are dug out of the moist Earth, when exposed a while to the dry Air.

It seems to me very probable, that Stones when they come to be of a large size, keep much one and the same posture in the Bladder at all times, there not being room in so pliant and membranous a Body, that always contracts it self to the least Dimensions it can, to allow a Stone of any considerable Bulk ; for the Case is different in those that are small, to tumble or change its Situation very much.

But however this Conjecture may prove true or false, 'tis undeniable, that some Stones from their way of Generation must of necessity remain fixt and immovable in the Bladder ; being closely joined and united to the very substance of its Membrane, of which sort there are several Examples recorded by *Scenkius*, and other Collectors of Observations : And I'm perswaded this Stone I am now describing may be reckon'd among them : For about the larger end, where 'tis marked *ddd*, there still closely adheres several thin Films and carneous Filaments, which manifestly shew it was formerly united by this part to the membranous Substance of the Bladder, and that lately by its own Weight, or some other Accident, it was torn away, and fell into the *Urethra*, through which 'twas voided ; and hence it was that this Woman, as she her self told me, never suspected her self, till very lately, at all troubled with the Stone.

For these Three Months past, whilst 'twas sticking in the Urinary Passage and coming away, she has suffered great Pains, and a perpetual Strangury, or an involuntary dropping of her Water from her ; and this Infirmary still continues, by reason the largeness of the Stone has over-stretch'd the Fibres that compose the Sphincter of the Bladder in its Passage through it, whence their Tone is so relaxt, they have lost all power of Retention : And for this Reason, I find all Women that void Stones this

way, of any considerable bigness, are constantly attended with this Weakness.

But this Trouble is fully recompens'd by the Remission of her Pains, which, since the Stone came away, are so abated, that she can walk about, and is now able to come abroad.

'Tis very extraordinary that so large a Stone should be naturally voided by the Bladder; and I have read but of very few that come nigh the bigness of this, which I have now in my Possession, and keep among some other natural Productions, as a curious Rarity.

*Thomas Bartholine* in his *Centurid 1<sup>a</sup> Hist. Anat. Observat. 71.* sets down the Description and Figure of a very large Stone as he thought, though he says 'twas but *Ovi Gallinacei magnitudine*, that came from a Woman as this did.

And *Daniel Angelus* in the *Miscellan. Physico-Medic. Germanic. An. 1676. Observat. 195.* gives the Figure of another Stone, much of the same size with *Bartholine's*, spontaneously discharged the same way.

Likewise *Petrus Borellus Centuriæ Secundæ Observ. 22.* mentions a Stone, but gives no Figure of it, voided by a Girl through her Urinary Passage, *Ovi Anserini magnitudinis*, as his own Words are, which I suppose was much of the same size with this of ours.

But *Nicolaus Tulpius* in his more elaborate *Observ. Lib. 3. cap. 7.* gives an Account of a Woman 89 Years of Age, that voided a Stone, of which he gives you an accurate Figure, full as broad, somewhat longer, and almost  $\frac{3}{4}$  heavier than this I have describ'd; yet she lived after it, and was so well as to walk abroad.

I mention these several Examples, not only to illustrate and confirm the Truth of our present Story, even to the most incredulous; but as so many Arguments, from whence I think, one may reasonably infer, That no Woman need be obliged ever to undergo the painful and hazardous

hazardous Section of the Stone ; though some among the Ancients describe the particular manner how the Operation is to be perform'd in this Sex ; as *Ælius Tetr. 4. Sermon 4. cap. 99.* And among the Moderns, *Monfieur Tolet Traité de la Lithotomie, Chapit. 15. pag. 122.*

For since Nature by her own Power, without the Assistance of any Help or Remedies, could disburthen herself, and force away such large Stones as these here describ'd, why may we not probably conclude, That even those still of a larger, if there be any such bred in Women, as one may well question, since all those Accounts of Stones of prodigious Bulk bred in the Bladder, are related of Men only ; as if Nature kept somewhat the same Rule of Proportion in these sort of Productions, as she observes generally in the Stature of Men and Women : I say, why may not they be brought away, by putting the Body into a convenient Posture, and so by the Hand and Fingers forcing the Stone into the Urinary Passage, which by Application of relaxing and strongly emollient Remedies, may be so dilated, as to give a free Passage to the Stone without any forceable Section ?

But this I leave to be determin'd by such, who lighting upon proper Subjects, may have occasion hereafter to try the Success of this Practice, which if found to answer Expectation, may be of solid and real use.

July 14. An. 1691.

Since my writing the foregoing Account, Mr. *Thom. Proby*, an ingenious Chyrurgion of this Town, has lately in two Instances of Fact, successfully demonstrated the Practicableness of what I then propos'd only with Probability, touching the Extraction of Stones bred in the Bladders of the Female Sex without any Incision, as well those of a large, as those of a smaller Magnitude.

The

The first Instance is the more remarkable, as well for the Girls being very young, and by consequence the Passage of her *Urethra* strait and small, as that the Stone was extraordinary long, and considerably large for one of her Years. The annext Figure expresses exactly enough both its Shape and Bigness. The Child's Name was *Sarah Cooke*, about Six Years old; for some Years past she had been so miserably afflicted with the Stone, and a perpetual Incontinency of her Urine, that her Parents at any Hazard were willing to attempt relieving her of so violent a Pain, and so foul a Distemper. Whereupon, *June* the 8th, 1693. the Child being placed in a convenient Posture in a Man's Lap sitting across a Table, with her Arms tied down to her Legs by a sort of Bandage usual in these Cases, the Chyrurgion first pass his *Catheter* into the Neck of the Bladder, that it might empty it self of all Urine, before he inserted his Dilatory Instrument, or his *Speculum Vesicæ* as one may call it, with which he extended the *Urethra* as much as possibly he might with safety, and without putting the Child to extraordinary Pain; afterwards by help of a Directory and Forceps gently thrust into the Bladder, he brought away the Stone without any manner of Incision in about 3 or 4 Minutes time from the passing in of his first Instrument, and put the Patient to so little Pain during the Operation, that when it was over, and she laid quietly a-bed, she slept without any Opiate 7 or 8 Hours together, as she had not done in many Months before, and is now perfectly well and at ease. Whether hereafter the Sphincter of the Bladder may restore it self, and become so strong, that she shall not be liable to a *Stillicidium Urinæ* as heretofore, the only Inconvenience that may be feared at any time can attend this sort of Operation, is uncertain as yet, since 'tis so lately perform'd; but being so young a Child, and the constant Cause of the Relaxation of the Sphincter, the Stone in the Bladder being

ing now wholly removed, 'tis probable she may recover it, and not be subject to this Weakness as heretofore.

The other Instance is a Child something elder, about 10 Years of Age, her Name *Elizabeth Mortimer*, who has been troubled with an Involuntary distilling of her Urine, and other painful Symptoms of the Stone for these three or four years past; but on *June* the 12th, 1693. was happily relieved by the extraction of a large Stone near as big as a Pigeons Egg, after the same manner and method as before describ'd, and with as good Success, though not altogether with as quick Expedition.

From these Examples one may reasonably conclude, That those of intermediate Years as well as Childhood and Old Age, are capable of undergoing this Operation of Extraction of the Stone with Safety: And I make no great doubt to assert, That 'tis the only proper and secure way of freeing the Female Sex from the Stone in the Bladder, and that such should never be perswaded to undergo the Section upon any account, since the Stone, if it be not of an immoderate bigness, may be extracted by dilating only the Neck of the Bladder; and if it be of so large a Bulk, (as I have reason to think it never, or very rarely is in this Sex) as that it cannot be drawn out this way; then the Section, if the Chyrurgeon be so bold as to venture on it, must be made so wide, as wholly to cut through the short Neck of the Bladder, and to divide likewise some part of its thin membranous Substance, which is known to be of the most dangerous consequence in cutting the Stone, and to be avoided as certain Death to the Patient.

I have added the Figures of the Three Stones I have here mention'd, all express'd as big as the Life. That Mark *Fig. 1.* is the Stone spontaneously voided by the Old Woman. *Fig. 2.* was taken out of the Child Six  
Years

Years Old. And *Fig. 3.* was brought away from the Child Ten Years Old, both these without any Section.

---

IV. *An Account of the Tubera Terræ, or Truffles found at Rushton in Northamptonshire; with some Remarks thereon.* By Tancred Robinson, M. D. and R. S. S.

S I R,

THE *Tubera Terræ* (which you was pleas'd to send me, together with a Draught of them drawn with your own Pencil) observ'd lately at *Rushton* in *Northamptonshire*, by that curious and learned Gentleman Mr. *Hatton*, are indeed the true French *Truffles*, the Italian *Tartuffi* or *Tartuffole*, and the Spanish *Turmas de Tiera*, which are not noted by Mr *Ray* to be found in our British Soyl. I have seen them thrice as large at *Florence*, *Rome* and *Naples*, where they eat them as a delicious and luxurious piece of Dainty, either fry'd in slices with Butter or Oil, Salt and Pepper; or else out of Pickle, and often boyl'd in their Soup. Of these there are three or four Species mentioned by *Matthiolus*, *Imperati*, *J. Bauhine* and *Mentzelius*.

These observ'd in *England* are all included in a studded Bark or Coat, the Tubercules resembling the *Capsules* or Seed-Vessels of some *Mallows* and *Alcea's*; the inward substance is of the consistence of the fleshy part in a young Chestnut, of a paste Colour, of a rank or hircine Odour, and unflavoury, streaked with many white Veins or Thrëds, as in some Animals Testicles; the whole is of a globose Figure, though unequal and chinky.

What

What these *Trubs* are, neither the Ancients nor Moderns have clearly informed us; some will have them *Callosities*, or *Warts* bred in the Earth: Others call them subterraneous *Mushrooms*. If you could ever find *Vestigia* or Marks of a Stalk, or of Fibres, or Capillaments about their outsides, I should be then almost tempted to guess, that they are the Product of some Bulbose or Tuberosè Plant, perhaps a *Satyrion* or *Orchis*, or some other Root of that numerous Tribe, many of which have a Seminal Smell.

I conjecture that these *Tubera Terræ* were found after the late Thunder and Rains; for some of the Ancients call'd them *Ceraunia*, to which *Juvenal* seems to allude, *Sat. V.*

*Post hunc raduntur Tubera, si ver  
Tunc erit, & facient optata tonitrua cœnas  
Majores: tibi habe frumentum, Alledius inquit  
O Libye: disjunge boves, dum tubera mittas.*

They are most tender in the Spring; though after Showers and sultry Weather they may be plentifully found in the Autumn: the Wet swells them, and Lightning may dispose them to send forth their particular Scent so alluring to the Swine.

*Ludovicus Romanus*, *Navigat. Lib. i. cap. 7.* affirms, That Thirty Camels Load of these *Truffles* or *Trubs* brought from *Armenia* and *Asia Minor* have been all sold at *Damascus* in two or three days. The manner of finding and rooting them up may be read in *Mr. Ray's Itinerary of Italy*, p. 403, 404. and in his *Catal. Stirpium Exot.* at the end of his *Travels*, p. 109.

I need not tell you the Uses to which the *Greeks* and *Romans* apply'd these Vegetable Bodies, nor how they are dress'd and eaten at this day. *Pliny*, *Martial*, *Plutarch*, *Athenæus*, *Galen*, *Apicius*, &c. may be consulted

for the first; *Nonnus, Bruyerinus, Ciccarellus, &c.* for the last.

## POSTSCRIPT.

**A**fter the writing of the foregoing Letter, I received Intelligence, that Mr. *Hatton* observ'd Fibres issuing out of some of these *Tubera*, which lay Spit deep under ground; so that perhaps they may be *Plantæ sui generis*, and their fulcated *Papillæ* analogous to, if not Seed-Vessels. You know several Vegetables bear their Seed near the Root, as the *Trifolium subterraneum tricoccum reticulatum flosculis longis albis*; most of the *Arachydnæ's*, and some other *Legumes*, which flower above, but seed under ground. As to the *Truffles* lying so deep, that is common to many Roots that shoot up Stalks above the Earth. To instance only in that *Lathyrus tuberosus*, call'd commonly *Chamæbalanus* and *Terræ Glandes*; in English, *Pease-Earthenut*, digg'd up and eaten by the poor People, *Non nisi altâ fossione inveniendæ*, says *John Bauhine*. But for a clear History of these, our Judicious Mr. *Ray* may be consulted, *Histor. Plant. Vol. 1. p. 895, 899, 918, 919, 942.*

The Roots of our *Bulbocastanum* (of the Umbelliferous Tribe) commonly call'd *Kepper-Nuts, Pignuts* and *Ger-nuts* in the North, lie very deep, and fatten Hogs, which are very greedy of them. I have often observ'd the Shepherds and Boys in *Yorkshire* digging them up for a delicate Dish: Perhaps this is the *Nucula Terrestris Septentrionalium* of *Lobel*, and the *Apios* of *Turner*.

Fleetstreet, Aug. 29.

1693.

Tours, &c.

Tancred Robinson.

V. *A Letter from Mr. Martin Hartop at Naples, to the Publisher. Together with an Account of the late Earthquake in Sicily.*

Worthy S I R,

I Have sent you, as you desir'd, all the Account which has yet seen the Light of the late Earthquake in *Sicily*. There was nothing that ever I could hear of particular in it, and therefore you can expect no great matter of Reflection upon it. However, to comply with your Commands, I send you my general Thoughts of this and such like *Phænomena*.

First, It seems highly probable that these Tremblings of the Earth proceed from the same incens'd matter, which finding a way at other times through the *Mongibello*, has so furiously broken out in Smoak and Fire: This appears by the Tragedy of *Catania*. Now you must know the Eruptions of these Mountains are of two sorts; the one not so very violent as to disturb much the adjacent Country, and this happens once in two or three Months, and lasts three or four days. The other is more furious and of longer Continuance, and is observ'd here at *Naples* to happen to Mount *Vesuvio* once in about Eighty Years, as I heard the ingenious Mr. *Peccacio* say. Of these, the last, which as well as I remember, he said was in 1632. was so very violent, that by the best of his Observation it cast the Rocks three Miles into the Air. Now from the burning or not burning of this Hill, *Naples* (and without doubt the same holds in *Sicily*) calculates its safety or danger of Earthquakes: For without doubt the matter is perpetually burning under the Mountain; and those vast Clouds of Smoak which daily issue out of the top, if the Cavity happen by any Rock or

inward Alteration to be stopt, must deviate through other Passages under ground, heaping up continually Magazines for a future Calamity. Now this combustible matter seems to me to be nothing but Nitre mixt with some other Minerals and Sulphur. He that has seen the way of making Salt of *Tartar* by Deflagration, where you mix an equal quantity of pulveriz'd Nitre, has seen an exact Type of these burning Hills: For after each spoonful you put into the burning Crucible, arises first a black thick Smoak, after which the fired Mineral boils up, as if it would over run the top of the Crucible.

This I take to be the matter. But, 2ly, How this Motion of the Earth is perform'd is not so easily explicable, especially if one considers, that the Motion of the Earth is not from the Perpendicular, but Horizontal *Verte*; 'tis a Vibration so quick, that it cracks the Glass in the Windows: 'Tis disputable whether the Reciprocations of a Lute-string are more frequent. Now when the Vibrations are so quick, and the Body mov'd so great, the Motion must be prodigiously violent, and by consequence the Cause, which I take to be nothing else but the aforesaid Vapours incens'd. We observe the Thunder, which is the effect of the trembling of the Air, caus'd by the same Vapours dispers'd through it, and encountering one the other, has force enough to shake our Houses. And why their may'nt be Lightning and Thunder under ground in some vast Repositories there, I see no reason, especially if we reflect, that the matter which composes the noisy Vapour above us, is in much larger quantities to be found under ground. Now if you ask me how this Horizontal Trembling is perform'd, (for such doubtless it is, as appears by the Cracks in the Earth, which they say, are to be found now all over *Sicily*) I can attribute it to nothing else but the furious Passage of the incens'd matter from one Grotto to another: For 'tis very probable these are continued in some parts

parts of the Earth for several Leagues together : Witness your last Earthquake about four or five year ago, which was felt, (with little difference as to time) in *England* and *Ireland*. Another Confirmation of this, is, the manner these trembling Fits are perform'd; which is not all of a suddain, like that of Gunpowder in a Mine, but is small at first, afterwards gradually more terrible, like a growing Tempest. A Third may be, the Observation of some here in *Naples*, that when Mount *Vesuvius* ceases to burn, the *Sulfaterra* sends out its Fumes more violently, & *vice versa*. Now this *Sulfaterra* is a Hill near *Puzzolo*, as distant from *Naples* on the one hand as the Hill *Vesuvio* is on the other.; so that 'tis more than probable *Naples* stands upon a burning Arch, through which, as a Pipe, these two furious Neighbours do reciprocally receive the abovesaid Exhalation. This seems to me a growing Evil to this wealthy and populous City, and what may possibly in time make good the Prediction of *Sanazarius*, who was born here...

*Et te, quis putet hæc ? altrix mea, durus Arator  
Vertet, & Urbs, dicet, hæc quoque clara fuit.*

*Tours, &c.*

VI. *An Extract of the Account mentioned in the foregoing Letter, taken out of an Italian Paper. Written by P. Alessandro Burgos. Printed first at Palermo, and afterwards at Naples. 1693.*

HOW difficult is the Task to describe in a few Pages the mournful *Iliads* of the once famous Kingdom of *Sicilia*, in great part ruined by the terrible Shakes of the late Earthquake? How shall I, amongst the Confusion of Tears, Sighs and Groans, discover the History of our Misery? Or amongst a Chaos of Rubbish find the Marks of our Desolation? Nay, how can I recall to mind, without Amazement, the Relations that came from all parts of the Desolate Land? Yet your Commands are to be obey'd.

*Quaquam animus meminisse horret luctuque refugit  
Incipiam-----*

The Island of *Sicilia* of 700 Miles Circuit, and divided into three Valleys, began on *Friday* the 9<sup>th</sup> of *Jan.* about half an hour past Four a Clock, to be sensible of the Shake in the Valley of *Mazara*: But in the two other Valleys of *Emone* and *Noto*, the Shakes were so terrible, as to throw down some Buildings, obliging the Inhabitants to seek Refuge either in the Fields, or with Prayers and Tears implore the Divine Pity in the Churches. On *Sunday* following, being the 11<sup>th</sup> of the same Month, at twenty hours and three quarters, the Hand of God appeared much more terrible, awakening the most Lethargick Sinner. The Shakes of this Earthquake

quake did no Damage in the Valley of *Mazara*, only frightening the People.

*Palermo* received some Detriment in most of the Buildings, especially the Palace and Hospital of *St. Bartholomews*. The Steeple of *St. Nicholas*, belonging to the *Augustines*, was ruined, and some hurt done to the Church; but little Mischief else done, and no body hurt.

In *Messina* all the Buildings of the Theatre are shattered, the Royal and Archbishop's Palace, with the Seminary, are all crack'd. The vast and stately Church of the *Franciscans* broken in many places, and the Roof of the Vestry fallen: The Steeple of the Church of the Annunciation thrown down, with the Death of the Sexton. The top of the Spire of the *Dome* cleft, all the other Religious Houses and Publick Buildings were saved. Many private Buildings were thrown down, and all the rest shored up. There were but few Persons kill'd.

*Troina*, *Randazzo*, *Nicosia*, Cities in the Mountains, suffered in their Buildings. The first had half of the Mother-Church destroyed, with the Parish Church of *St. Lucy*, and was much damaged in his Monasteries; one whereof is not habitable. The last had its *Dome* very much hurt. *Castiglione* had the Castle and many Houses thrown down. In *Francavilla* and *Linguagrossa*, the greater part of the Buildings and some Churches. *Mascali* quite ruined, but not many killed, most of the People being abroad a Procession with the Reliques of *St. Leonard* their Protector.

*Aidone* received a considerable Mischief, two whole Quarters, with many of its Inhabitants being destroyed. In the Quarter of *St. Laurence* there is not one House standing, and the Churches ruined. In that of *St. James* the Church of the *Annunciation* and its Oratory thrown down, with several other Sacred Edifices. In the other part of the City which stands lower, there were not so many Houses nor Persons lost, yet the Church of  
Pope

Pope Leo is quite flat, and the magnificent Church of the *Dominicans* in Ruines, with the Convent of the *Reformati Osservanti*, one of the best in the whole Province.

*Abi Aquilea*, commonly called *Jaci Reale*, situated at the Foot of *Etna* is almost quite destroyed, and its Inhabitants buried in the Ruines, with many Convents; amongst the rest, the famous one of the *Osservanti Reformati*. *Aci St. Antonio*, *Aci St. Filippo*, *S. Gregorio*, *Pedara Trecaſtagni*, *Bonnacorei*, *Nicolosi*, *Motta*, *Mesterbianco*, *Fenicia*, and several other fruitful Villages situated near *Mongibello*, are destroyed, with all the Habitations of the pleasant Hills about *Cananea*, which are now in the Dust.

*Paterno*, about Twelve Miles from *Catania*, a populous City at the foot of *Mongibello*, subject to the Dutchy of *Montalto*, felt the dreadful Effects of the Earthquake, loosing most of its Buildings, all the Convents of Fryars, and a very fine Monastery. In the Ruines were buried Forty Persons. *Aderno*, a City subject to the same Lords, had the same Fate.

*Cantabiano Piemonte* in the Valley of *Emona*, *Francofonte*, *Palagnia* in the Valley of *Noto* are little less than wholly level'd, and about 300 Persons destroyed, as we have by the Letter of the Marquess of *Francofonte*; who was miraculously saved by leaping out through the Crack in the Wall of the Falling Edifice.

*Catania*, one of the most ancient and famous Cities of the whole Kingdom, honoured by the Courts of several Monarchs, and an Episcopal See, even from the time of the Apostles, giving place to none in the Beauty of its Sacred Edifices; amongst which the *Dome* was the most sumptuous and large in all *Sicily*, adorned with excellent Pictures, and richly furnished, and bless'd with the Reliques of the Invincible Martyr *St. Agatha*, honoured with the Bodies of several Kings; besides it had a very high

high and curiously built Steeple. Here were a great many Nunneries; amongst the rest, the Monastery of the Trinity, and that of St. *Benedict*, with that Prodigy of Workmanship the magnificent Monastery of St. *Nicholas*, with its Temple, a place famous for several Reliques. Next the Jesuits Colledge, the Convent of the *Minorites*, and two of the *Dominicans*, the beautiful one of *Capuchins*, the Imperial Convent of the *Carmelites*, that of the Reformed *Minorites*, that of the Reformed *Augustines*, with several other Frieries, with an infinite number of Ancient and Modern Churches, Colleges, and other Publick Buildings, inhabited by about 23000 Souls, its Nobility many and ancient. Learning was here in its Glory; the Citizens were themselves Learned, and Lovers of Knowledge, assisted with the many Priviledges granted by the King. The University, where the Learned Laurel was confer'd on the worthy, made this place the *Sicilian Athens*. This once so famous, now unhappy *Catania*, had the greatest share in this Tragedy. Father *Antonio Serrovita*, who was to preach at *Catania* the Lent following, was on his way thither on the 11th, at 20 hours and  $\frac{1}{2}$ , and at the distance of a few Miles; he observed a black Cloud like Night hovering over the City; that there arose from the Mouth of *Montgibello* great Spires of Flame, which spread themselves all round, that the Sea all of a suddain began to roar, and raise it self in swelling Billows, that there was a very great and dreadful Blow, as if all the Artillery in the World had been at once discharged; that the Birds flew about astonish'd in the Air; that the Beasts and Cattle in the Fields ran crying about affrighted; that his and his Companions Horses were so startled, that they stood stock still, trembling so as they were forced to alight, which they had no sooner done, but they were lifted from the Ground above two Palms; and casting his Eyes toward *Catania*, he with Amazement saw no-

thing but a very thick Cloud of Dust in the Air. This was the Scene of their Calamity. For of the magnificent *Catania* there is not the least Foot-step to be seen. All its Edifices are levell'd with the Ground, except the Chappel of *St. Agatha*, the *Rotunda*, the Castle of *Ursino*, the Walls that encompass'd it, and a few mean Houses. There was a very great Destruction of the Inhabitants buried in the Ruines of the Bishop's Palace; the Steeple and *Dome*, where most of the City, frightned with *Friday's* Earthquake, were got together to carry the Reliques of *St. Agatha* in Procession. Many of the Nobility were saved under the Chappel of the Saint, and some of the Clergy. The number of the Dead was about 15000; for though the People had staid in the Fields all the *Saturday*, yet the Solemnity obliged them to be in the City on the *Sunday* to pay their Devotions, at the Procession. Of the *Benedictines* about 25 were killed in the Quire, of the *Jesuits* 21, of the *Conventuals* 11, the number of the *Dominicans* is not known; the *Carmelites* were all buried except one as they went in Procession; and so were the greater part of the other Religious Orders, and of the Nuns few were saved. This was the Tragedy of *Catania*, which was accompanied with dreadful Lightnings and Thunder from Heaven, with Deluges of Rain; and in the Ruines were heard nothing but Cries, Schrieches and dying Groans. On the Heaps of Stones we may now write, *Here was Catania*.

*Lentini*, a very ancient City, honoured with the Births of many Illustrious Persons; amongst the rest, that Father of Eloquence, *Georgio Leontino*, of a long time an Episcopal See, &c. felt that Shock on the 9th with such Violence, as threw down and ruined the greater part of its Buildings; amongst which was the ancient Convent of *Minorites*, famous for being the Dwelling-place of *St. Anthony of Padua*; the *Royal Convent*, so called from  
the

the Tomb of one of our Queens buried there, under the Ruines of which 4 Religious were buried, the rest escaped miraculously. But the last Earthquake on the 11th laid in the Dust the remainder of the City, with the Death of about 4000 People that returned thither after the first Shake to take care of their Goods. So that there is now but the Carcase of a City all shatter'd to pieces, not one House left standing.

*Carlentine*, a Modern City, being as a Citadel dependent on *Lentine*, had the same Fate. The beautiful Castle of *Licodia* all ruined, with the Marchioness of *Martini* and all her Children buried therein.

*Bizrini*, a City of rich Inhabitants, is level'd with the Ground, with the Death of many People; part by the first, and the rest by the last day's Earthquake.

*Sortino* and *Cassero* are quite demolish'd; in the first about 3000 perish'd, and in the other a very great number.

*Agosta*, a Trading Town, built on an Island in a large Bay, which makes a capacious Port, was all blown up into the Air; for besides the Damage of the Earthquake, there was a great quantity of Powder in the Castle that took Fire, and killed several of the Citizens that had escaped into the Fields with the Stones of the Buildings: Here perish'd about 3000. The enraged Sea grew terribly boisterous, and tempestuously beat against the Walls of the *Dominican* Convent with such Fury, that some Gallies belonging to the Knights of *Malta* scarcely escaped Shipwrack in the Port. In fine, *Luctus ubique pavor, & plurima mortis imago*. The Country of *Mililli* in the Dutchy of *Montalto*, felt the same Fate, with the Destruction of the Inhabitants.

*Syracusa*, famous in old time, an Episcopal See; in our time like the Phœnix arising from the Ashes, standing upon a Peninsula, by Art made an Island, having a Bridge to the main Land; strengthened with a Modern

Fortification, sufficiently populous by reason of its convenient Situation for Trade, full of Nobility, and beautify'd with Churches, Convents, Monasteries and Palaces, now mourns in Ruines. It was sensible of *Friday's*, but all shook to pieces by the *Sunday's* Earthquake, with the loss of many Thousand Persons. Most of the Nobility saved themselves by a timely Flight. Of the Religious not many perish'd. Scarce a Village in the whole Diocess is left: Confusion reigns every where; and the Misery is encreased by the want of Food, caused by the Granaries and Mills being destroyed.

*Laferla, Palazzuolo* and *Busceni* lie in Ruines, with many Inhabitants destroyed.

*Spacaformo*, a populous place, situated near the Sea, which washes the Foot of the Promontory *Pachino*, has lost all its Buildings: Here they reckon about 2000 dead.

*Giarratana* with its Fall killed most of the Inhabitants. The Marquess himself with his Wife and Three Children escaping on *Friday*, were on *Sunday* buried in the Ruines; the Marquess and his Children were taken out alive to bewail the loss of his Lady.

*Melitello* in the Valley of *Noto* is shaken to pieces, the Churches and chief Buildings even with the ground, and the Religious Orders all turned out in the open Air, or under Huts and Cabines.

*Occhiula* escaped not the common Calamity.

*Mineo*, an ancient City, is now no more; and the greater part of the Citizens and Religious.

*Caltagirone*, a City conspicuous for its Senate and Nobility, suffered in this universal Calamity the total Ruine of its proud Edifices: As the principal Church with its very high Steeple or Spire, the Famous Colledge of *St. Julian*, the Temple of *St. George*, the Parish-Church of *St. James*, admired for the Pictures of *Epiphanius*, the Chappel only remaining, with the Image and Reliques of the

the Saint. The Temple of the *Conventuals* thrown down, the famous Bridge that joyns the Convent to the Town shattered to pieces, and the Dormitories not to be inhabited ; the famous Convent of *St. Bonaventure*, the fall of whose Temple and Spire was the Destruction of the lower Buildings ; the Colledge of the *Jesuits*, and the Steeple of that Noble Church are quite ruined. The *Carmelites*, *Dominicans*, *Augustines*, *Crouched Friars*, &c. are all without Churches and Convents. The Monasteries of *St. Gregory*, *St. Chiara*, *St. Salvator* and *St. Stephen*, with a Conservatory of Orphans, are all shook down. In fine, the Senate-House, adorned with most curious Statues, and all the other Buildings, are either fallen, or threaten a sudden Ruine in these Desolations. About 1000 People were lost.

*Modica*, a populous place, and chief of the Seigniorie of the Admiral of *Castile*; has its Buildings and Famous Castle laid in the Dust. Seignior *Abbot Frederick* the Procurator General saved himself in the Colledge of the *Jesuits*, from whom we have the Account ; and that the Cities of *Ragusa*, *Scicli*, and *Chiaramonte* had the same Misfortune.

*Comiso* suffered much in its Buildings, though but few were killed. The Convent is down, but the Church stands.

*Noto*, an ancient and ingenious City, full of Nobility and fine Buildings, Convents and Monasteries, as we hear by a Courier from thence, is all ruin'd ; the Convents of the *Dominicans*, *Conventuals*, *Reformati*, *Carmelites*, and *Capuchins*, which was indeed a wondrous Fabrick, are all torn to pieces. The Church of the Crucifixion, the *Dome*, and all the Nunneries are down, with the Deaths of many Citizens and Nobles.

To conclude, there is not a Corner in all the Valley of *Noto* that is not ruined wholly, or for the most part, with a dreadful Slaughter of the People. The Southern Coasts, as *Licati*, *Terra Nova* and *Gircuti* have suffered Damage in their Buildings. And all the Castles of the Valley of *Emone* near *Mongibello* are crack'd and broken, or fallen down.

This is the Tragedy of *Sicilia*. His Excellency Seignior *Vicere* has given prudent and necessary Orders from *Palermo* for the Relief of the afflicted and miserable Remains of an amazed and half-dead People.

---

VIII. *An Extract of a Letter from Mr. Anth. Van. Leeuwenhoek, containing several Observations on the Texture of the Bones of Animals compared with that of Wood : On the Bark of Trees : On the little Scales found on the Cuticula, &c.*

**I** Some years since writ Mr. *Oldenburgh*, That I conceived the Bone to be constituted of Globules ; but finding my Mistake, I retracted that Opinion : For what I then took for Globules, was the tops of the Tubes or Cylinders whereof the Bone is composed.

Not satisfied with my Observations thereon, I continued my Endeavours to discover the true Texture of Bones ; and at length found plainly in the Thigh Bone of an Ox, that it consisted of four sorts or sizes of Tubes, whereof some are so very small and close united, as not easily to be discerned in a Bone cut a-cross, though  
with

with an extraordinary sharp Knife, nothing but Globules appearing : But when it is broken, some Shivers are separated, in which these *Tubuli* may be seen.

Another sort of these *Tubuli* (of which some are six times bigger than the other) are yet hard to be discovered ; for though the Knife be very sharp, yet by reason of the hardness of the Bone many Particles of them are broken and squeezed together, so as the Mouths of the little Tubes are closed up.

A Third sort much larger than the former, had nevertheless their Mouths scarce discoverable ; but I found them placed in such an Order, as convinced me, that the Ring of these *Tubuli* was the Augmentation of the Bone, as I had formerly discover'd it to be in Wood, especially when I saw, at a little distance, another Circle or Ring of *Tubuli*.

A Fourth sort exceeded the former very much, and were fewer ; so that in the space of three or four Sands I did scarce find one of them.

I have represented as well as was possible a small bit of an Oxes Thigh Bone, as it shew'd before my Glasses, *Fig. 6. ABCD*, the bit by the naked Eye was not bigger than the little Spot, *Fig. 7. EFG* is the Point of a small Needle on which the bit of Bone was stuck. I could not observe the first and least sort of *Tubuli* in this little bit ; for when the Bone is thus cut, the ends of the small Tubes are but confusedly to be seen, like irregular Globules. But the second sort look like little dark Specks, their Cavities being stopt, by cutting which are scarce to be discerned, especially if the Knife does not cut them at very true right Angles ; for if it be ever so little aslope, it is impossible to discover these Vessels. They are represented Letter *HHH*.

The third sort of *Tubuli* are shewn by Letter *III*, and there I found not only placed in Circles orderly, but likewise in a different manner, as the large Vessels are in Wood.

The fourth sort of Tubes large, in comparison of the rest, are represented by *KK*. *LM* are several cracks or clefts in the Bone caused by the Pressure of the Knife, especially if it be not very sharp.

Besides the above-mentioned four sorts of Tubes running the length-ways of the Bone, I sometimes imagin'd I saw some in a contrary Situation, which seem'd to proceed from the middle of the Bone, and terminate at the circumference; and that these were of two sizes, whereof the smaller were such as the above-mentioned least sort, that for the most part make up the length of the Bone. The Reason why I could not well discover these, was, from their being at a great distance from each other; and some seem'd as if perforated by those that run the length-ways. And though I could not be certain I saw these radiated *Tubuli*, yet I do not question their being there; and I suppose the *Periosteum* is mostly constituted and nourished by these; the rather, since we see the same in Trees, whose Bark is formed by the transverse Fibres that run from the Center passing between the direct ones. And as we cannot determin the beginning of the Bark in the Tree, because it is annually formed anew out of all the Horizontal Vessels; so I conceive that the Membranes surrounding the Bones have their encrease from some Vessels proceeding from the cavity of the Bone to the circumference, where they are dilated into that thin soft Skin defending the Bone as the Bark does the Tree.

I know many believe the Origine and Nourishment of the Bark is from the Root; but if it were so, we should find the parts of the Bark near the Root larger, and ramify'd into smaller and smaller as they run higher, as  
the

the Arteries and Nerves are, the further they go from the Heart and Brain ; whereas there is no difference between the Vessels of the Bark of the Root and Trunk : Besides, the Vessels of the Bark of several Trees, as the Birch, Cherry, Peach, &c. run not upwards as they do in the Ash, Oak, Elm, Nut, Apple, Pear, &c. but Circularly round the Superficies of the Tree. And all Bark whose Vessels run upwards, grows thicker as the Tree increases, the outside cracking grows Dead, and sticks to the young Bark underneath, which is the only living Part of the Bark. The contrary is evident in those Barks whose Vessels run round the Tree ; for as the Tree increases the Vessels not being able to Stretch nor Separate from each other, must necessarily break asunder ; so that the Old Bark is easily Separated and falls off from the New. Wherefore such Trees have always a very thin Bark, as is most evident in the Birch Tree.

And as we said of the Bark, that it is produced and nourisht from the Trunk of the Tree, so is it in the Production of the Skin of Animals, which is covered over with the Scarf-skin, consisting of Scaly Particles : For having examined the Skin of many Animals, it seemed to me to be formed by the wondrous interweaving of all the extremities of the Vessels that proceed to the extrem parts of the Body ; from the ends of which, a certain matter issues forth forming the Scales ; the extremities terminating at those Scales which so long stick fast to the Vessels, till new ones displace them ; and once in the Skin of a very Fat Dog, I found a great number of Fat-globules between the branches of the Vessels that constitute the Skin.

These Observations brought me to Examine again the Scales that cover our Bodies, to find if it were possible whether they were not formed after the same manner as those of Fishes : and indeed each Scale of our Body is composed of a great company of Vessels, interwoven

together after the same manner as the Scales of Fish. Provident Nature as I have often found, performing her Operations usually after the same Method.

I therefore applied my utmost endeavours, in this Examination of the Scales of our Body, and judged those of the Mouth to be the fittest for that purpose, for that they not being dryed are more easily separable from the Skin, and from each other: Examining these divers times, I still found a clear spot in the middle of them, standing up above the rest of the Scale (which I had observed before often, but thought it accidental) whence I concluded, that the Scales, not only of the Mouth but the whole Body, were composed as those of Fishes, of Vessels, proceeding to this clear Part, and nourishing the Scales which grow from thence.

Now as to the Transpiring Parts of our Bodies, I have formerly said the moisture was exhaled from the Vessels placed between the Scales; but now I find the number of the Vessels, far to exceed what I then thought, so that by the motion and heat of the Body, there may a very great quantity of sweat be expelled by so many Vessels; the number of which I endeavoured to Calculate, by laying some of the Scales of my Skin by some Sands, so to find their comparative magnitude, and found the Axis of some larger Sands, 20 times, of others 15, and of others 10 times bigger than the Diameter of a Scale: These Scales are placed in a triple order upon one another: I took therefore the least of them and thus computed: 250 Scales as aforesaid are covered by one Sand, suppose then every Scale to consist of 500 Vessels, then will the moisture in the space of a Sand be thrust out at 125000 several little Pores, not reckoning the mouths of the Vessels between the Scales.

Examining the Scales of the Skin of my Arm I found a spot in the midst of some of them, but not so distinctly as in those of my Mouth.

I cannot well omit (in this place, relating to Transpiration) what some time since happened to me; which was an extraordinary itching on the upper part of my Nose, which viewing with an enlarging Looking-glass, I found a whitish scurfy speck which I took off, but not without some pain, it stuck so firmly to the Skin; observing it with my Microscope, I found the reason of its Scurfiness, and of its sticking so fast; for this bit of the skin constituted of Scales, was thick beset with little *Conical Bodies*, caused as I judged by a more than ordinary expulsion of a thick *Matter* or *Pus* in this place, which not being able to pass through the Scales, much less through the Vessels of the Scales, had made several pits or dents in the Skin, and forceably raised and torn off the Scales from the Skin, both which had caused the Itching and made the white scurfy speck, some part of the true skin being separated: and the little pain that I felt was caused by the fast sticking of the *Conical Bodies* to the Skin, which in separating were torn there-from; but what seemed strange to me, was that in a Days time, and sometimes sooner, a new scurfy Particle was formed like the former, beset with the same pointed parts, and this 6 or 8 times one after another, as fast as I took them off. I have given the Figure of this little bit of Skin, having never observed the like where I might well expect it, *viz.* in Leprous Persons, whose Disease is a scurfy separation of the Skin.

*Fig. 8.* is the bit of Skin of the true size by the naked Eye. *Fig. 9.* *A B C D* the same magnified, in which the *Conical Bodies* formed out of the *Matter* or *Pus* are observable. *E* a little hole in the *Cuticula*, through which a small hair grew. The under side of the little bit of the *Cuticula* which stuck to the true Skin is here represented.

VIII. *A Proposal concerning the Parallax of the Fixed Stars, in Reference to the Earths Annual Orb. In several Letters of May the 2d, June 29. and July 20. 1693. from Dr. John Wallis to William Molineux Esq;*

S I R,

I Am obliged to you for two Books which you have been pleased to send me, that of your *Sciothericum Telescopicum*, and that of *Dioptricks*; which you have performed so well, that I have not been better satisfied with any that I have seen of that Subject. I should not so long have neglected to return my Thanks for them, but that I thought a Letter of bare Thanks to be too empty, unless I had somewhat else to send with it.

You will, I hope, give me leave (though I have not had the opportunity of being personally known to you) to suggest a Speculation, which hath been in my Thoughts these Forty Years or more; but I have not had the opportunity of reducing it to Practice, as being not so well stored with necessary Instruments of that kind, nor much exercised to Telescopick Observations. And though I have many Years since suggested it to others, yet neither have they had leisure or convenience of putting it in Practice.

It is concerning the Parallax of the fixed Stars, as to the Earths Annual Orb.

*Galileo* complains of it a great while since (in his *Sy-  
stema Cosmicum*) as a thing not attempted to be observed

ved with such diligence as he could wish, and I doubt we have the same cause of complaining still. I know that Dr. *Hook* and Mr. *Flamsteed* have attempted somewhat that way, but have desisted before they came to any thing of Certainty. What hath been done to that purpose abroad I know not.

*Galileo* hath suggested divers things considerable in order to it.

As to the times of Observation; That it should be when the Sun or Earth are in the Tropicks, or as near thereto as may be: Because at those times, if any, will be the greatest difference observable in their Meridional Altitude.

As to the Stars to be observed, That they should be such as are as near as may be to the Pole of the Ecliptick: For such as are in the Plain of the Ecliptick, or near unto it, though they may be sometime nearer, sometime farther from us, (which might somewhat alter their apparant Magnitude, if it were so much as to be observable) yet it would little or nothing alter the Parallax Angle, as *Galileo* doth there demonstrate.

He notes also, that in a business so nice, the ordinary Instruments of Observation (though pretty large) would be insufficient (he doubts) for this purpose, and doth propose, that by the side of some Edifice or Mountain, at some miles distance, the setting of some noted Star (as that of *Lucida Lyræ*) might be observed at those different times of the Year, which might be equivalent to an Instrument whose Radius were so large.

Which were a good Expedient if Practicable; but I doubt the Density of our Atmosphere is so great, as that it will be hard to discern a Star just at the Horizon, or even within some few Degrees of it: And that the Refraction would be there so great, and so uncertain, as not to comply with so curious an Observation.

That

That which occurred to my Thoughts upon these Considerations, was to this purpose; That some Circumpolar Stars (nearer to the Pole of the Equator than is our Zenith, and not far from the Pole of the Zodiac) should be made choice of for this purpose. And in case the Meridional Altitude be discernably different at different times, so will also be their utmost East and West Azimuth, which may be better observed than their Rising or Setting: And this will be not obnoxious to the Refraction, as is the Meridional Altitude; (for though the Refraction do affect the Altitude, yet not the Azimuth at all); and we may here have choice of Stars for the purpose; which in Observations from the bottom of a Well we cannot have; being there confined to those only which pass very near our Zenith, though very small Stars.

I would then take it for granted, as a thing at least very probable, that the Fixed Stars are not all (as was wont to be supposed) at the same distance from us; but the distance of some, vastly greater than of others; and consequently, though as to the more remote, the Parallax may be undiscernable; it may perhaps be discernable in those that are nearer to us.

And those we may reasonably guess (though we are not sure of it) to be nearest to us, which to us do appear biggest and brightest, as are those of the First and Second Magnitude; and there are at least of the Second Magnitude, pretty many not far from the Pole of the Ecliptick, (as that in particular, in the Shoulder of the lesser Bear): And in case we fail in one, we may try again and again on some other; which may chance to be nearer to us than what we try first. And Stars of this bigness may be discerned by a moderate Telescope, even in the day-time; especially when we know just where to look for them.

The manner of Observation I conceive, may be thus: Having first pitched upon the Star we mean to observe, and having then considered (which is not hard to do) where such Star is to be seen in its greatest East or West Azimuth; it may be then convenient to fix (very firm and steadily on some Tower, Steeple, or other high Edifice (in a convenient situation) a good Telescopic Object-glass in such position, as may be proper for viewing that Star. And at a due distance from it near the Ground, build on purpose (if already there be not any) some little Stone Wall, or like place, on which to fix the Eye-glass, so as to answer that Object-glass: And having so adjusted it, as through both to see that Star in its desired Station, (which may best be done while the Star is to be seen by Night in such situation, near the time of one of the Solstices), let it be there fixed so firmly, as not to be disturbed, (and the place so secured, as that none come to disorder it), and care be taken so to defend both the Glasses, as not to be endangered by Wind and Weather. In which contrivance I am beholden to Mr. *John Caswel* M. A. of *Hart-hall* in *Oxford*, for his Advice and Assistance; with whom I have many Years since, communicated the whole matter.

This Glass being once fixed (and a Micrometer fitted to it, so as to have its Threds perpendicular to the Horizon, to avoid any inconvenience which might arise from diversity of Refraction if any be) the Star may then be viewed from time to time (for the following Year or longer) to see if any change of Azimuth can be observed.

This I thought fit to recommend to your Consideration, who do so well understand Telescopes, and the managery of them; not knowing any who is more likely to reduce it to Practice. If you shall think fit to give yourself the trouble of attempting the Experiment, and that it succeed well, it will be a noble Observation, and worth  
the

the Labour : And, if it should miscarry, the charge I hope would not be great.

But when I suggest (as a convenient Star for this purpose) the shoulder of the lesser Bear (as being the nearest to the Pole of the Zodiack of any Star that is of the first or second Magnitude), I do not confine you to that Star ; but (without retracting that) suggest another ; namely, the middle Star, in the Tail of the Great Bear, which (though somewhat farther from the Pole of the Zodiack) is a Brighter Star than the other, and may be nearer to us.

But I do it principally upon this Consideration: namely, That there is adhering to it a very small Star, (which the *Arabs* call *Alcor*, of which they have a Proverbial saying, when they would describe a sharp-sighted Man ; That he can *discern the Rider on the middle Horse of the Way*; and of one who pretends to see small things but over-look much greater ; *Vidit Alcor at non Lunam plenam*): Which *Hevelius* in his Observations, finds to be distant from it about 9 Minutes, and 5 or 10 Seconds : So that besides the advantage of discovering the Parallax of the greater Star, if discernable. The difference of Parallax of that and of the lesser Star (being both within the reach of a Micrometer) may do our Work as well. For if that of the greater Star be discernable, but that of the lesser be either not discernable, or less discernable. Their different distances from each other at different times of the Year, may, perhaps (without farther *Apparatus*) be discerned by a good Telescope of a competent length, furnished with a Micrometer, if carefully preserved from being disordered in the Intervals of the Observations ; and discover at once, both, that there is a Parallax ; and that the Fixed Stars are at different distances from us, wherein, that I be not mistaken, my meaning is not, that the Instrument or Micrometer should be removed for the observing of the lesser Star ; but that (when the Azi-  
muth

azimuth of the greater Star is taken) by a Micrometer (consisting of divers fine Threads parallel and transverse) may (at the same time) be observed the Distance of the two Stars, each from other, in that Position (both being at once within the reach of the Micrometer;) which distance (the Instrument remaining unmoved) if it be found (at different times of the Year) not to be the same; this will prove, that there is a *different* Parallax of these two Stars.

This latter part of the Observation (of their different distances at different times) I suggest, as more easily practicable though not so nice as the former. For it may be done, I think, without any further *Apparatus* there than a good Telescope, of ordinary form, furnished with a Micrometer, (this being carefully kept unvaried during the Interval of these Observations.) And if this part only of the Observation (without the other) be pursued; it matters not though the two Observations (near the two Solstices) be, one at the Eastern, the other at the Western Azimuth (whereby both may be taken in the Night-time,) for the distance must (at both Azimuths) be the same, if after observing the Azimuth of the greater Star it be necessary to move the Micrometer for measuring its distance from Alcor that may be done another Night (and it is not necessary to be done at one Observation) for that distance cannot be discernably varied in a Night or two.

I shall give you no farther trouble at present, but subscribe my self, Sir,

*Yours, &c.*

## IX. An Account of a BOOK.

*Synopsis Methodica Animalium Quadrupedum & Serpentinae Generis Auth. Joanne Raio, S.R.S.*

THE Excellent Author of this *Synopsis* of Quadrupeds and Serpents, continues to oblige the World with fresh and frequent Specimens, not only of his great Penetration in discovering, but of his particular Sagacity in ranging and digesting the vast Body of *Nature* in most proper Classes and Orders; whereby the Memory is extremely assisted, and the Beauty of

the Creation illustrated. Of this the Worthy Author has already been pleas'd to publish very conspicuous Proofs in the Histories of Plants, Birds, Fishes, and perhaps may do more in Insects.

The Design of this present Work, intended for a Manual or Pocket-Book, is to reduce all Quadrupeds into the most proper and natural Method, for the more easie Comprehension and Memory of them; and to add to the several *Species* such short Characterick Notes, as whereby they may be certainly known and distinguished from others of the same kind.

First of all, there is propos'd the most exact division of all Animals in general, which is first into *Sanguineous* and *Exanguious*. Under the *Exanguious*, or such as want that red Liquor we call *Blood*, are comprehended, 1. All *crustaceous* Fishes, *Crabs*, *Lobsters*, *Shrimps*, 2. All *Testaceous* or Shell-Fishes, as *Cockles*, *Mussels*, *Oysters*, *Scallops*, *Periwinkles*, *Whilks*, &c. as also all Land Shell-Snails, 3. Those they call *Mollia*, or Soft-fishes, as *Pulps*, *Cuttle-fishes*, *naked Snails*, &c. 4. Insects of all sorts.

The Sanguineous kind are divided into such as breath by *Lungs*, and such as breath by *Gills*, of which kind are all Sanguineous Fishes except the *Whale-kind*. Such as breath by *Lungs* are divided into those that have but *one Ventricle* in the Heart, and such as have *two Ventricles*. Of the former kind are those they call *Oviparous Quadrupeds* and *Serpents*.

The latter are again subdivided into *Viviparous*, or such as bring forth living Young, and *Oviparous*, or such as lay Eggs, which are Birds or feathered Foul.

Lastly, The *Viviparous* are divided into *Aquatic*, or the *Whale-kind* and *Terrestrial* (under which the Author comprehends the *Amphibious*) or *Quadrupeds*; although all *viviparous* Animals of this kind are not Four-footed, there being one exception, *viz.* The *Manati* or *Sea-cow*, which hath but two Feet. But all of them without exception are hairy, and so may be distinguished from the *Whale-kind*; all of which have a smooth Skin.

Then follows a Division and Table of *Viviparous Quadrupeds* or *Viviparous hairy* Animals: which are either *hoof'd* or *claw'd*.

The *hoof'd* are either *whole-footed*, or *whole-hoof'd*, as the *Horse* and *Ass*; or *clowen-footed*. The *Clowen-hoof'd* are either *Bisulc*, such as have the Hoof divided into *two* parts, as the *Ox*, *Sheep* and *Goat*, or *Quadrifulc*, which have the Hoof divided into *four*. The former are either *Ruminant*, such as chew the

the Cud; or *Non-Ruminant*, viz. The *Hog-kind*. The *Ruminant* are divided in respect of their Horns, of which there are three Kinds. 1. The *Beef-kind*, which have four Teats. 2. The *Sheep-kind* which bear Wool, have but two Teats, and wreathed Horns. 3. The *Goat-kind* which have streighter Horns, and are covered with Hair instead of Wool; and such as have *solid, branched and deciduous* Horns, as the *Deer-kind*. The *Claw'd*, have the Foot divided either into *two* Claws, viz. the *Camel-kind*, or into *more*, called therefore *Multifidous*.

The *Multifidous* are divided into such as have broad Nails, and a humane Shape, as *Apes* and *Monkeys*, and such as have narrower and pointed Nails.

These latter in respect of their *Teeth* are divided into such as have *many fore Teeth* or *Cutters* in each Jaw; and such as have but *two*, all which last are *Herbivorous* or *Phytivorous* Animals, and from the most known Creature of this Tribe called the *Hare-kind*.

Those that have *more fore Teeth* or *Cutters* are distinguished into *greater*, which have either a *shorter Snout*, and round or square Head; or a *longer Snout* and Head: These from their likeness to the most known Animals of each kind, the *Cat* and the *Dog*, we call the former the *Cat-kind*, and the latter the *Dog-kind*: To the *Cat-kind* belong the *Lion, Tyger, Leopard, Ounce, &c.* to the *Dog-kind* belong the *Wolf, Fox, Badger, Otter, &c.* and *lesser*, which from their long slender Bodies, like to the *Weasel*, we call the *Vermineous* or *Weezel-kind*.

To the *Cat-kind* are referred some anomalous Animals, viz. The *Bat*, and the *American* Creature called *Ai* or *Sloth*. To the *Dog-kind* from their having a longer Snout are referred; The *Urchin* or *Hedge-hog*; the *Tatou* or *Armadillo*, the *Mole*, the *Shrew-mouse* or *Erd*, i. e. *Earth-shrew*, the *Tamandua* or *Ant-bear*; which hath no Teeth at all.

Then are briefly described the several Species of all these kinds in order: and to some of them large Anatomical Descriptions and Observations added. As first of the *Uterus* of a pregnant Sow, wherein the Adhesion of the *Chorion* to the *Uterus* round about is shown; and notice taken, I. Of the two large diaphanous Bladders, one at each end of the *Tunica Allantoides*, into which is a Passage out of the *Allantoides*, so that the Liquor contained therein may easily be impelled into the Bladders, and out of the Bladders back again into the *Allan-*

*toides*, 2. Of the great quantity of Water contained in the *Allantoides*, more by far than the Urine of so small an Animal in so short a time can likely amount to, and inquiry made into the Original and Use of it. Its likely part of it may be separated from the Blood, and excerned into the Cavity of the Tunicles by certain little Glandules, which the Author observed disseminated all over the *Chorion*. The *Tubæ uterinæ* or *Fallopianæ* in this Creature are described; and shewn to be when extended at least 9 Inches long. They do manifestly perforate the *Cornua uteri*, so that a Style or Probe may easily be thrust either upward out of the *Uterus* into the *Tubæ*, or downward out of the *Tubæ* into the *Cornua uteri*, without resistance or the impediment of any Valve.

Secondly, Dr. *Tyson's* Description of the *Tajacu* or *American Musk-hog*, recorded in the *Philosophical Transactions*, Numb. 153. is inserted at large, wherein are many curious Remarks, which I shall not mention, because I suppose they are well known; having been so lately published in these Papers.

Thirdly, An Anatomical Description of the *Elephant* by the Learned and Ingenious Dr. *Moulins*, which also having by the Author been published in *English*, I shall for the Reason fore-mentioned, forbear to set down Particulars.

Fourthly, *Excerpta* out of the Description of the *Ape* set forth by *Parisian* Academists, wherein the Differences between the internal and external Parts of the *Ape* and *Man* are observed and noted.

It is especially remarked, that though the Muscles of the *Os hyoides*, or Tongue-bone, the Tongue, the *Larynx*, and *Pharynx*, which especially serve for the Articulation of the Voice, be in *Apes* altogether like to those of a *Man*, at least much more than the Muscles of the Hands, which the *Ape* uses almost as perfectly as *Man* himself to all purposes; yet is the *Ape* deprived of Speech. Whence it is clear, that Speech is an Action peculiar to *Mankind*, by which he is more distinguished from Brutes; than by the use of the Hand: neither doth it necessarily follow, that natural Agents do perform such and such Actions, because they are furnished with Organs proper for the Performance of them.

Lastly,

*Lastly*, Such *Sanguineous* Creatures as breath by Lungs, and have but one Ventricle in their Hearts are enumerated and described. They are of four kinds, 1. *Frogs*, 2. *Tortoises*, 3. *Lizards*, 4. *Serpents*: Concerning each of which there are curious Anatomical Observations added: But especially a large Description of the outward and inward parts of the *Rattle-snake*, composed by the fore-mentioned Learned Person Dr. *Tyson*, and published in these Transactions, *Numb.* 144. the Particulars whereof I shall therefore omit.

Before this *Synopsis* is premised some Discourses concerning Animals in general.

As *First*, Whether they are meer Machines, or have any Sense and Perception, that is, whether they reflect upon, and are conscious of what they do or suffer. The Affirmative whereof seems most probable to the Author.

*Secondly*, Concerning the Generation of Animals there are Three Questions discussed. 1. Whether there be any Spontaneous or Equivocal Generation? The Author's Opinion is, That there is no such thing, but that all Animals, even the vilest Insects, are generated by Animal Parents of their own kind. 2. Whether all Individuals of every Species of Animals, that ever were or shall be, were at first created by God, or whether there are every day new ones produced by Generation? The Author is inclinable to their Opinion that hold all were at first created, but not confident of it. Seeing neither Man nor any other Creature is capable of forming such an Engine as an Animal Body; and since all Females have in them from their first Formation the Seeds of all the Individuals they shall during their whole Life bring forth, it is clear they have no power of producing new ones; and a strong Presumption, that all that have been or shall be were at first created. 3. Whether the Seeds of Animals, or rather the primordial Animalcules are lodged in the Egg of the Female, or in the Sperm of the Male. The Author is of the former Opinion, for many Reasons which may be seen in the Book.

*Thirdly*,

Thirdly, The Distinction of Animals into *Viviparous* and *Oviparous* is considered; and it is shewn, that if the Word *Viviparous* signifies according to the Etymology of it, such as bring forth live Young, then Animals of the same *Genus* may be some *Viviparous* and some *Oviparous*: So for Example, Some Serpents, as the *Adder*, are *Viviparous*, and some, as the common *Snake*, *Oviparous*: But if the Word *Viviparous* signifies such Animals as continually afford Nourishment to the *Fetus* during gestation from the Womb it self: And *Oviparous* such as either lay Eggs, or produce perfect Eggs, that is such as contain all the Nourishment of the *Fetus* till it be excluded, though they retain such Eggs in the Womb till exclusion, affording them only warmth and harbour; then the distinction may be of good use; and as well such Serpents and Lizards as hatch their Eggs in their own Bodies, as those that lay them in a Dunghil, or other warm place to be cherished and hatch'd by the Heat of the Sun, may be called *Oviparous*.

For the more easie and clear Comprehension and Distinction of the several Kinds of Animals, Mr. *Ray* gives two *Schemes* or *Tables* of them: The first a General one of all Animals; the second a Particular one of *Quadrupeds*.

Animals are either

*Sanguineous*, that is such as have Blood, which breath either by

*Lungs*, \* having either

*Two Ventricles in their Hearts*; \*\* and those either

*Viviparous*,

*Aquatic*, as the Whale-kind

*Terrestrial*, as Quadrupeds, or in general all hairy Animals.

*Oviparous*, as Birds, which have immoveable and perforated Lungs.

But *one Ventricle in their Hearts*, as Frogs, Tortoises, Serpents.

*Gills*, as all Sanguineous Fishes except the Whale kind.

*Exanguinous*, or without Blood, which may be divided into

*The Greater*, either

*Naked*

*Terrestrial*, as Naked Snails

*Aquatic*, as the Poulp or Pour-control, *Polypus*; the

Cuttle-fish, *Sepia*; The Sleeve or Ink-fish *Lolligo*

*Covered*, with a Tegument either

*Crustaceous*, as Lobsters and Crab-fish.

*Testaceous*, whether *Univalve* as Limpets, or *Bivalve*,

as Oysters, Muscles, Cockles; or turbinate, as Periwinkles, Snails, &c.

*The lesser*, as Insects of all sorts.

\* Gills and Lungs differ in that Gills are but as it were inverted Lungs: The Air being drawn inwardly into the Lungs, whereas it only outwardly touches or slides by the Gills.

\*\* Animals that have two Ventricles in their Hearts use a frequent and constant inspiration and expiration, taking in and breathing out the Air. But those that have but one Ventricle use no such frequent inspiration and expiration; but receive in and retain the Air a considerable time in their Lungs before they breath it out again.

## A T A B L E of Viviparous hairy Animals or Quadrupeds.

Viviparous Quadrupeds or Viviparous hairy Animals are either

Hoof'd, which are either

{ Whole-footed or hoof'd, as the Horse and Ass.

{ Cloven-footed, having the Hoof divided into

{ Two principal parts, called Bisulca, either

{ Such as chew not the Cud; as all sorts of Swine

{ Ruminant, or such as chew the Cud, divided into

{ Such as have perpetual and hollow Horns, of which there are

{ three Kinds, viz. 1. The Beef-kind. 2. The Sheep-kind.

{ 3. The Goat-kind.

{ Such as have solid, branched and deciduous Horns; as the

{ Deer-kind.

{ Four parts, which we call Quadrifulca; as the Rhinocerot and Hippopotamus.

{ Clawed, or Digitata, having the Foot divided into

{ Two parts or Toes, having two Nails, as the Camel-kind.

{ Many Toes or Claws; either

{ Undivided, sticking all together, covered with a common Skin, the tips of the Toes only peeping out or appearing outwardly, and being covered with Nails, as the Elephant.

{ Divided from each other a good way down, which have either

{ Broad Nails and an Humane Shape, as Apes and Monkeys.

{ Narrower and more pointed Nails; in which in respect of their

{ Teeth are divided into such as have

{ Many fore Teeth or Cutters in each Jaw, either

{ The greater, which have

{ A shorter Snout and rounder Head, which we call the Cat-kind.

{ A longer Snout and Head, which we call the Dog-kind

{ The lesser, with a long slender Body, and shorter Legs, which we call the Vermine or Weazel-kind.

{ Only two large and remarkable fore Teeth, all which are Phytivorous. These we call the Hare-kind.

For all which, and the many subordinate Species under each Genus; together with short Histories of them, the Book it self must be consulted.

L O N D O N :

Printed for S. Smith and B. Walford, Printers to the  
Royal Society, at the Princes Arms in St. Paul's  
Church-yard, 1693.

1851. 11. 23.

1851

1851

1851



BRITISH MUSEUM  
NATURAL HISTORY

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

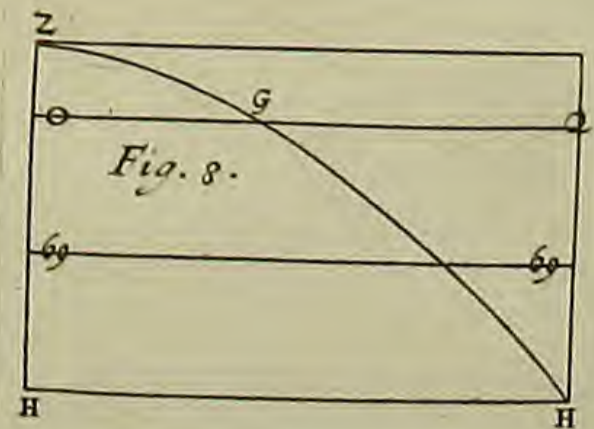
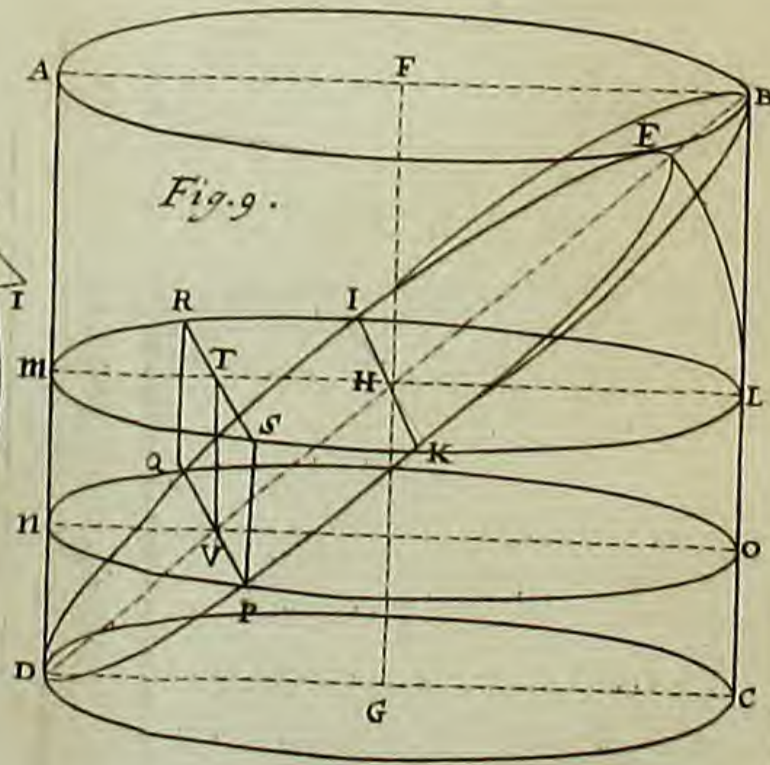
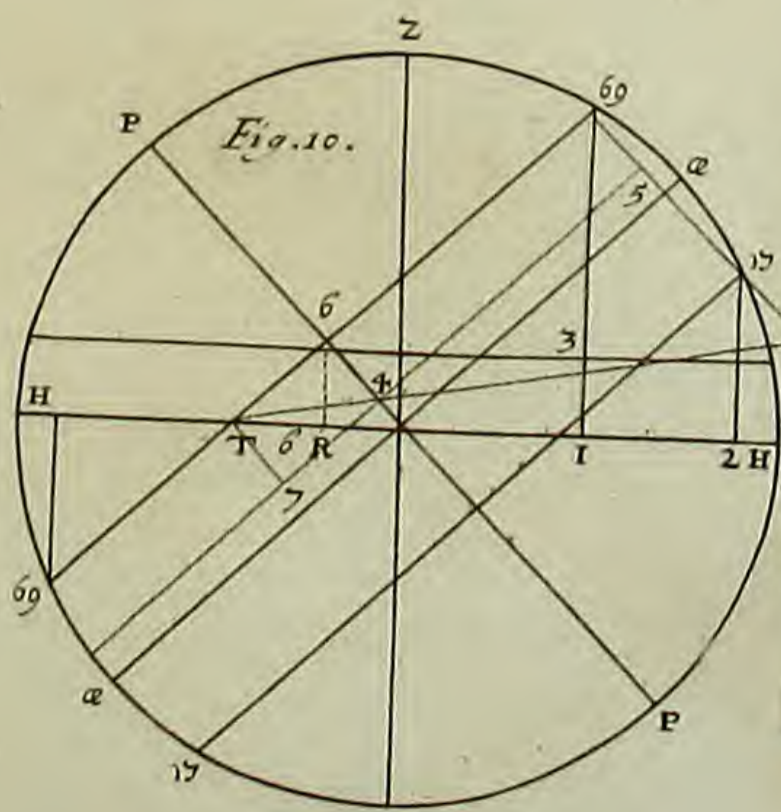
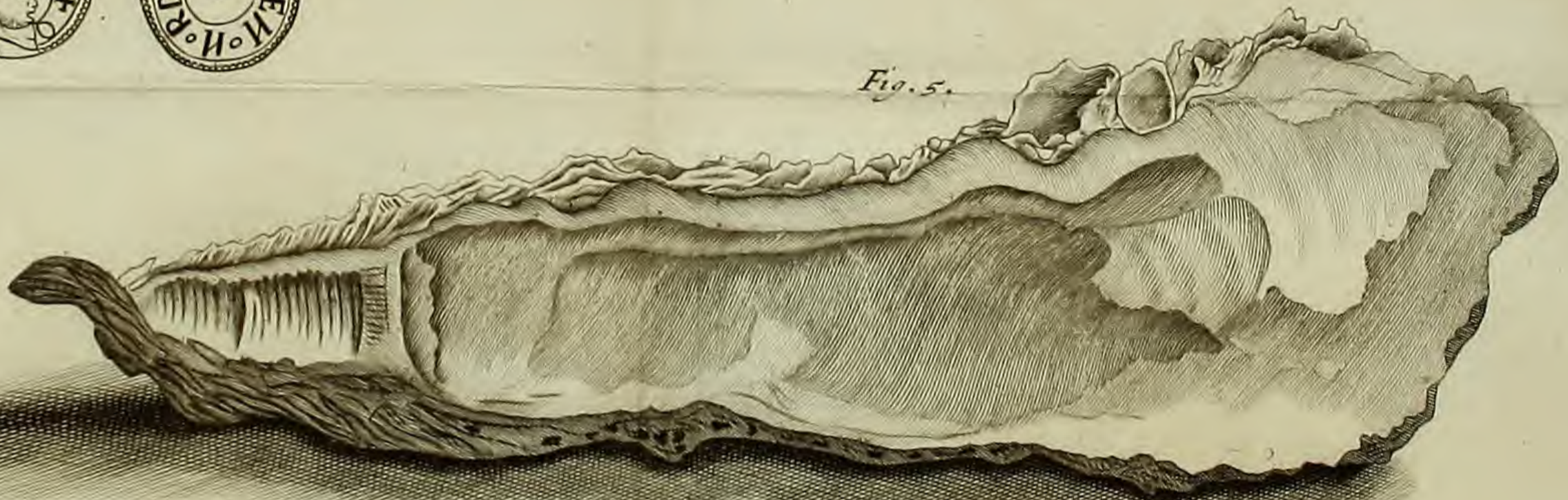
Fig. 7.



Fig. 6.

UYA O O D Y J J J 2  
O E 3 3 T V 8 2 O W I

Fig. 5.



---



---

# PHILOSOPHICAL TRANSACTIONS.

---

For the Month of September, 1693.

---

I. **T**HE Extract of a Letter, giving an Account of a prodigious Storm of Hail of an extraordinary bigness in Lille, in May, 1686. II. *Observatio Eclipsis Solaris Bononiæ habita die 12. Julij, Anno 1684. à Cl.V. D<sup>no</sup>. Dominico Gulielmino.* III. Several Observations and Experiments on the Animalcula in Pepper-Water, &c. By Sir Edm. King, M.D. and S.R.S. IV. The manner of making of Steel, and its Temper; with a Guess at the way the Ancients used to Steel their Picks, for cutting or hewing of Porphyry. By Martin Lister, M.D. and S.R.S. V. The Description of certain Shell-fish found in the East-Indies, extracted out of a Letter from Mr. Witzén to Dr. Lister, who communicated it to the Publisher, with some Notes of his own thereon. VI. A Paper of Mr. Flowers, containing some unknown ancient Characters, with Remarks thereon. By Francis Alton, Esq; S. R. S. VII. A Letter from Mr. Samuel Dale, giving a farther Account of some Coins found some time since at Honedon in Suffolk. VIII. Part of a Letter from Mr. T. M. in Salop to Mr. William Baxter, concerning the strange Effects from the eating of Dog-Mercury, with Observations thereon. By Hans Sloane, M. D. and S. R. S. IX. A Discourse concerning the Proportional Heat of the Sun in all Latitudes, with the Method of collecting the same, as it was read before the Royal Society in one of their late Meetings. By Edm. Halley X. Accounts of Books. XI. *Diogenes Laertius Græcè & Latine cum Commentariis integris Doctorum Viatorum. Amstelodami, apud Hen. Westenium, in 4to. 1692.*  
 2. Considerations on a Book Entitled, The Theory of the  
 T t Earth

Earth. *Publiff'd some Years since by the Learned Dr. Burnet. Writ-  
ten by John Beaumont, jun. Gent. in 4to. 1693. Lond. 3. Epi-  
stola ad Regiam Societatem Londinensem qua de nuperis Ter-  
ræ-motibus differitur, &c. in 4to. Lond. 1693. 4. Traité des  
moyens de rendre les Riviers navigables, &c. a Paris, in 8°.  
1693.*

I. *The Extract of a Letter from Lisle in Flan-  
ders, May 25. N.S. 1686. giving an Account  
of an unusual Storm of Hail which fell there.*

— **T** Here fell in this City Hail of so great a bigness,  
that the least exceeded Pigeons Eggs. Several  
of them were weighed, and were some a quarter of a Pound,  
others of a Pound Weight and more. One among the rest  
was observed to contain a dark brown matter in the middle  
thereof; and being thrown into the Fire, it gave a very great  
Report. Others were transparent, which melted before the  
Fire immediately. This Storm passed over the Cittadel and  
Town, and left not a whole Glas in the Windows on the  
windward side. The Trees were broken, and some beat  
down, and the Partridges and Hares killed in abundance.

II. *Observatio Solaris Eclipsis habita Die 12. Ju-  
lii, 1684. Bononiæ, à Cl. V. Dono. Dominico  
Gulielmino.*

**D** Esumberant Solis à Vertice Distantias D. D. *Jo. Ludovicus  
Donellus & Nicolaus Ignatius Joannettus;* Phasibus deter-  
minandis tres aderamus, D.D. *Jo. Galeatus Mauzius, Hercules  
Vanottus & Ego.* Observationes scribebat *D. Gregorius Malisar-  
dus;* horas vero in horologio notabat *D. Bartolomæus Ferra-  
rius.*

Horæ horologii  
automati p. m.  
Diei 12.

Horæ eruta  
ex distanti-  
is observatis  
centri solis à  
Vertice.

Distantiæ  
Centri so-  
lis à Verti-  
ce.

Phases.

Hor. 3. 20. 00.  
3. 34.

Eclipsis apparente so-  
le inter nubes. Quan-  
titas obscurationis. dig.  
2. 30.

3. 37. 30.

dig. 3.

3. 48. 14.

3. 47. 47.

gr. 51. 31.

dig. 4. 20. dubia ubiq;

3. 52. 00.

dig. 5. optima.

3. 57. 00.

3. 56. 2.

gr. 52. 58.

dig. 5. 30.

4. 2. 00.

4. 2. 29.

gr. 54. 10.

dig. 6.

4. 4. 45.

4. 5. 59.

gr. 54. 44.

dig. 6. 30. optima.

4. 9. 20.

4. 9. 1.

gr. 55. 17.

dig. 7. exacta.

4. 14. 40.

4. 15. 43.

gr. 56. 28.

dig. 7.

4. 19. 00.

dig. 7. 20. dubia.

4. 27. 44.

4. 28. 42.

gr. 58. 39.

dig. 7. 20.

4. 32. 35.

4. 34. 20.

dig. 7. satis exacta.

4. 34. 20.

dig. 6. 45.

4. 44. 30.

dig. 6. 30.

4. 47. 15.

dig. 6. 30.

4. 51. 30.

dig. 6. optima.

4. 54. 38.

4. 53. 53.

gr. 63. 16.

dig. 5. 30. exacta.

4. 58. 2.

4. 57. 38.

gr. 63. 56.

dig. 5. exacta.

5. 1. 55.

5. 1. 2.

gr. 64. 32.

dig. 4. 30. satis exacta.

5. 4. 40.

5. 5. 28.

gr. 65. 19.

dig. 4. diligens ubiq;

5. 7. 0.

5. 6. 23.

gr. 65. 28.

dig. 3. 30. exacta.

5. 10. 30.

5. 9. 9.

gr. 65. 58.

dig. 3. exacta.

5. 12. 35.

5. 13. 28.

gr. 66. 43.

dig. 2. 30. satis exacta.

5. 16. 15.

5. 16. 14.

gr. 67. 13.

dig. 2. exacta.

5. 19. 50.

5. 20. 24.

gr. 67. 57.

dig. 1. 30. exacta.

5. 22. 30.

5. 23. 21.

gr. 68. 28.

dig. 1. exacta.

5. 25. 0.

5. 25. 14.

gr. 68. 48.

dig. 0. 30. diligens.

5. 27. 40.

5. 28. 7.

gr. 69. 18.

dig. 0. accuratissima.

Circa

Circa observationes ab initio Eclipsis usque ad medium circiter, eas quidem præter unam, aut alteram, omnis erroris expertes esse non ausim affirmare; intercurrentibus enim identidem nubibus Solis species nonnihil minor & pallidior reddebatur, unde non omnimoda certitudo promitti potest. A medio autem Eclipsis ad finem usque cum nullis nubibus Sol impediretur, observationes certiores sunt & diligentius habitæ.

Notabile fuit; cum quantitas Eclipsis fuerit dig. 7. 20. quod non modicam aëris offuscationem debebat inducere, ut aliàs multoties in consimilibus defectibus observatum est; nihilominus tamen vix sensibiliter consuetum in sole libero aëris statum mutatum fuisse; unde plurimis solem non respicientibus orta suspicio, aut solem non defecisse, aut minimum quidem; cujus quidem rei non alia mihi videtur assignanda causa, quàm ingens vis nubium à Sole maxime illuminatarum, quæ non multum ab eo distabant; ab his enim solis radius per reflexionem, & refractionem multiplicatus certè intensior redditus deficientem aliundè splendorem potuit compensare: sic aliquando videmus præsertim occidente Sole nubes adeo illuminatas esse, ut post ejus etiam occasum, vividissimam lucem effundant, quinimo etiam umbras non semel projiciant.

1750	1751	1752	1753	1754	1755	1756	1757	1758	1759
1760	1761	1762	1763	1764	1765	1766	1767	1768	1769
1770	1771	1772	1773	1774	1775	1776	1777	1778	1779
1780	1781	1782	1783	1784	1785	1786	1787	1788	1789
1790	1791	1792	1793	1794	1795	1796	1797	1798	1799
1800	1801	1802	1803	1804	1805	1806	1807	1808	1809
1810	1811	1812	1813	1814	1815	1816	1817	1818	1819
1820	1821	1822	1823	1824	1825	1826	1827	1828	1829
1830	1831	1832	1833	1834	1835	1836	1837	1838	1839
1840	1841	1842	1843	1844	1845	1846	1847	1848	1849
1850	1851	1852	1853	1854	1855	1856	1857	1858	1859
1860	1861	1862	1863	1864	1865	1866	1867	1868	1869
1870	1871	1872	1873	1874	1875	1876	1877	1878	1879
1880	1881	1882	1883	1884	1885	1886	1887	1888	1889
1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
1900	1901	1902	1903	1904	1905	1906	1907	1908	1909

III. Sc.

III. *Several Observations and Experiments on the Animalcula, in Pepper-Water, &c. By Sir Edm. King, M. D. and S. R. S.*

S I R,

U Pon reading some Abstracts of Mr. *Leeuwenboek's* Letters in the late Philosophical Transactions, I called to mind some Microscopical Experiments that I made too, concerning *Animalcula*, which I do not remember, have been publickly taken notice of; therefore in Obedience to your Commands, I have faithfully transcrib'd them, such as they are, being certainly true, as to matter of fact.

1. First, having steep't Oates in Rain-water, some days (perhaps 9. or 10.) and looking upon it with my bare Eye, I saw a Substance, that seem'd to me like that usually call'd a Mother (on other Liquors) and laying as much of it as a small Pin's head upon the Object Plate of my best Microscope, I could very easily and plainly discern 7 or 8 sorts of *Animalcula*, of different sizes and shapes (or more) swimming in this Substance, which was Liquid enough, for them to perform very nimble and brisk Motions in, which was very pleasant to observe: Their shapes and sizes were after this manner, as near as I could guess.

Vide  
Fig. 1.

They were all very nimble in their Motions, by computation, several Thousand times magnifi'd.

2. The thin Scum upon Pepper-water, that did resemble Flakes of Salt, upon some sorts of Human Urine, apply'd in the same manner to the Object Plate of the Microscope, was only Clusters of *Animalcula*, that had Liquid Matter enough to Swim in, and I was in admiration at their Numbers, Motions, Variety and Minuteness.

\* *Vide*  
Fig. 2.

3. In a Decoction of Herbs, that was strain'd, and set by for a particular Use : In a little of the settling of that (as much as a Pin's-head) I saw Créatures like little Eeles, about thus long \*, and seem'd to be as thick, but much sharper at both ends, with a wriggling Motion, like Eels.

4. I observe these small Creatures above-mentioned (if I may so call them) resemble the Nature of Fish, in several respects.

First, They'll flock together, and lye close together, as if they were in shoals, like Carps in a Pond, that has been so shallow, as I have often seen, sometimes in one place, and sometimes in another, but when disturb'd, they are, as to your sight, all dispers'd and lost in a trice ; and so are these little Creatures in their Original Liquor, if you shake the Liquor before you look to find them in shoals, or after : At least I am sure I did, and could never find any in that parcel of Liquor, till next day, or till they did associate again.

Secondly, They will follow their Liquor, to act in, to the last Particle of it, till they have no more to swim in, and then will seem to struggle for want on't, till their Strength fails them, and then after a minute, or less, they will seem dead upon the Object Plate, (when the watry Parts are dry'd away).

Thirdly, They will lye as if they were dead, near half an Hour, or more, then put a little Water to them, in half a minute they will begin to move themselves again, and by degrees, begin to swim faintly and feebly at first, (as Fish will do,) and then recovering their strength again, will perform their brisk Motions as vigorous as ever.

Fourthly, Those that are almost dead will look flat, as if prest thin, but when they move, turn themselves over and over, without any regular Motion ; so that you might see them as thin, as the thinnest Spangle  
you.

you ever saw, and like it in shapes; and they will continue so, so long as they are faint and sick; but within about an hours time, they will grow plump and well again, if you add fresh Liquor to them in time.

These *Animalcula* choose, for the most part, the top of the Liquor; I suppose for the sake of the Air.

If you perceive them lye dead upon the Object Plate, as I did, and do not remember to add Water to revive them, within an hour, they will be dead indeed: But you may see them in the posture you left them, many days after, as I did; and shewed others the same sight.

Now to give a farther Testimony, That they are *Animalcula*, which some doubt; I have noted the following Observations, for the sake of those that disbelieve Microscopical Experiments: But they may as well deny the use of Spectacles so well known.

If you take a fine Needle, and put the point into Spirit of *Vitriol*, (tho' you can see none of the Spirit with your bare Eye upon its Point, when you take it out, yet if you prick the same point of that Needle into the middle of that drop no bigger than a small Pin's-head, when some Hundreds of these *Animalcula* are swimming, very nimbly frisking about, you shall immediately see (as I did) these minute Creatures (if I may so call them) presently affected from the Acid Particles, so as to spread themselves, and tumble down seemingly dead\*. \* Vide Fig. 3.

If you dissolve Salt, and with the point of the same Needle, repeat the Experiment (in the same manner) in some of the same Liquor that contains some of the same parcel of *Animalcula*, you shall see the Creatures afore-mentioned, be affected too, stop in their Motion, but in another manner quite; not spread flat, as those with Spirit of *Vitriol* did, but shrink long and round, in Form and Figure of that we call (whole Oat-meal, or) an Excorticated Oat.

And whereas the first with the Spirit fell down flat without turning; these, as soon as affected, turn round and round, when they begin to be sick, and wobble, as we say, before they fall down to the bottom and die; unless you quickly recover them with fresh Water, and then you will perceive them get a new Life by degrees.

*Tincture of Salt of Tartar* put into them in the same manner, kills them more immediately; but yet they will be first so sick, or so affected, call it what you please, as you may see by a surprising Convulsive Motion, they will grow Faint and Languid apace; as you may see them fall to the bottom of the Drop upon your Object Plate dead, but in their own Shape, (which I wondred at) that they were in before you apply'd your Needle, and will neither be flat as with Spirit of *Vitriol*; nor cylindrical, as with common Salt Liquor; but lie dead in the same Shape, as before you put in your Needle with the *Salt of Tartar*.

*Inks* kill them as soon as Spirit of *Vitriol*, but makes them seem to shrink divers ways; I suppose by the Solution of Copper which is in its Composition.

*Blood* (newly prest from a Prick purposely made in your Finger) kills them almost as soon as Spirit of *Vitriol*; by reason, (I suppose) of the Salt therein; But it's a fine and surprising sight, to observe them swimming and bustling, first amongst the Globbules of the Blood jostling one another, like Fish that are suddenly depriv'd of Water, and bustle together amongst Mud; for so they appear'd to me: And I could think of no better a Comparison then, and I thought my Glasses as good as any Bodies, except some I have heard of Mr. *Leeuwenhoek*, that I never saw.

*Urine* kills them too, in a little time, tho' not so soon.

*Sugar.*

*Sugar* dissolved like *Salt* kills them also, if used in the same manner, and with that some dye flat, and some dye round.

*Sack* will kill them, but not so speedily as the other Liquors. If I had had time, I might have set down many more Observations of this kind, to shew the Sensibility of these, and such like *Animalcula*.

---

IV. *The manner of making Steel, and its Temper; with a Guess at the way the Ancients used to Steel their Picks, for the cutting or hewing of Porphyry. Communicated by Martin Lister, M. D. and S. R. S.*

I N the Philosophical Transactions, Numb. 93. p. 6015. amongst other Desiderata's and Queries, are these: *To endeavour to retrieve the Art of Hardning and Tempering of Steel, for cutting of Porphyry, &c.* We know not which way to rough-hew Stones of that untractable hardness.

Those famous and stupendious Monuments of Antiquity, the *Ægyptian* Obelisks are of *Porphyry*, and most of them curiously Carved with a vast number of Figures, one way of Writing of the Ancient *Ægyptians*: These Witness the Facility that Nation had of graving in *Porphyry*; a Stone which no Tool will now touch, nor nothing less affect, than *Emery* or *Diamant Powder*.

Mr. *Ray* assures us, That all the Obelisks of *Rome*, that are Graven with Hieroglyphicks, are of one and the same kind of Stone, viz. a Marble of a mingled Colour, Red and White, very hard, and hath not in so many Ages suffered the least by the Weather.

Something there is certainly lost in this Age, as to the manner of *Steeling of Tools*: I should be glad, if by any Conjecture of mine, I could help to extricate and retrieve it.

To this Purpose, let us first see what Steel it self is, and how made: and then we shall best guess at the applying of it, in the making of Tools.

As for the moderns, there is great abuse in this Manufacture, and the Processes now used by most Nations, are fraudulent, and a poisoning of Iron, by certain Mineral Salts, rather than a true making of Steel.

The most Ancient Account, is that which is given us by *Aristotle, Meteorologicor. l. 4. c. 6.* which yet is very obscure and imperfect. The Passage is this; *Wrought Iron it self may be cast so, as to be made Liquid, and to harden again. And they are wont to make Steel thus: For the Scoria of Iron subsides, and is purged off by the bottom. And when it hath been often defæcated and made clean, this is Steel. But this they do not often, because of the much wast, and for that it looses much Weight in fining. But Iron is so much the more excellent, the less Excrement it hath. Thus far Aristotle.*

This Account is a little confused, and not well understood: It is indeed true, That Iron is still better, the more it is purged. So in our Furnaces in *England*; those Bars which are wrought out of a Loop, taken up out of the Finney Harth, or second Forage, are much better Iron than those which are made in the Bloomary or first Harth, because those are more purged of the Dross, and accordingly give double Price.

Also, it is as true, that even wrought Iron may be melted as oft as you please.

Again, Iron, as oft as it is melted and purged, looseth much of its Weight. But after all, Iron of it self, how oft soever it is purged and refined, it will never become  
Steel;

Steel; yet of this so purged, the best Steel doubtless may be made.

And this is the most favourable Construction that I can make of this Passage of *Aristotle*.

In the next place, we shall give you the best account how *true Steel* is made at this Day, waving all fraudulent processes. The manner is this, faithfully described by *Agricola* (*de re Metallica, lib. 9.*) And to confirm to you the Antiquity of it; this way of making Steel is by *Kircher* said to be now in use in the Island of *Ilva*, a place famous from all Ages, even from the times of the *Romans*, for that Metal alone, down to our Days.

‘ Make choice of Iron which is apt to melt, and yet  
 ‘ hard, and yet which may easily be wrought with the  
 ‘ Hammer: For although Iron, which is made of Vitri-  
 ‘ olick Ore, may melt, yet it is soft, or fragil, or eager.  
 ‘ Let a Parcel of such Iron be heated red hot, and let  
 ‘ it be cut into small Pieces, and then be mixt with that  
 ‘ sort of Stone which easily melts; then set in the Smiths  
 ‘ Forge or Harth, a Crucible, or Dish of Crucible Metal,  
 ‘ a Foot and a half broad, and a Foot deep; fill the Dish  
 ‘ with good Charcoal, and compass the Dish about with  
 ‘ loose Stones, which may keep in the Mixture of Stone,  
 ‘ and Pieces of Iron put thereon.

‘ As soon as the Coal is throughly kindled, and the  
 ‘ Dish is red hot, give the Blast, and let the Workman  
 ‘ put on, by little and little, all the Mixture of Iron and  
 ‘ Stone he purposes.

‘ When it is melted, let him thrust into the middle of  
 ‘ it 3 or 4, or more Pieces of Iron, and boil them there-  
 ‘ in 5 or six Hours, with a sharp Fire; and putting in  
 ‘ his Rod, stir often the melted Iron, that the Pieces of  
 ‘ Iron may imbibe the smaller Particles of the melted Iron,  
 ‘ which Particles consume and thin the more gross Parti-  
 ‘ cles of the Iron Pieces; and are, as it were, a Ferment  
 ‘ to them, and make them tender.

‘ Lett

‘ Let the Workman now take one of the Pieces out of  
 ‘ the Fire, and put it under the great Hammer to be  
 ‘ drawn out into Bars, and wrought, and then hot as it is,  
 ‘ forthwith plunge it into cold Water.

‘ Thus Tempered, let him again Work it upon the  
 ‘ Anvil and break it; and looking upon the Fragments,  
 ‘ let him consider whether it look like Iron in any part  
 ‘ of it, or be wholly condensed, and turned into Steel.

‘ Then let the Pieces be all wrought into Bars; which  
 ‘ done, give a fresh Blast to the Mixture, adding a little  
 ‘ fresh Matter to it, in the room of that which had been  
 ‘ drunk up by the Pieces of Iron; which will refresh and  
 ‘ strengthen the remainder, and make yet purer, the Pieces  
 ‘ of Iron again put into the Dish: every which Piece, let  
 ‘ him as soon as it is red hot, beat into a Bar upon the An-  
 ‘ vil, and cast it hot as it is into cold Water. And thus I-  
 ‘ ron is made into Steel; which is much harder and whiter  
 ‘ than Iron.

Being now certain what Steel is, and how it is to be distinguished and differs from Iron. In the last place, we will consider, if yet any thing can be found in the Ancients, which may hint to us any defect in our Tools, and how that may be remedied.

There is but one place that I know of to this purpose, which may give us any sight in our Enquiry; and that is in *Pliny*, (*lib. 34. c. 14.*) where speaking of Iron, he says, *Fornacum maxima differentia est: in iis equidem Nucleus ferri excoquitur ad indurandum aliter, alioque modo ad densandas incudes malleorumve rostra.*

From this Passage it should seem, that the Ancients had one way to make Steel, and another way to harden or temper their Tools, particularly such as Picks and Anvils.

Also it is plain, That *Nucleus Ferri* was melted down in both.

Again

Again, the difference was in the Furnaces, that is, in the manner of ordering of the Iron to be made into Steel, or for the superlative hardning of the Heads and Bitts of Tools, and not in the Matter of which they were made; for both was done by excocting them in molten Iron.

I suppose none will doubt, but by *Nucleus Ferri*, must be meant well purged Iron; the same which *Aristotle* calls *εργασμένον σίδηρον*: For why else should he tell us that Wrought Iron it self may be made Liquid, so as to harden again; that is, according to our Phrase, cast again into Sow-metal, if it was not to explain to us the manner of making of Steel; which yet plainly is his design. It remains then, that we shew the different manner or use of this Liquid Iron; and we have no other light in this matter, but what two different Phrases afford us, *viz. ad indurandam Aciem*, and that of *ad densandos incudes malleorumve rostra*.

The first difference then, in my Opinion, is to be understood, of making Steel Bairlic; which they did probably after the Precept above delivered; that is, not only boil the Iron in its own Sow-metal, or Liquid Iron, but hammer it also, and after quench it in cold Water.

And this Opinion those other Words of *Pliny* in the next Chapter favour, *Ferum accensum igni, nisi duretur ictibus, corrumpitur*: And again, *aquarum summa differentia est, cui subinde candens immergitur*. And this way was sufficient for Sword-Blades, and Knives, Razours, &c.

The other difference is in the Steeling their Tools: that is, they boiled their Tools in Sow-metal, to such a degree of Hardness or Temper, as was requisite, and did not afterwards hammer them. And this seems to be implied in the Phrase *Densare*, for indeed, altho' it generally be said, that Iron is purged and refined for

the making of Steel, yet according to the last and truest Process, the matter is plainly otherwise; for Iron this way made into Steel, becomes a kind of *Electrum*, and is filled with an exceeding brittle and hard Body of its own Nature; Iron being spongy and not close; for which purpose the refore, the Word *densare* is by *Pliny* aptly and elegantly used. And this way was used when the strongest temper and hardness was required; as to Picks and Anvils.

There might be divers reasons given for this last usage; as first, that there is far greater ease in working Iron, than Steel into any Figure, that being far softer and more ductible and loose.

Again, it is certain, and the Ancients in the passage last quoted do testify as much, that Iron by ignition is spoilt or corrupted, so that the oftner it is purged, tho' it were Steel it would the more relent. Whence knowing well, that in making their Tools out of Steel, they could not but considerably loose it and abate of their temper; they therefore first shaped them, and then gave them a strong Body of Steel and Temper together, and so had nothing else to do but to finish them on the Grindstone and Hone, to set the point or edge.

V. *The Descriptions of certain Shells found in the East Indies, Communicated by Mr. Witzen to Dr. Lister, and by him to the Publisher, with some Remarks of his own.*

S I R,

I Here sent you inclosed an Account of certain Shells and their Figures, which I received from Mr. *Witzen*, formerly Ambassadour here from the States of *Holland*, and

and also well known to the Learned World by his excellent Map of *Tartary*.

Translated from the *French*. He Writes thus :

‘ There are found on the Coasts of *Malabar* and *Ceylon*, certain Cockles or Shells in *Dutch* called *Kouk-borens*.  
 ‘ These Shells contain a Fish that lives in the bottom of the Sea, fixt to the Body of the Shell, and at a certain Season of the Year, they cast their Seed which produces a sort of *Matrix* of the size of the Figure<sup>\*</sup>; this *Vid Fig.*  
 ‘ long Body which is wrinckled like an *Andouille* or *Sausf*.  
 ‘ *age* is filled with a great number of round Celles, which  
 ‘ are so many *Matrices*, each producing its little shell-fish; which quit not their cells till they are grown to  
 ‘ such a bigness and maturity, as their weight breaks them  
 ‘ off and loosens them from their cells, and so from their  
 ‘ common *Matrix*, which remains fastned to the bottom  
 ‘ of the Sea by the great end, the other end moving about freely in the water, which is flexible every way  
 ‘ like an *Andouille*. This *Matrix* the *Hollanders* call  
 ‘ *Swambalk*.

‘ It is observable that this *Matrix* has a kind of back-part and Belly, the Back is something like that of a  
 ‘ *Sckelvis* and of a greyish colour, the Belly is whiter, and is that part which is filled with the cells from one  
 ‘ end to the other: the Skin which covers it is very like that of Stock-fish or other dried Fish.

‘ *Figure the 5th*, Is a shell found in the River of *Goa*, which holds a sort of Oyster. It is very scarce and  
 ‘ in the *Indies* as well as here the shell powdered is esteemed a good Medicine.

S I R,

His last Figure is of an Oyster-shell, the like is to be found in the *West Indies*, whether the same species I cannot determine, having never seen them intire together to compare them. But Sir, considering the hint that is here given us, of its being thought Medicinal at *Goa* where it is found; and also how that calcined Shells are the most common entertainment all over the *Indies*, chewing them all day long with the Leaves of a certain hot piperate and spicy Plant and a sort of Nut mixt therewith: we may reasonably suspect the *Goa Stone* to be made up of them, or such like Ingredients.

Tours, &amp;c.

---

VI. *A Paper of Mr. Flowers, containing some unknown Ancient Characters, with Remarks thereon by Francis Aston Esq; S. R. S.*

These Characters being Two and Twenty in Number, are all that could be distinctly Collected out of the Ancient Sculptures, to be found this day extant at the admired Hills of *Canary*; where there are divers receptacles cut out of the main Rock, by incredible Industry and Charge of the Ancient Inhabitants of those Parts supposed *Moors* or *Negroes* of *Ethiopia* rather than *Gentues*; by reason of the large proportion of their usual Statures, which is at least Eight Foot in height, having great Lips, full Eyes, flat Nose and curled Hair, and is worthy the Observation. So far Mr. *Flower* Feb. 3. 167<sup>z</sup>.

Its

Its probable the intent of this Paper was to compare these Characters, being very Ancient with them at *Persopolis*, the Gentlemen having got together (as appears) several other Alphabets that had been used in the *Eastern* parts of the World.

The places here pointed at, are chiefly three, two upon the Island *Salsete*, and one upon the Island *Pory*, called the *Pagode* of *Olifant* of such a bigness that one of them is described by *Linschoten* to be equal to a Village of 400 Houses, to consist of Four Ranges of Building one over another within the Mountain; and to contain no less than 300 Rooms or Habitations; adorned throughout with strange frightful Statues, of Idols, of Lyons, Tigers, Elephants, Amazons, and a hundred other things so well designed, that *Andrea Corsali* in the Year 1515 had a mind to send some of them to *Julian de Medices* for their Curiosity, who were the Architects is very uncertain. *Balbi* names the *Romans* and *Alexander* the Great, others the *Chineses*, Mr. *Flower* the *Abessins* who have some few Churches cut in the Rocks; but *Alvarez* who saw them twice, says the Country affirms they were made by *Ægyptians* or other white Men; but though their beginning be obscure, their end may more easily be declared, for the *Portugueses* upon the building of *Goa* began to destroy them, and have continued to do so ever since.

VII. *A Letter from Mr. Samuel Dale, giving a further Account of some Coins found at Honedon in Suffolk.*

S I R,

**Y**OU may Remember that in one of the Philosophical Transactions of your Honourable Society; Published in the Year 1687 viz. N 189, an Account was given of some *Saxon* Coins found at *Honedon* in *Suffolk*, of which I have seen divers pieces, tho' I do not remember that the Sexton of the Parish who found them, told me of any Pot that they were found in; but only that digging in the Church-yard deeper then ordinary, he chanced to strike with his Pickax just among the Mony, and beat it about the Grave, at which being Affrighted, he got out as fast as he could, and called one of his Neighbours, who coming to the Grave, soon perceived what they were, and jumping in began to pick them up; whereupon the Sexton took Courage and jumped into the Grave also, and got up into his Hat what he could, Earth and all, which might be between 200 or 300 peices, some of which were Green by lying in the Ground, as Sir P. S. who communicated that aforesaid Account; very well observed the Novelty of the thing and rarity of the Mony, soon procured the Sexton Chapmen enough to purchase all his Mony, and among others it was my good hap also to procure some few; Three of which I think are not published by that aforesaid Worthy Gentleman, and therefore herewith send you their exact description, hoping they will not be unacceptable to you, which is all at present from

*Tours &c.*

*Vid. Fig.*

7.

VIII. *Part of a Letter from Mr. T. M. in Salop, to Mr. William Baxter, concerning the strange effects from the eating Dog-mercury with Remarks thereon by Hans Sloan M. D. and S. R. S.*

— **W**. *Matthews*, his Wife and Three Children, have been lately very ill, and like to dye; the occasion and manner of their Sickness was very odd, and therefore I shall give you a particular account of both. About Three Weeks ago, the Woman went into the Fields and gathered some Herbs, and (having first Boyled them) Fryed them with Bacon for her own and her Families Supper: After they had been about Two Hours in Bed, one of the Children (which is Dumb and about Seven Years Old) fell very Sick, and so did the other Two presently after; which obliged the Man and his Wife to Rise and take the Children to the Fire, where they Vomited and Purged, and within half an Hour fell fast asleep. They took the Children to bed as they were asleep, and they themselves went to bed too, and fell faster asleep too than ever they had done before. The Man waked the next Morning about Three Hours after his usual Time, went to his Labour at Mr. *Newports*, and so by the strength of his constitution carried it off; but he says, he thought his Chin had bin all the Day in a Fire, and was forced to keep his Hat full of Water by him all the Day long, and frequently dipt his Chin in it as he was at his Work. The Woman wakened a while after her Husband, and being forced to it, got up to look after her little Family concerns; but she was very Sick and has continued so till within these few Days, since which she is very well recovered. One of their Children slept from that Night (which was Thursday Three Weeks) til

till Monday Evening following; and then (having just only opened her Eyes and made Two Sprunts, without speaking one word) dyed immediately while she was asleep; endeavours were used to awaken her, but in vain. The other Two Children slept about Twenty Four Hours, and upon their wakening fell a Vomiting and Purging again, which I think saved their Lives. By Mr. *Newports* and my Direction, they sent some of the same Herb to the Doctors and Apothecaries in *Salop*, who generally say 'tis *Dog-mercury*, but some say 'tis a sort of Night shade: whatever it be, 'tis certainly Poisonous, and 'tis observed that the Cattle never browse it. *Matthews* told me he never eat so pleasant an Herb in his Life; and his Wife says that her old Master, *viz.* Mr. *Moxon* did frequently eat of it; but I guess it to be a mistake. I know your profound Judgment and Learning in these matters, and have therefore given you t his large Account. I am no herbarist, but this I observed of the Herb; 'tis branched and seeded something like *Spinage* or *Mercury*, but leaved rather like *Lakweed*. The leaves are dented too.

*Tours,*

*T. M.*

*S I R,*

**T**H E enclosed Letter was sent last *April*, to Mr. *William Baxter*, who soon after did me the Favour to shew it me; I found the operations of the Plant therein mentioned to be extraordinary, and the Circumstances related very particularly, and that the account was the

the more Surprizing if it should be *Dog-mercury*; which by all Writers I have perused, is reckoned innocent and to have the same Vertue with the ordinary Mercury used every day by Phisitians. On these Considerations I begg'd the Favour of Mr. *Baxter*, that he would please to write to the Gentleman who sent the Account, for a Dried Sample or Specimen of the Herb; which he did, and it proves to be the same they thought it was, the Stalks, Leaves and Spikes agreeing exactly in every thing with those of *Dog-Mercury*. It is describ'd and figur'd in several Authors. Mr. *Ray* in his History of Plants calls it *Mercurialis Perennis repens Cynocrambe dicta*, p.163. Gerard calls it *Cynocrambe*, p. 333. *Parkinson*, *Mercurialis Sylvestris Cynocrambe dicta vulgaris*, p. 295. *Theatr. Botan. Johan. Bauhine* in his Second Tome, *Lib. 23. Cynocrambe mas & fœmina sive Mercurialis repens*, p.979. And *Caspar Bauhine* in his *Pinax*, p.122. *Mercurialis Montana testiculata & spicata*: In which Books the other Names given it by other *Herbalists* may be found, whither I refer you for a further Account of it. Whether the Quantity or Quality of this were the Cause of the Effects I know not, but think that every Body will do well to be cautious and wary in the use of it in such Quantities, after such a Warning.

*Tours, &c.*

IX. *A Discourse concerning the Proportional Heat of the Sun in all Latitudes, with the Method of collecting the same, as it was read before the Royal Society in one of their late Meetings.*  
By E. Halley.

**T**Here having lately arisen some Discourse about that part of the Heat of Weather, simply produced by the Action of the Sun; and I having affirmed, that if that were considered, as the only Cause of the Heat of the Weather, I saw no reason, but that under the Pole the solstitial Day ought to be as hot as it is under the Equinoctial, when the Sun comes vertical, or over the Zenith: for this reason, that for all the 24 Hours of that Day under the Pole, the Sun's Beams are inclined to the Horizon, with an Angle of  $23\frac{1}{2}$  degrees; and under the Equinoctial, though he come vertical, yet he shines no more then 12 Hours, and is again 12 Hours absent, and that for 3 Hours 8 Min. of that 12 Hours he is not so much elevated as under the Pole; so that he is not 9 of the whole 24 higher than 'tis there, and is 15 Hours lower. Now the simple Action of the Sun is, as all other Impulses or Stroaks, more or less forceable, according to the *Sinus* of the Angle of Incidence, or to the Perpendicular let fall on the Plain, whence the Vertical Ray (being that of the greatest Heat) being put *Radius*, the force of the Sun on the Horizontal Surface of the Earth will be to that, as the *Sinus* of the Sun's Altitude at any other time. This being allowed for true, it will then follow, that the time of the continuance of the Sun's shining being taken for a *Basis*, and the *Sines* of the Sun's Altitudes erected thereon as Perpen-

Perpendiculars, and a Curve drawn through the Extremities of those Perpendiculars, the *Area* comprehended shall be proportionate to the Collection of the Heat of all the Beams of the Sun in that space of time. Hence it will follow, that under the Pole the Collection of all the Heat of a tropical Day, is proportionate to a Rectangle of the *Sine* of  $23\frac{1}{2}$  gr. into 24 Hours or the Circumference of a Circle; that is, the *Sine* of  $23\frac{1}{2}$  gr. being nearly 4 tenths of Radius; as  $\frac{8}{10}$  into 12 Hours. Or the Polar Heat is equal to that of the Sun continuing 12 Hours above the Horizon, at 53 gr. height, than which the Sun is not 5 Hours more elevated under the Equinoctial.

But that this matter may be the better understood, I have exemplified it by a Scheme (*Fig. 8.*) wherein the *Area*  $ZGHH$ , is equal to the *Area* of all the *Sines* of the Sun's Altitude under the Equinoctial, erected on the respective Hours from Sun-rise to the Zenith; and the *Area*  $\textcircled{S}HH\textcircled{S}$  is in the same proportion to the Heat for the same 6 Hours under the Pole on the Tropical Day; and  $\textcircled{O}HHQ$ , is proportional to the collected Heat of 12 Hours, or half a Day under the Pole, which space  $\textcircled{O}HHQ$  is visibly greater than the other *Area*  $HZGH$ , by as much as the *Area*  $HGQ$  is greater than the *Area*  $ZG\textcircled{O}$ ; which, that it is so, is visible to sight, by a great excess; and so much in proportion does the Heat of the 24 Hours Sun shine under the Pole, exceed that of the twelve Hours under the Equinoctial: whence *Cæteris paribus*, it is reasonable to conclude, that were the Sun perpetually under the Tropick, the Pole would be at least as warm, as it is now under the Line it self.

But whereas the Nature of Heat is to remain in the Subject, after the Cause that heated is removed, and particularly in the Air; under the Equinoctial the twelve Hours absence of the Sun does very little still the Motion

tion impress'd by the past Action of his Rays wherein Heat consists, before he arise again: But under the Pole the long absence of the ☉ for 6 Months, wherein the extremity of Cold does obtain, has so chill'd the Air, that it is as it were frozen, and cannot, before the Sun has got far towards it, be any way sensible of his presence, his Beams being obstructed by thick Clouds, and perpetual Foggs and Mists, and by that *Atmosphere of Cold*, as the late Honourable Mr. *Boyle* was pleas'd to term it, proceeding from the everlasting Ice, which in immense Quantities does chill the neighbouring Air, and which the too soon retreat of the Sun leaves unthawed, to encrease again, during the long Winter that follows this short Interval of Summer. But the differing Degrees of Heat and Cold in differing Places, depend in a great measure upon the Accidents of the Neighbourhood of high Mountains, whose height exceedingly chills the Air brought by the Winds over them; and of the nature of the Soyle, which variously retains the Heat, particularly the Sandy, which in *Africa*, *Arabia*, and generally where such Sandy Desarts are found, do make the Heat of the Summer incredible to those that have not felt it.

In prosecution of this first Thought, I have solv'd the Problem generally, *viz.* to give the proportional degree of Heat or the sum of all the *Sines* of the Sun's Altitude, while he is above the Horizon in any oblique Sphere, by reducing it to the finding of the Curve Surface of a Cylindrick Hoof, or of a given part thereof.

Now this Problem is not of that difficulty as appears at first sight, for in *Fig. 9.* let the Cylinder ABCD be cut obliquely with the Ellipse BKDI, and by the centre thereof H, describe the Circle IKLM; I say, the Curve Surface IKLB is equal to the Rectangle of IK and BL, or of HK and 2 BL or BC: And if there be supposed another Circle, as NQPO, cutting the said Ellipse in the  
points

points P, Q; draw PS, QR, parallel to the Cylinders  
Axe, till they meet with the aforesaid Circle IKLM in  
the points R, S, and draw the Lines RTS, QVP bisected  
in T and V. I say again, that the Curve Surface RMS-  
QDP is equal to the Rectangle of BL or MD and RS,  
or of 2 BL or AD and ST or VP; and the Curve Sur-  
face QNPD is equal to  $RS \times MD$  — the Arch RMS  $\times$   
SP, or the Arch MS  $\times$  2 SP: or it is equal to the Sur-  
face RMSQDP, subtracting the Surface RMSQNP. So  
likewise the Curve Surface QBPO is equal to the sum of  
the Surface RMSQDP or  $RS \times MD$ , and of the Sur-  
face RESQOP or the Arch LS  $\times$  2 SP.

This is most easily demonstrated from the considera-  
tion, That the Cylindrick Surface IKLB is to the inscrib-  
ed Spherical Surface IKLE, either in the whole or in its  
Analogous Parts, as the tangent BL is to the Arch EL,  
and from the Demonstrations of *Archimedes de Sphæra*  
& *Cylindro, Lib. 1. prop. xxx. and xxxvii. xxxlix.*  
which I shall not repeat here, but leave the Reader the  
pleasure of examining it himself; nor will it be amiss to  
consult *Dr. Barrows's Learned Lectures* on that Book,  
Published at *London, An. 1684, viz. Probl. ix.* and the  
Corollaries thereof.

Now to reduce our Case of the Sum of all the *Sines*  
of the Suns Altitude in a given Declination and Latitude  
to the aforesaid Problem, let us consider *Fig. 10.* which is  
the *Analemma* projected on the Plain of the *Meridian*,  
Z the Zenith, P the Pole, HH the Horizon,  $\alpha \alpha$  the E-  
quinoctial,  $\mathcal{S} \mathcal{S}$ ,  $\mathcal{V} \mathcal{V}$  the two Tropicks,  $\mathcal{S}I$  the *Sine*  
of the Meridian Altitude in  $\mathcal{S}$ ; and equal thereto, but  
perpendicular to the Tropick, erect  $\mathcal{S}I$ , and draw the  
Line  $T I$  intersecting the Horizon in T, and the hour  
Circle of 6, in the Point 4, and 6 4 shall be equal to  
 $6R$ , or to the *Sine* of the Altitude at 6: and the like for any  
other Point in the Tropick, erecting a Perpendicular  
thereat, terminated by the Line  $T I$ : Through the Point 4  
draw

draw the Line 4 5 7 parallel to the Tropick, and representing a Circle equal thereto ; then shall the Tropick  $\mathcal{S} \mathcal{S}$  in *Fig. 10.* answer to the Circle NOPQ, in *Fig. 9.* the Circle 4 5 7 shall answer the Circle IKLM, T 4 I shall answer to the Elliptick Segment QIBKP, 6 R or 6 4 shall answer to SP, and 5 I to BL, and the Arch  $\mathcal{S} \mathcal{T}$ , to the Arch LS, being the semidiurnal Arch in that Latitude and Declination ; the *Sine* whereof, though not expressible in *Fig. 10.* must be conceived as Analogous to the Line TS or UP in *Fig. 9.*

The Relation between these two Figures being well understood, it will follow from what precedes, That, *the Sum of the Sines of the Meridian Altitudes of the Sun in the two Tropicks, (and the like for any two opposite Parallels) being multiplied by the Sine of the semidiurnal Arch, will give an Area analogous to the Curve Surface R MSQDP ; and thereto adding in Summer, or subtracting in Winter, the product of the length of the semidiurnal Arch, (taken according to Van Ceulen's Numbers) into the difference of the above-said Sines of Meridian Altitude : the Sum in one case, and difference in the other shall be as the Aggregate of all the Sines of the Sun's Altitude, during his appearance above the Horizon ; and consequently of all his Heat or Action on the Plain of the Horizon in the proposed Day.* And this may also be extended to the parts of the same Day ; for if the above-said Sum of the *Sines* of the Meridian Altitudes, be multiplied by half the Sum of the *Sines* of the Sun's horary distance from Noon, when the Times are before and after Noon ; or by half their difference, when both are on the same side of the Meridian ; and thereto in Summer, or therefrom in Winter, be added or subtracted the product of half the Arch answerable to the proposed Interval of Time, into the difference of the *Sines* of Meridian Altitudes, the sum in one case, and difference

rence in the other, shall be proportional to all the Action of the Sun during that space of time.

I foresee it will be objected, that I take the *Radius* of my Circle on which I erect my Perpendiculars always the same, whereas the *Parallels* of Declination are unequal; but to this I answer, that our said circular Bases ought not to be Analogous to the *Parallels*, but to the *Times* of Revolution, which are equal in all of them.

It may perhaps be useful to give an Example of the Computation of this Rule, which may seem difficult to some. Let the Solstitial Heat, in  $\ominus$  and  $\uparrow$  be required at *London*, *Lat.*  $51^{\circ} 3' 2''$ .

38° - 2'8	Co - Lat.	Diff. Ascen.	33° - 1'1.
23 - 30	Decl. $\odot$	Arc. Semidi. estiv.	123 - 11.
61 - 58	Sinus = ,882674	Arc. Semidiur. hyb.	56 - 49. Sin., 638923.
14 - 58	Sinus = ,258257	Arc. estiv. mensura	2,149955.
	Summa 1,140931	Arc. hyber mensura	991683.
	Diff. ,624417		

Then 1,140931 in ,836923  $\div$  ,624417 in 2,149955 = 2,29734  
 And 1,140931 in ,836929  $\div$  ,624417 in ,991638 = 33895

So that 2,29734 will be as the Tropical Summers days Heat, and 0,33895 as the Action of the Sun in the Day of the Winter Solstice.

After

After this manner I computed the following Table for every tenth Degree of Latitude, to the Equinoctial and Tropical Sun, by which an Estimate may be made of the intermediate Degrees.

Lat.	Sun in $\gamma \approx$	Sun in $\$$	Sun in $\psi$
0	20000	18341	18341
10	19696	20290	15834
20	18794	21737	13166
30	17321	22651	10124
40	15321	23048	6944
50	12855	22991	3798
60	10000	22773	1075
70	6840	23543	000
80	3473	24673	000
90	0000	25055	000

Those that desire more of the Nature of this Problem, as to the Geometry thereof, would do well to compare the XIII *Prop. Cap. V.* of the Learned Treatise, *De Cálculo Centri Gravitatis*, by the Reverend *Dr. Wallis*, Published *Anno. 1670.*

From this Rule there follow several Corollaries worth Note: As I. that the Equinoctial Heat when the Sun comes Vertical, is as twice the Square of *Radius*, which may be proposed as a Standard to compare with in all other Cases. II. That under the Equinoctial, the Heat is as the *Sine* of the Sun's Declination. III. That in the Frigid Zones when the Sun sets not, the Heat is as the Circumference of a Circle into the *Sine* of the Altitude at 6. And consequently that in the same Latitude these Aggregates of Warmth, are as the *Sines* of the Sun's Declinations; and in the same Declination of *Sol*, they are as the *Sines* of the Latitudes, and generally they are as the *Sines* of the Latitudes into the *Sines* of Declination.

IV. That

IV. That the Equinoctial Days Heat is every where as the Co-sine of the Latitude. V. In all places where the Sun sets, the difference between the Summer and Winter Heats, when the Declinations are contrary, is equal to a Circle into the *Sine* of the Altitude at 6 in the Summer Parallel, and consequently those differences are as the *Sines* of Latitude into or multiplied by the *Sines* of Declination. VI. From the Table I have added, it appears that the Tropical Sun under the Equinoctial has of all others the least Force. Under the Pole it is greater than any other days Heat whatsoever, being to that of the Equinoctial as 5 to 4.

From the Table and these Coralleries may a general *Idea* be conceived of the Sum of all the Actions of the Sun in the whole Year, and that part of Heat that arises simply from the Presence of the Sun be brought to a Geometrical Certainty: And if the like could be perform'd for Cold; which is something else than the bare Absence of the Sun, as appears by many Instances, we might hope to bring what relates to this part of *Meteorology* to a perfect Theory.

## X. An Account of BOOKS.

1. *Diogenes Laertius Græce & Latine, cum Commentariis integris Doctorum Virorum Amstelodami.* Typis Henrici Wetstenii, Anno 1692. Prostant Londini apud S. Smith & B. Walford ad Insignia Principis in Cæmeterio D. Pauli.

THE Ten Books of *Diogenes Laertius*, containing the *Lives, Sayings* and *Opinions* of the most ancient and eminent Philosophers of *Greece*, have been Printed more than Twenty times, (a good Testimony of their Acceptance with the Learned) as appeareth by a Catalogue of the several Editions, which we find set here in the Entry of the former Volume.

All these Editions gradually surpassed each other by some new Accomplishments; yet all are very far short of that Perfection which this hath attained.

Its evident that Mr. *H. Wetsten* before he adventured on this famous Piece, first took the Advice of his Learned Friends of several Nations; from whom he understood what further Improvements *Diogenes* might yet receive. After this he (and who could do it better?) cast the Work into the most useful Form and Model. Lastly, He spared no Cost in providing the most excellent paper, Types, Sculpts; and Heads of the Philosophers which could be found amongst the curious Antiquaries.

And

And when we speak of the Elegancy of the Types and Letters used in this Impression, we cannot but observe to the Reader, that Mr. *Wetsten*, by Advice of that most Learned Man Mr. *Mark Meibomius*, hath in this Edition (and some other Greek Books) thrown away out of the Alphabet all those knotty and perplexing Abbreviations, commonly called by Printers *Ligatures*. These *Ligatures* have been a long time Thorns in the Eyes of all that first learn Greek. It may be hoped that all Founders of Greek Letters will for the future wholly omit, and banish these troublesome and useles *Ligatures*.

The Greek Text of *Diogenes Laertius* was thought still, even after that Edition at *London*, 1663. very corrupt and unintelligible. Therefore Mr. *Wetsten* made a Journey into *England*, to see what Helps might here be had, to mend the Text. Two Copies in Greek of *Diogenes* were found; one in *Trinity Colledge* in *Cambridge*, the other in the *Arundelian Library*, now in the Possession of the Royal Society. Out of both these the Publisher, Mr. *Wetsten*, obtained the *Variantes Lectiones* from his Friend Dr. *Gale*, who had entred them upon his *Laertius*, which he put into Mr. *Wetsten's* hand.

Now whereas the famous Mr. *Aegidius Menagius* in the *London* Edition of *Diogenes*, was thought to have left nothing untoucht in his Polite Notes, which might illustrate his Author; yet here, in this Edition, he hath added so wonderful Collections, that he hath now outdone not only *Isaac Casaubone*, *Aldobrandinus* and others, but even himself also.

To him in the same Undertaking hath succeeded Mr. *Kubnius*, who very happily hath cleared many places which seemed still dark and less intelligible.

But to omit all others, we here find the most accurate Critick in the Greek and Latin Languages, *M. Meibomius*, far engaged: He undertook the revising of the Copy, the Correcting the Press, the directing and steering the

whole Work; and also besides his commenting on a good part of it, he hath mended and supplied the Defects of the Latin Version, which was indeed hitherto very lame and insufficient.

Here are in the end subjoyned Four very necessary Indexes: For all these we are beholden to the Learned Mr. *John Clerk*. The First, to mention no more, so far exceedeth that in the late Edition, which contained the Names of Authors alledged by *Laertius*, that it may well be judged to be totally a new one.

In a word, this Age hath not seen any Work performed with so great Fidelity, Accuracy, Elegancy and Perfection in all Points, as we see meet here in this Edition, Mr. *Wetsten* hath very highly, at his own proper Charge, obliged the Publick; may he find encouragement for other his worthy Undertakings in future.

2. *Considerations on a Book Entituled, The Theory of the Earth: Publish'd some Years since by the Learned Dr. Burnet. Written by John Beaumont, jun. Gent.*

**T**HOUGH several Persons before had printed some Reflections on this *Theory*, the Author of these *Considerations*; arguing generally in a way differing from them, thought it might not be a thing ungrateful to the Learned, if he publish'd what his own Thoughts might be towards the clearing of the abstruse matters there treated. He proceeds upon each Chapter, as the Author of the *Theory* has writ them, in his English Copy, first briefly stating the Contents, and then offering what he has

has to say upon them. The *Theory* is divided into Two Parts. The First treats of the *Deluge and Dissolution of the Earth*. The Second of the *Primæval Earth and Paradise*.

Asto to the first part of the *Theory*, the Author of these *Considerations* on it, first sets forth, in opposition to it, what he finds the Grounds and Reasons of the Ancients generally were, for admitting *Deluges* and *Conflagrations*, and what their Learning was in General. Next, Whereas a *Chaos* is represented in the *Theory* (as the ground on which its Author proposes to build it) whence the World is said to have risen in time : He shews that there is no material Reason, why a *Chaos* should be admitted, and that, as far as Humane Understanding can reach, the World may have been in a perfect state from Eternity, according to the Opinion of *Aristotle*, its Rise in time being meerly a Point of *Faith*. And admitting a *Chaos*, and a gradual Formation of the World from it, he conceives he has represented a more natural Explication of the *Modus*, than that which is propos'd in the *Theory*. And again, admitting the Original Formation of the World, as the *Theory* has represented it, *viz* By a first Sediment of the *Chaos*, and an Orb of Waters or an Abyss Orb over that, and an Orb of Earth over both ; which made the Primigenial or Antidiluvian Earth, he thinks he has shewn it impossible, that *Noah's Deluge* and the Formation of the present Earth should have been thence caus'd, and this both according to the Proportions of the Orbs of Earth and Waters, represented in the *Schemes* of the *Theory*, and according to other Proportions which seem to be there intimated ; and he conceives no other Proportions whatsoever assignable to such Orbs, for producing the said Effects, but he shall be able to shew the same Impossibility.

In the next place he argues against the assigning of any Natural Causes for the *Deluge*, which is undertaken in the *Theory*: And whereas its there set forth, that the Earth before the *Deluge* was all smooth and even, without *Mountains* and a *Sea*; he shews by many natural Reasons the necessity of both from the beginning of the World: And for a Conclusion to this part of the *Theory*, it being there set forth, that the first Order of things is regular and simple; and that the Deformity of the present Earth, as it appears all broken; and its Incommodiousness shew, that the present state of it was not Original, nor dispos'd according to the Laws of Gravity. He replies to this, that Common Gravitation rules not all in the Distribution of the parts of the World; as tho' all the heaviest parts were to be lowermost, and the lightest uppermost, no more than in the Distribution of the parts of Animals, in whom many times, in order to certain uses, the heaviest parts are plac'd uppermost, and lighter lowermost; and he thinks it easie to shew analogous uses in the parts of the Earth, if their Site be sometimes in the like Order.

As to the Second Part of the *Theory*, concerning the *Primæval Earth* and *Paradise*, its there set forth, That the Ancients having represented in the *Golden Age*, or *Paradisiacal Times*, a perpetual Spring, a great Longevity of Animals, and the production of them out of the Earth, and the great Fertility of the Soil in all other things; the Earth, in the Antidiluvian times, must have had a right Situation and Posture to the Sun, which must then have constantly mov'd in the *Equinox*, for making good these things; and that upon the Earths Disruption at the *Deluge*, it lost its equal Poysse, and so its right or *parallel* Situation, which it had before to the Sun, was chang'd into an *Oblique*, in which Posture it has stood ever since; and upon this Change, the Change of  
the

the Form of the Year hapned, it bringing in the inequality of Seasons.

Now the Author of the *Considerations* having made good, as he conceives, in the first part of them, That the Earth could not be otherwise ballanc'd before the *Deluge* than since, here farther shews the impossibility of the Earths changing it's Posture, through the Causes assigned in the *Theory*; and subjoyns many Reasons why the Earth must have always had the same Posture to the Sun it has now; and represents many Absurdities which must follow, if it had that Posture to the Sun in the Antediluvian Times which is contended for in the *Theory*. And as for the Antediluvian Longevity's being ascrib'd to the said Posture of the Earth to the Sun, he shews that the varieties of Species and Constitutions in Animals being considered, the Diversity of Seasons is more commodious for their orderly Succession in Life, and assigns other Causes, more probable, as he conceives, for the said Longevity. Next, the *Theory* sets forth the Source and Origine of the Waters in the Primæval Earth, the Course the Rivers then had, and their issue; the state of the Air in the Antediluvian times, and the Origine of the Rainbow; against all which many things are objected in the *Considerations*. And whereas the *Theory* represents *Paradise* as plac'd in the other Hemisphere by the ancient Gentiles and Christian Fathers, the *Considerations* set forth, That as for the Ancient Gentiles, they meant *Paradise* only Intellectual, as the Allegorical Fathers did; and that tho' most of the Christian Fathers held a Topical *Paradise*, yet there is no ground for us to conclude, that they held it to be in the other Hemisphere, but rather in this we inhabit.

In the next place the *Theory* gives an Explanation of the Ancient's *Chaos*; represents the *Torrid Zone*, uninhabitable before the *Deluge*, and the Changes of the *Poles* of the World at the *Deluge*; explains the Doctrine of the  
Ancients

Ancients concerning the *Mundane Egg*, and how *America* was first Peopled: All which Points are oppos'd in the *Considerations*. As for the two last Chapters of the *Theory*, which treat concerning the Author of Nature, and Natural Providence; the Author of the *Considerations* owns them to be well and soundly reason'd; and for a Conclusion, gives his own Opinion, what he conceives may be said concerning the *Creation*, *Deluge*, *Conflagration*, *New Heavens* and *New Earth*, *Paradise*, &c. according to the Sence of the Ancients. And whereas the Motive which induc'd the Author of the *Theory* to write it, was (as he says) to justify the Doctrines of the Universal *Deluge* and of *Paradise*, by a new Light of Nature and Philosophy; the Author of the *Considerations* thinks, that when things are represented in the *Scriptures*, as grounded on a particular Providence, as he conceives the *Deluge* and *Paradise* are, we ought not to endeavour to assign Natural Causes for them, which do but destroy the Miracle by lessening it; there being no Divine Law but must set forth God as a most free Agent, and often acting beside and contrary to the tendency and common course of any Natural Causes whatsoever.

3. *Epistola ad Regiam Societatem Londinensem, qua de nuperis terræ-motibus differitur, & veræ eorum Causæ eruuntur.* Lond. in 4<sup>to</sup>. 1693.

**T**HE Author of this little Tract, who is pleased to conceal his Name, complains in the first place of the little Regard many Learned Men have for Astrology, who account it trifling, false and impious; from which Imputations he by no means excuses that part which relates to Nativities and Humane Actions, but affirms it unjust so to judge of that part which searches after the general Causes of the great Alterations of the Air, Epidemical Distempers, Comets, Earthquakes, and the like universal Effects of Nature. These he endeavours to shew proceed from the Influences of the Stars, from their constant Concomitancy to such returning Positions of the Heavens. Proceeding to the late Earthquakes, he shews them to be caused by the Stars, according to the Principles of the Astro-meteorological Art, publish'd by Dr. Good, who foretold several great Alterations, as Earthquakes, &c. to happen in the Years 92, 93, 94, 95. and gives a Scheme of the Heavens, Dec. 28. 92. *St. V. hor. 10. noct.* the time when *Ætna* began to roar, viz.

II 12. ♃ R.

♁ 7 ♀. 17 ♃. ♃ 5 ♂ tard. 18 ☉ ≈ 5 ♃. 6 ♀ tard.

The next day the Earthquake began. He makes some Observations on this Figure of the Heavens, and the Earthquake that followed it, the greatest Shake being at the  $\frac{1}{11}$  of Jan. 93.

By the same Art he attempts to give a reason of the Earthquake in *Jamaica*, *Jun. 7, 92. semihora ante merid.* consulting the same Treatises of *Dr. Goad*, and affirms the same may be observed of the Earthquake that happened at *London*, and other parts, *Sept. 8. St. V. 92.* a little after 2 p. m.

He concludes these Warnings are given the World to forsake their Wickedness, and especially Idolatry, which will at last bring on the final Conflagration.

4. *Traité des Moyens de rendre les Rivieres navigables, &c. a Paris, 1693. in 8vo.*

THE Author of this Treatise tells us in the Preface, that the Methods and Machines he proposes are not meer Imaginations, but are already put in practice chiefly by the *Hollanders*, who have the most cultivated this matter. Coming to the subject in hand, he supposes first, that all Impediments to its being Navigable, are of two sorts, either in the Channel it self, or out of it; the latter are caused either from the badness of the Banks, on which Men and Horses cannot easily pass to draw up the Vessels against the Stream, such as Trees, cross Rivulets, &c. The other Hindrances in the Channel are from Rocks, inequality of the bottom, Falls, Mills, dividing of the Stream, Rapidity, overflowing and breaking down of the Banks, Banks of Sand, &c. all which he reduces chiefly to Four; too great a breadth in some places and by that reason Shallowness, especially in the Summer; Water-falls or Cascades; Rocks to be met with in the bottom; or lastly, Mills. For each of these he proposes some Remedies; and for such as arise from the Banks, they are easie to be overcome by

a little Labour : And here he shews the Method of drawing a Vessel up the Stream, where the winding of the Stream makes an acute Angle, so that Vessels are apt to strike against it, and gives the Figure of an Engine for that purpose. Proceeding to the other Impediments from the Channel : As to the first, He shews the ways of narrowing it by Piles drove down and inter-wound with Branches of Trees, the middle fill'd up with Fascines, and on those great Stones : These Works are to be made almost even with the Surface of the Water, that extraordinary Floods may go over them, rather than bear too hard upon them. He gives several Directions for this matter, with the shape of the Piles, and the ways of driving them above and under Water, annexing the Figures of them, and the Engines for that purpose. The means of remedying the second Inconvenience, caused by the inequality of the bottom, or by Cascades, are first by Bridges with Rollers, over which the Vessel, which ought to be flat bottom'd, is drawn. Secondly, by Sluces, especially for Water-falls : Of these he shews the make and use. For the third Obstacle, caused by Rocks, he shews the Method of working dry in the bottom of the Water, so to break and carry them away. Then he shews several ways of preserving the Banks of Rivers, by building Wings or Cribs to break the force of the Water ; by Piles drove along the Shore ; by making a new Channel, &c. He shews some ways of cleansing and evening the bottoms of Rivers, and proceeds to treat of Floods and Inundations, with their Causes, Effects and Remedies. He concludes his Treatise with the ways of cleansing and opening Ports and Channels, giving the Schemes of several Engines to this end.

At the end of the Treatise he shews the means of weighing up sunken Vessels, blowing up the Decks under Water, and taking out the Goods by means of the Diving Bell, &c.

---

*E R R A T A.*

**N**umb. 200. p. 748. l. 14. r. at. p. 749. l. 12. r. atro. p. 751. l. 20. r. *Plectro-*  
*nites.* l. 28. r. *lapidis.* l. 30. r. *titulis.* Numb. 201. In the engraved  
 Plate of the Characters, N<sup>o</sup> 2. l. 2. r. *BACIAEON.* p. 784. l. 12. r. *considerable.*  
 p. 791. l. 15. r. at. *Col. Coles.*

---

*L O N D O N:*

Printed for *S. Smith* and *B. Walford*, Printers to the  
*Royal Society*, at the *Princes Arms* in *St. Paul's*  
*Church-yard*, 1693.



*Fig: 1*



*Fig: 2*



---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of October, 1693.*

---

## The CONTENTS.

I. **A** *N Account of an Experiment made before the Royal Society of the Change of Colour, in a pale transparent Liquor, to a deep Blue, applyed to illustrate some Changes of Colour, and other Effects on the Blood of Respiring Animals, by Fred. Slare, M. D. and S. R. S. and Censor of the Colledge of Physicians.* II. *An Abstract of a Letter from Dr. William Oliver, concerning the strange Flowing and Ebbing of a Well near Torbay.* III. *A Second Letter from the same Person, giving a farther Account of the same Well, as likewise of a Storm of Thunder and Lightning in the Bay of Biscay; both Communicated by Walter Moyle, Esq;* IV. *Emendationes ac Notæ in vetustas Albatênii Observationes Astronomicas, cum restitutione Tabularum Lunisolarium ejusdem Authoris. Per Edm. Halley, S. R. S.* V. *An Account of the true Cortex Winteranus, and the Tree that bears it, by Hans. Sloane, M. D. and S. R. S.* VI. *An Account of a Book; Pharmacologia seu Manufactio ad materiam Medicam in quâ Medicamenta Officinalia, &c. describuntur, &c. à Sam. Dale. Lond. in Octavo, 1693. Impensis S. Smith & B. Walford, R. S. Typogr.*

- I. *An Experiment made before the President and Fellows of the Royal Society, in which a surprizing change of Colour from a pale Transparent or Clear Liquor, to a very Blue Ceruleous one was exhibited, and that in an instant, by the admission of Air only: Apply'd to illustrate some changes of Colour, and other Effects on the Blood of Respiring Animals.* By Fr. Slare, M. D. Fellow of R. S. and Censor of the Colledge of Physicians.

**I**N order to the making of this Experiment, the Operator should furnish himself with a quantity of Filings of Copper fresh made, and place them in a Glass Vial, whose bottom is broad and even, and then pour on a Urinous Spirit, either of *Sal Armoniac*, or of Urine it self, not made with Quick-Lime: The Glass should not be fill'd up much above one half-way, and then must presently be so exactly stop't that no Air be capable of intruding; for if you err in a Circumstance the Experiment will not succeed. The Foundation of this Experiment is justly due to the Immortal Mr. Boyle; but our Aims are very differing in the Application, as well as in the manner of preparing and exhibiting the Experiment. He was searching after some hidden proprieties of the Air, and particularly apply'd it to the broken or lessen'd Spring of the Air, which this *Phænomenon* afforded his Speculation. But I have endeavour'd to bring it home to my own Profession, to justifie a Notion of some Importance, tho' much disputed, concerning an alteration made by the Air upon Humane Blood, both as to Colour,

lour, and other Vertues. You have also this difference in the manner of exhibiting, in Mr. Boyle's Experiment you have the Filings of Copper contiguous with your *Menstruum*, in ours you have a clear Colourless Liquor, and no Materials at all in your Glass to give the least Umbrage to this sudden change of Colour; but this cannot be performed without some *Encheirests* and an *Apparatus* extraordinary.

' In making the Experiment you will observe, for  
' four, five, or six days the Tincture will be growing  
' deeper and deeper, and then will keep a stand for two  
' or three days more or less, and afterwards will gradual-  
' ly decline until it become quite pale, and void of all  
' Colour. When it is in this state, the easiest way of  
' performing the Experiment for your own satisfaction,  
' is to decant this clear Spirit into a Glass so as to leave  
' all the Filings behind, and that will demonstrate that  
' the Filings did not give this Tincture *de novo*, but that  
' it belongs to the influence of the Air. But in case you  
' are furnish'd with an Air-pump, and can pour off this  
' palid Liquor in a *Vacuo Aeris*, and there stop it up se-  
' curely, you may then preserve it so long as you please,  
' and exhibit it to advantage, which is the way I com-  
' monly use. You may also observe, that so soon as  
' you let in the Air, the upper Superficies immediately  
' tinges first, and so descends deeper and deeper until it  
' has penetrated the whole, and this it does the sooner, if  
' the Glass be wide, and the Liquor by consequence have  
' a large Superficies: Or if you pour it out of one Glass  
' into another, the Air makes a more sudden change of  
' the whole.

That Liquors should lose their Tinctures is not to be wonder'd at, for even Ink it self by standing still will lose much of its Tincture, and so do the Tinctures of many Minerals, Tincture of Sulphur, and of Salt of Tartar will lose their Tinctures, and many Vegetables are not  
long

long to be preserved, but do grow turbid, some pale, and colourless, and leave their *Menstruums*, and precipitate to the bottom, and are not easily if ever recover'd. But in our Experiment we have some things very uncommon, a deeply ting'd Liquor grows pale and colourless in a few days, without any admission of Air or any other Ingredient to disturb it, or to cause any discernable precipitation or separation. Yet when I consider that two Grains of Copper will give a deep Colour to three Ounces of Urinous Spirits, we need not expect any great quantity should be discharg'd out of the Liquor to be very conspicuous at the bottom, which does better solve it than a bare change of Texture can do; namely, to allow it to subside to the bottom of the Glass, tho' it be scarce perceptible by reason of the Filings that may conceal it. But a yet greater difficulty emerges to account for, which is, That since our *Menstruum*, (that is, our Spirit) is divested of its Venereal Particles, which gave the Tincture, and is become as clear as Rock-water, and being separated from its Metalline Filings, does yet upon the approach of the Air immediately afford a very Blue Tincture. This indeed plainly shews, that there must be conceal'd in the Pores of the Liquor, such Particles as are of a Cupreous Nature. But how may this come to pass? To which I answer, I cannot be so vain to think, that the Air gives the matter of the Colour to the Spirit, but that it conveys into it such Particles as do stimulate and give motion to the *Menstruum*, and inable it to dissolve those Particles thoroughly, that for want of more Air had not been fully broken in pieces.

In the next place, I discover two very differing sorts of Matter that our Urinous *Menstruum* acts upon in this Experiment. One I call a Sulphureous Matter, which gives the Blue Colour, and does let it fall again; and another which deserves the name of Saline; but tho' it be taken up into our tinging Spirit, does yet notwithstanding

standing afford no Tincture whilst secluded from the Air : This was made to me very plain and clear, for having found out a way to separate a white slimy substance out of our clear Liquor, I then destroy'd the Experiment, so that when expos'd to the Air the *Menstruum* would no more give the least Tincture : For a farther confirmation, this white Saline Substance being in a small quantity dissolved in any proper Urinary *Menstruum* exhibits the Experiment set down to advantage, and gives a much finer and brighter Colour than what is drawn from Crude Copper, or from the Sulphureous parts : But since the method above is more feasible, I will not spend time for fear of discouraging the Undertaker of an Experiment, to set down this very elaborate method of procuring the Salt of *Venus*.

The great Interest the Air has in this Experiment made me think of applying it to the great change that is made upon Blood ; for it is obvious to every Body that there is a great difference in Colour betwixt the Venal and Arterial Blood, the Venal so soon as it is let out of the Vein is observed to be of a dark Complexion, and requires some time to be expos'd to the Air before it obtains a florid Red, and that only Superficies which is contiguous to the Air, does for a good while become Red ; for I have turn'd up a Cake of Blood twenty four hours after it had been let out, and found it of a very dark and opaque Colour, but the Air has immediately given it a bright and florid Red Tincture. This so manifest a change made by vertue of the Air is obvious even *Lippis & Tonsoribus*, which would make one wonder to find great Philosophers and Anatomists endeavour to assign more foreign and ambiguous Causes of so demonstrable an effect of the Air. Thus our Famous Anatomists Dr. *Higmore*, and Dr. *Needham*, and others, have adventur'd to do ; who would have respiration to be chiefly to promote the Circulation of the Blood, and that

great *Apparatus* of Air-Vessels to be for a Fan to cool the Mass of Blood, and that the Air returns unalter'd, and not capable of making any great alteration, being denied any ingress into or mixture with the Blood. The Observation is certain and unerring, that the Venal Blood as it passes the Right Ventricle at its entrance into the Lungs is of a very opaque and blackish Complexion, and in its passage through the Lungs before it comes to the Left Auricle, is changed into a very florid and bright Red. I have often observed that Persons that have Vomited Blood upon a Rupture of some Capillary Vessels of the Lungs, have sent up a very frothy or spumous Blood, and at the same time of a bright Scarlet Red: That it was frothy, argues that the Air had incorporated with it; that it was Red was due to the tingeing power of the Air. To expect that this change should be made in the Heart by any Local Ferment, or *flamma vitalis* is fruitless; because we find it performed before its arrival there; the structure of the Heart denoting that Engine to be principally made for projecting the Blood in order to a Circulation through those various Arteries or Pipes which are branched from the Heart. Let us therefore examine the structure of the Lungs, and very briefly consider them, we shall soon discover it to be a Pneumatic Engine made principally for taking in Air, and that in great quantities, which a Remark in the Fourth Corollary does much favour. It's true, we may call the Lungs a Contexture of Veins, Arteries, Nerves, Lymphæducts, &c. and that these do very much make up the Parenchyma (as some do use the word) of the Lungs; but yet we shall find the great bulk of the Lungs to be Vesicular: It seems to me to be a Continuation of the *Aspera Arteria*, or Wind-pipe, divided and subdivided into many Branches, and these still spun out into lesser and lesser Pipes, all of them hollow; the farther they run the thinner their sides do grow, which  
upon

upon the Inspiration of Air do swell up and grow round, and upon expiration do fall something flaccid, and abate something of that Figure, as the Microscope does plainly represent. That these Pipes should run to a great length hollow, tho' very small, I the less wonder at, having seen a hollow Pipe of Glass drawn out at the flame of a Lamp so very small as to be scarce visible without a Microscope, and yet was so hollow as to take up tinged Spirit of Wine, where only the ordinary pressure of the Ambient Air impell'd it: Nor will compress'd Air be kept out where there is the least Pore left open, which makes it more than probable that it should insinuate into this Machine so truly adapted to receive the Air, and that in great quantity, the *Apparatus* of Air-Vessels being so very considerable, which appears in each inspiration; for the Luugs are stretch'd at that rate as to take up double the room they do in the state of expiration, or in their compress'd state; and even in this state the Air-bladders are not fully evacuated, but contain Air for good purposes. Nor can it be pretended that any augmentation is due to the Expansion of the Blood-Vessels, or any other which do not swell beyond their usual Tension in each inspiration. The Sanguiferous Vessels are divaricated through all the Lobes of the Lungs, and do give a very close attendance to each *Vesicula* (for there is not the least *Vesicula* but has a Capillary Vessel which intimately insinuates into it) in order to receive some considerable benefit from it; and this appears to the Eye, for in an instant a dark and foul Blood is changed into a bright florid Red Colour, which would make a Man of Contemplation to admire it, and a Lover of Red Wine, who is presently offended to see his Liquor foul, (and perhaps justly condemns it for unwholesome) wish for such another expedient to clear up his turbid Liquor. Thus the very structure of the Lungs, the effect of change of Colour both in the Blood and in our

Experiment, the one from a dark opaque Colour to a noble Scarlet Dye ; the other from a pale or colourless Liquor to a rich *Ultra Marine* Blue, do all combine to do justice to the Air for this celebrated alteration. Nor is the Air thus infus'd into the Lungs for a bare Colour, and of no farther consideration: But I am apt to believe the great Fermentations of the Blood the cause of the Motions and Actions of the Muscles ; the Animal Spirits themselves, the great Spring of Motions, derive their Energy and Powers, if not Nature, from hence.

#### COROLLARY I.

The Air is full of Volatile Salts none will deny, but that these Salts must bear the name of Nitrous Salts, it has been scarce call'd in question, which this Experiment and some others I have made, do. Nitrous Salts seem to me not to have any property of Volatile Salt : Nitre is a Salt of so fixed a nature, that it will continue melted in a very strong Fire with scarce any Evaporation ; but if you put into it Charcoal, or Brimstone, or give it an Accension by another Eucheiresis you may obtain a great quantity of as fixed a Salt as any Concrete whatever affords ; so that to me Gold seems not of a more fix'd Nature.

#### COROLLARY II.

A standard of Volatile Salts should be settled, at present I can think of none better than Water. That Salt which in Distillation is more fix'd than Water, ought not to be reckon'd amongst Volatile Salts : This standard will be justified by good measures, grounded on Experience ; for all Salts that are truly Volatile, as far as I could observe, are really lighter than Water, that is in a Chymical sense, do with a less degree of Fire sublime  
in

in our Glasses, or come over the Helm, than Water does. This I find justified in our Volatile Salt of Amber erroneously so call'd, for it does not come up to our standard of Volatility, and is really no Volatile Salt, as will be made appear : If you take this supposed Volatile Salt and Distil it in a Retort, or Head, and Body, with common Water, the Water will ascend in such a degree of Fire where the Salt will not, for you must increase your Fire considerably to make it rise after the Water is gone, and has left the dry Salt at the bottom. This made me enquire farther into the properties of this Salt, which did not at all Correspond with Volatile Salts (for all true Volatile Salts are Alkalies) but on the contrary would ferment with them, and quite destroy the property of true Volatile Salts, by bringing them to a dull insipid Salt, which some call *Sal Neutrum*; and also by fixing their Volatile Nature, not only in putting them by the standard of Volatility, but also does quite destroy their spiritous and stimulating smell, by vertue of which they have been always deservedly esteem'd such excellent Cephalick Medicines. Therefore examining this Salt yet a little farther, you will plainly prove it to be an Acid, that Corrodes Iron, turns Syrup of July-flowers Green, destroys the Tincture of *Lignum Nephriticum*, and does not ferment with common Acids; so that it plainly belongs to the Tribe of Acids, and should be struck out of the Catalogue of Volatile Salts; and perhaps out of the number of Specific Cephalicks, and rather be degraded amongst the Diureticks, and even in that rank to have but an inferior station; for it seems to me to be but a dull Medicine, and more Valuable for its Price than great Vertue, especially if quite divested of all its Oyl, in which the great *Cephalic* and *Cordial* Vertue must needs be own'd to consist.

## C O R O L L A R Y III.

That Volatile Salts have a great property to draw Tinctures, and do particularly advance those Colours that are dispos'd to be Red : For tho' Spirit of Wine be a very Catholic *Menstruum*, and draws a very deep Tincture of Cochine, yet we have often observed that if we put to this Tincture, when highest, a small proportion of Volatile Salt that would advance it to a great, even a double degree. Thus I have observed it to advance the Tincture of Arterial Blood ; and which is very Curious, if you dissolve it in your Blood whilst you are Bleeding at one of your Veins, that Blood will become very florid, and like Arterial Blood. Therefore since Nitrous Salts produce none of these tingeing Effects ; this Corollary seems much to favour the Notion, That the Effects of the Air upon the Blood, may be due to such Salts as are of a Volatile Alkalifat Nature.

## C O R O L L A R Y IV.

Contagious Diseases are Communicated by the Air inspired at the Lungs ; and this seems more probable than what Dr. *Needham* and others, have endeavour'd to make out with more difficulty ; in attributing the same effect to the Air taken in our Meat by Mastication, and swallow'd down in our Drink, and communicated to our Chyle from thence to our Blood and Spirits ; but this way a very small quantity of infected Air is Communicated, if we compare it with what is Communicated to the Lungs : For in each inspiration, Humane Lungs of an ordinary size do at least take in such a quantity of Air as will fill up a Quart Bottle, and in the space of a Minute I have made Twelve Respirations, ( when I was very sedate, and drew in my Breath very treatably ) and

in that time by consequence took in as much Air as would fill up a Vessel capacious enough to hold three Gallons of Water ; and it's plain that the Air expired returns much alter'd, for as much as the Breath or *Halitus* returns impregnated with a moist Vapour, and such a one as does many times indicate the Temper of the Blood: From this *Halitus* Imposthumations of the Lungs are frequently predicted: Such as have Sulphureous Blood shall emit no very pleasing but rancid Exhalations: Nor does the Blood only clear it self of some Vapours in expiration, but also imbibe, and impregnate it self with such Particles as are necessary to maintain Life in inspiration; for a Man could not subsist long in a Tun of Air, should he be kept close in so capacious a Vessel, as we have found by Experiments made with several respiring Animals, Dogs, Cats, and Birds, &c. that these would soon die there; so that we need constant supplies of vast quantities of fresh Air, which makes me believe that those Particles separated out of the Air by the Lungs are very sparingly deliver'd or mix'd with the common Air, but yet with this difference, that the more compress'd the Air is, the more it contains of that vivifying Salt or Spirit, and the contrary, the more rarified the less is found; for we are told by the Experience of such as have been on the Pike of *Teneriff*, that their breathing is more difficult there than at the bottom, where the Air is more compress'd. And we have found Birds and Mice, &c. would live as long again, in a Vessel where we had crouded in, by a Syringe ( or any other condensing Engine ) a double quantity of Air, as they did where they were confined only to common Air. To conclude, since the vivifying Particles in the Air seem to be very sparingly disseminated through it, I am apt to believe that the Noxious and Pestilential are more sparingly scattered up and down; ( the Author of Humane Nature having taken more

more care for its Preservation than for its Destruction ) and therefore it may much better be inferr'd from the Premises, That Contagious Diseases must needs be communicated to the Blood by Inspiration into the Lungs, rather than any other way.

---

II. *An Extract of a Letter from Dr. William Oliver, Communicated by Walter Moyle, Esq;*

Torbay, the 15th. of July, 1693.

S I R,

**W**HEN we Cruised in the Bay of *Biscay*, June the 8th, and had a hundred Fathom of Water, we took a Quart Glás Bottle stopt with a large Cork, and after tyed down with a strong Packthread, as we use to for Bottle Syder, or Ale, fastening our Bottle to our Plumbing-rope, and with a Lead at the end, sunk it to the bottom of the Sea, which as soon as we perceiv'd, we drew it up again, and found the Cork quite press'd thro' the neck of the Bottle into its cavity, and the Bottle full of Salt Sea-Water. We repeated our Experiment with another Bottle and Cork in the same manner as before, but the Cork being not found, the Sea-Water soak'd thro' it, and the Bottle was half full of Water, so the Cork remain'd in the mouth of the Bottle not press'd down at all. We repeated our Experiment a third time in ninety Fathom of Water, with a very sound Cork, and much larger than the mouth of the Bottle, for we were forc'd to beat it in with a Hammer as far as it would go, leaving about an inch of the Cork above the mouth of the Bottle, and tyed down as before, but it succeeded not so well as at first, tho' the Cork was now press'd down into the neck, and became level with the mouth

mouth of the Bottle ; and I really believe, had we ten or twenty Fathom of Water more, 'twould have succeeded as well as our first Tryal. I send you not this as an Experiment altogether new to you, and shall insist no longer on it, but proceed to an uncommon *Phænomemon* I met with near this place. Going a-shoar one day last Week to breath a little Land Air, I walked about a Mile into the Country to see a Well much talked of in these Parts, called *Lay-Well*, which made me more than amends for the pains I had taken to come at it. This Well is about six Foot long, five Foot broad, and near six Inches deep, which ebbs and flows very often every hour, visibly enough ; for from high Water to low Water-mark, which I measured, I found it somewhat more than five Inches. I could not see any augmentation above my mark when it flowed, nor fell it below my mark when it ebb'd, but always kept the same distance. I observed the Time as well as I could, but having no Minute-Watch nor Glafs, I could not measure that so exactly, but really judg'd the flux and reflux, taken both together, was performed in about two Minutes ; nothing could be more regular, each succeeding the other as the Tides of the Sea do : The next time I go a-shoar I'll have a Minute-Glafs, and be more exact. I drank of it, and found it a pleasant, delicate, fine, soft Water, not brackish at all, which the Country People use in Fevers as their ordinary Diet-drink, which succeeds mighty well.

III. *An Extraēt of a Second Letter from Dr. Oliver, Communicated by Walter Moyle, Esq;*

*Spithead, the 9th. of October, 1693.*

S I R,

I Went once more to the Well to make my Observations, when we lay last in *Torbay*, and having a little more time than I had before, tho' little enough for so odd a *Phænomenon*, I shall answer those Questions you were pleased to send me as well as I am able.

*Quest. Whether the Flux and Reflux be constant, at all times of the Day and Year, or only after Rain? And what Account the Country People give of it?*

*Answ.* By every Body I met with, I am informed 'tis most constant Winter and Summer, tho' I am apt to think, it moves faster in Winter, when the Well is fuller, than in Summer, because when I observed it first, I think it flow'd somewhat quicker, than I found it did on my second Observation, which was above six Weeks later in the Year, being towards the end of *August*; for the Water was then considerably shrunk in the Well, notwithstanding we had for about a Fortnight much Rain: And tho' when once it began to flow, it perform'd its flux and reflux in little more than a Minutes time, yet I observed it would stand at its lowest Ebb sometimes two or three Minutes, so that it ebb'd and flow'd by my Watch about sixteen times in an hour, and sometimes, I have been told, twenty. As soon as the Water in the Well began to rise, I saw a great many bubbles ascend from the bottom, but when the Water began to fall, the bubbling immediately ceased. I measured its high and low-water marks again, and found them as before, between five and six Inches distant; not of Perpendicular depth,

depth, but as it spread itself on a broad Stone, as the Sea does on a Beach or Shoar; tho' I am apt to think, its Perpendicular height would be as much or more in that time, were its out-let damm'd up to try an Experiment, for as it rises it runs out with a small stream, which is greater or less, according as the Water in the Well rises and falls, which soon after joyning some other little Rills thereabouts, that come out of these Hills, they empty themselves into the Sea at *Brixam*.

Quest. 2. *Whether it has any Communication with the Sea, or any Hills above it ?*

Ans<sup>w</sup>. That it has any Communication with the Sea, is not manifest, nor is the Water brackish at all. The whole Country adjacent is very Hilly all along the Coast, infomuch that from *Brixam* to the top of the Hill is about a Mile and half, the Well is about half way up the Hill, which hereabout is somewhat uneven and interrupted, and comes out at a small descent, yet considerably higher than the surface of the Sea.

Quest 3. *Whether it be a Mineral Water ?*

Ans<sup>w</sup>. I cannot apprehend 'tis impregnated with any manner of Mineral: I tryed it with an Oaken Leaf as soon as I saw it the first time, but could not find it change colour. I drank of it, 'tis very soft and pleasant, has no manner of roughness in it, and serves for all manner of uses to the Country People in their Houses. I could not make any farther Experiments for want of Time and Opportunity.

Give me leave before I finish this, to tell you of one of my Adventures at Sea this Summer, 'tis Philosophical too.

The 12<sup>th</sup>. of *August* last I was sent for on Board the *Suffolk*, to visit some that were sick, the Weather proving foul, was obliged to lye there that Night: In the Morning about Three a Clock it began to Thunder and Lighten, and Rain, which continued for near an hour

moderate enough ; but about Four a Clock came a Clap of Thunder and Lightning all at the same moment of time, that was so smart and violent, that I thought the Ship had been split in pieces, and jump'd out of Bed, put on Stockings and Shoes, to see what the matter was, I no sooner got out of my Cabin, but an Alarm went through the Ship, of *Fire! Fire!* the dreadfullest word that can happen on Board, and put us all into Confusion. The Sick, and all that were in Hamocks, came up on the Deck in their shirts, and made a grievous Noise ; Thunder and Lightning going before, made it look like a Resurrection : It happened to Rain briskly about that time, and so with the help of our Buckets, the Fire, which was occasioned by the Balls of Lightning that came between Decks, was soon put out ; this happened in the Bay of *Biscay*, in 47 and 48. *gr. lat.* I lay at that time forward near the Mast, in one of the Officers Cabins ; over my head in the Gang-way was one Man knockt down, and lay some time before he recovered himself : A second near him was blown almost the length of the Quarter-deck, a third was burnt all down his Back with the Lightning in his Hammock. Our Main Top-Gallant Mast was split in pieces, our Top-Mast not touch'd ; our Main-Mast split from the top down to the very Deck. I made what hast aboard the *Elizabeth* I could, and that very Morning our Lieutenant in this Storm jumped over Board, as you have heard.

IV. Emendationes ac Notæ in vetustas *Albatèni* Observationes Astronomicas, cum restitutione Tabularum Lunifolarium ejusdem Authoris. Per *Edm. Halley*, S. R. S.

**C**UM inter Monumenta Veterum nihil usquam reperitur Observationum Astronomicarum nisi apud Claudium Ptolemæum, cumque etiam nullas alias in Syntaxi sua tradiderit, præter eas quæ Theoriis suis comprobandis usui erant, cæteras vero permultas sine dubio à Timocharide, Hipparcho aliisque posteritati consignatas, insigni Scientiæ detrimento suppresserit; haud abs re fore videtur, Albatèni sive *ElBatèni* ( ut Arabice sonat ) medio præcise loco inter nos ac Ptolemæum florentis, ac Ptolemæi Sphalmata primum corrigere ausi, Cœlestia Observata in lucem promere, atque à traductoris vel Typographi vel utriusque mendis quâ potui diligentia liberare.

Author iste sane pro suo sæculo admirandi acuminis, ac in administrandis observationibus exercitatissimus, ut apparet ex eo quod Solis motum, captis Æquinoctiorum momentis, penitus restaurasse videretur, si longius Ptolemæi vestigiis abcedens, Eccentricitatem Solis bifecandam esse vidisset. Liber quem patrio sermone conscripsit saltem apud nos non reperitur; ante aliquot sæcula vero ex Arabico in Latinum transtulit quidam Plato Tiburtinus neque Linguarum satis sciens, neque Astronomicâ disciplinâ instructus, ut ex ipso opere conspicuum est. Hujus autem traductionis binas vidi editiones, alteram Noribergæ Anno 1537. alteram Bononiæ Anno 1645. sed ex priori omnino desumptam, cum etiam errata omnia Typographica prioris conservet, licet Bibliothecæ Vaticanæ exemplar prætendatur. Utcunque sit, utraque Editio crebris scatet mendis, præsertim quoad Numeros, atque utraque Tabulis Astronomicis Authoris, quarum passim fit mentio, mutilatur.

\*

*Alba-*

Albatēnius autem in Luna ☿ Planetis Ptolemaicis Hypothesibus emendandis frustraneam operam insumit ; cumque veriora scientiæ Syderalis principia jam nacti simus, cætera quidem ejus haud usque adeo necessaria sunt ; Observationes vero ejus quas solas habemus, per tot sæcula inter Ptolemaum ☿ Regiomontanum lapsa, jure conservari atq; inter pretiosissima Urania κειμήλια reponi merentur. Præsertim cum usus eximios præbeant in demonstrandâ Temporis Annuæ inæqualitate ; uti alia occasione probare satago.

Floruit Albatēnius circa Annum Christi 890. vigente jam Imperio Saraceno ; creditur Vir Nobilis, à quibusdam etiam patriæ suæ Princeps : Utcunque fuerit, constat illum Syriæ incolam per plures annos Antiochiæ vel Arractæ vitam egisse : Tabulasque Astronomicas Observationibus propriis fretas ad Meridianum Arractæ construxisse. Urbs autem ista propriè dicebatur Alracia vel Alrecca, tempore Albulfedæ desolata, olim autem magna ☿ celebris fuit, juxta Euphratem sita, ad latus Orientale ☿ Boreale : Albulfeda in descr. Mesopotamiæ. Consentiuntque omnes Geographi Arabes ad ripam Euphratis positam fuisse, sub Latitudine 36 gr. quantam ei assignat ipse Albatēnius Cap. IV. Videturque Urbs ista à Persis condita ad tutandam ripam Persicam quo tempore Romana potestas mole suâ ruens in occasum vergeret. Antiochiæ vero Syriæ ad Orontem situs satis notus est, cum etiam hodie urbs incluta sit.

His in urbibus observationes suas instituit Albatēnius, quas cum malè descripserit qui librum ejus Latinitate fere barbarâ donavit, neque numeros, quod maxime oportuit, curaverit, hortatu R. Societatis non potui hanc emendationem non suscipere, simulque Tabulas Astronomicas Authoris, quæ Solem Lunamque spectant, quæque periisse videbantur, quantum fieri possit, redintegrare. Observationes autem sic se habent.

Primum refert se observasse distantiam Tropicorum prægrandi instrumento ac omni adhibitâ curâ 47 gr. 10 min. 1 cil. Solis æstivi à Zenith minimam distantiam 12°. 26'. Hiberni vero maximam 59 gr. 36'. unde etiam elicitur  
 Latitudo

Latitudo Urbis Araçtæ 36 gr. 1 min. Maxima vero declinatio Solis sive Zodiaci obliquitas fit 23 gr. 35', quam tamen, sine ullo examine, immutatam supposuere Astronomi omnes hoc nostro seniores, qualem Ptolemæus ab Hipparcho receperat, nempe 23 gr. 51 min. 20 sec. Cap. IV. Deinceps.

Anno 1194 Dhilcarnajin sive Anno 1206 ab obitu Alexandri, hoc est, Anno post Christum natum 882, die 19no Mensis Elul sive Septembris, 4 h. 45' ante Solis exitum, in Arracta observabatur Æquinoctium Autumnale. Hoc est Septemb. 18º 13 h. 15' P. M. Factaq; collatione cum observatione Ptolemæi Anno tertio Antonini habita, hoc est Anno Christi 139 Sept. 26. hora unâ post ortum Solis, sive Sept. 25º 19 h. Alexandria, ex intervallo 743 Annorum, colligitur spatium Annuum sive quo Sol ad æquinoctia revolvebatur. 365 dierum 5 h. 46' 24'', motumq; ejus in Anno communi 11 s. 29º 45' 46'' 25'''  $\frac{1}{2}$ , aliquantum justo celeriores. Quod quidem evenit ex eo quod Ptolemæum, arte ac industriâ ne dicam fide Hipparcho longe inferiorem, hoc in negotio prætulit; cum scilicet jam pro comperto habeamus Ptolemæi æquinoctia nullo modo cum aliorum observationibus conciliari posse, ut potius ficta quam cœlitus deprompta credere liceat. Hæc Cap. XXVII. traduntur.

Deinde Cap. XXVIII. refert Albatenius Æquinoctiorum intervalla, qualia multo labore ac diligentia ipse plurimum annorum repetito experimento determinaverat. Scil. ab æquinoctio Autumnali ad Vernali intercedere 178 dies 14 h. 30', a Vernali vero ad Autumnale æquinoctium 186 dies 14 h. 45', cui etiam plus fidei adhibet Author. Eademq; curâ Solis in quadrante vernali moram, sive a principio Arietis ad Solstitium æstivale, definivit 93 dierum ac 14 horarum. Ex quibus datis, calculo debite instituto, totam Solis Eccentricitatem 2º 4 $\frac{1}{4}$  statuit, qualium Radius Eccentrici est 60 : vel 3465 qualium radius est 100000. Apogæon vero Solis tunc temporis, viz. Anno Christi 882,

Gemi-

Geminorum 22 gr. 17' tenuisse similiter demonstratur; idq; mobile, una cum stellis fixis, singulis 66 annis Julianis gradum unum conficere docetur, Cap. XXXIII. ac LI. unde provenit motus ejus annuus 54" 33'''

His positis principiis numeros Albatenii qui Solis motum spectant haud difficulter restaurare possumus. Ac inito calculo proveniunt Radices motuum, incuntibus Annis Christi, sub Meridiano Arractensi.

Anno Christi	Apog. $\odot$				Med. motus $\odot$			
	s	o	'	''	s	o	'	''
881	2	22	16	5	9	14	24	42
882	2	22	17	0	9	14	10	28
883	2	22	17	55	9	13	56	14
891	2	22	25	12	9	14	0	42
901	2	22	24	19	9	14	35	52

Logarithmus autem pro equatione Solis 9.969888.

Ut autem corrigantur Librorum impressorum graviora errata sensumq; turbantia, praesertim in Numeris ubi de Solis motu argumentatur, utramq; Editionem sic emenda.

Edit. Bonon		Edit. Norib.		pro.	lege.
pag.	lin.	pag.	lin.		
66	15			20 dies.	70 dies.
	21	27 b	7	300.	300 annos.
	28		13	Tamenith.	Phamenoth.
	31		15	36 modo.	463.
	31		16	Mufræ.	Mefori.
67	5		25	60 annos.	600 annos.
	11		31	186.	286.
68	7	28 a	18	31 quart.	32 quart.
	19		28	55 quint.	53 quint.
69	18	28 b	11	14 horis.	14 hor. 45'
70	19		31	PKLM.	PKLMT.

Edit.

Edit. Bonon		Edit. Norib		pro.	lege.
pag.	lin.	pag.	lin.		
70	25	28 b	37	80.	180.
	31		42	6 secund.	10 secund.
	32			59 min.	58 min.
71	12	29 a	23	59 sec.	29 sec.
	17		30	58 min.	59 min.
201	ult.	79 b	38	2 gr. 22 min.	5 gr. 55 min.
202	11	80 a	6	20 min.	50 min.

Ex hoc specimine conjectare licet quali castigatione indigeat liber iste, cum tam paucis paginis etiam numeri toties vitiati reperiantur: ut taceam verborum ac literarum errata ut leviora.

Præcipuas vero Observationes suas tradit Cap. XXX. quatuor scilicet Eclipses, duas Solares totidemq; Lunæ.

Primæ Solaris medium observatum est Arractæ Anno 1202. Dhilcarnajin sive ab obitu Alexandri 1214, hoc est, Anno Christi 891, die octavo Mensis Ab sive Augusti, horâ unâ temporali post Meridiem; hoc est (occidente Sole horâ 6 h. 45') 1 h. 7 $\frac{1}{2}$  P.M. ac tum defecit in Sole plus duabus tertiis vel octo digitis. Tempore autem veræ Conjunctionis, quam medium Eclipsis octavâ horæ parte præcessisse computat, sive 1 h. P. M. æquate vero 1 h. 4' juxta Albatenii Tabulas motus supputati sic se habebant.

	s.	°	'	
Solis Locus medius	♌	20	54	
Solis Locus verus	♌	19	14	°
Lunæ motus medius	♌	17	6	pro 17 50
Anomalia Lunæ correctâ	♌	11	3	7 pro 2 57
Argumentum Latitudinis medium		5	24	43
Argumentum Latitudinis verum		5	26	51 pro 26 11
Ideoq; tempore medii Eclipsis		5	26	55 pro 27 11
Unde Latitudo } vera Septen- trionalis }		0	0	16

Concluditque numeros Ptolemæi integrâ horâ citius quam observatum est, hanc Eclipsin representare.

Alterius Solis Eclipsis medium Antiochiæ visum est, Anno Dhilcarnajin 1212 ( pro 1205 ) sive Anno à morte Alexandri 1224 ( pro 1554 ) hoc est, Anno Christi 901, die 23<sup>o</sup> Mensis Canun ( non Huni ) secundi, sive Januarii, 8<sup>h</sup>. 20' A. M. vel Januarii 22<sup>o</sup>. 20<sup>b</sup>. 20'. Arractæ vero 20<sup>b</sup>. 32'. Ac quantitas deficiens parum excedebat centrum Solis sive sex digitos. Mediumque Eclipsis 50 minutis ( non horæ dimidio, ut habent libri impressi, pro dimidio ac tertio ) veram conjunctionem præcedere debuit, quam proinde fuisse constat 21<sup>h</sup>. 22'. Arractæ: Tempore vero æquato 21<sup>h</sup>. 37'. quo Motûs ex Tabulis Authoris sic inveniuntur.

	s	o	'
Locus Solis medius	≈	7	9
Locus Solis verus	≈	8	35
Lunæ motus medius	≈	12	49 s
Anomalia Lunæ correctâ	4	6	35 pro 5 6 55
Argumentum Latitudinis medium	5	23	25 pro 5 23 55
Argument. Lat. verum	5	19	11 pro 5 19 41
Ideoque tempore medii Eclipsis	5	18	45
Unde vera Latitudo Lunæ Borea	o	59	

Secundum Ptolemæi vero numeros hanc Eclipsin totis duabus horis tardius contingere debuisse affirmat.

Ex Eclipsibus Lunaribus prima observata est Anno 1194 Dhilcarnajin, vel 1206 à Morte Alexandri, sive Anno Christi 883. die 23<sup>o</sup> mensis Tamuz ( pro 53 Temur vel Zemur ) vel Julii. Mediumque in Arracta apparuit 8 horas & aliquid amplius Post Meridiem; pone 8 h. 5 min. id est, æquate 8 h. 9 min. Defectusque parum ultra decimum digitum attigit. At juxta Numeros Authoris tenere tunc temporis.

	s	o	'	o	'
<i>Sol medio motu suo</i>	♁	5	21	pro	5 51
<i>Locus ejus verus</i>	♁	4	1	pro	4 5
<i>Luna autem medio motu</i>	♃	8	45		
<i>Anomalia Lunæ media</i>	3	23	8	pro	93 0
<i>Anomalia autem correctæ sive æquata</i>	3	24	10	pro	94 10
<i>Argumentum Latitudinis medium</i>	6	10	49		
<i>Argument. Latitudinis verum</i>	6	6	5		
<i>Unde Latitudo ) Austrina</i>		0	32		

*Error autem Ptolemæi in hac Eclipsi, est trium horæ quadrantium, quibus Medium citius observato ex numeris ejus supputatur.*

*Secunda vero Lunarium erat Anno 1212 Dhilcarnajin, vel 1224 à morte Alexandri, Annove Christi 901, die secundo Mensis Ab sive Augusti; ☾ Observabatur Medium Antiochiæ 15<sup>h</sup>. 20'. P. M. id est, Arractæ 15<sup>h</sup>. 35' fere, æquate vero 15<sup>h</sup>. 39'. Ac Lana fere tota deficere visa est. Tunc temporis Elementa calculi juxta Albatenium colliguntur.*

	s	o	'	o	'
<i>Solis Locus medius</i>	♁	16	10		
<i>Solis Locus verus</i>	♁	14	36		
<i>Lunæ Locus medius</i>	♃	19	24	pro	19 54
<i>Anomalia Lunæ media</i>	3	20	7		
<i>Anomalia Lunæ æquata</i>	3	21	5	pro	91 5
<i>Argumentum Latitudinis medium</i>	6	10	10	pro	109 10
<i>Argument. Latit. verum</i>	6	5	21	pro	185 51
<i>Unde Latitudo Lunæ Austrina</i>	0	0	28		

*Ptolemæi vero numeri hanc Eclipsin 50 fere minutis citius quam observatum est promittunt.*

*Vides ex his numeris, quasi tot errores quot veros reperiri, ideoq; haud levi studio emendandos fuisse: ne, tamen correctionis nomine temere eos immutasse videar, Radices mediorum motuum Lunæ, Apogæi ☽ Nodi, quales ipse Albatenius in his*

computationibus supposuit, adjungere placuit, ut cuilibet experiri liceat qua fide hæc observata tractavimus. Radices autem sive Epochæ Lunarium motuum ab Æquinoclio, ineuntibus Annis Christi sub Meridiano Aractenti sic proveniunt.

Annis Christi.	Mot. Med. ☽			Apog. ☽			Nodus Asc. ☽		
	s	o	'	s	o	'	s	o	'
881	7	27	29	3	01	33	5	17	25
882	0	6	53	4	12	12 $\frac{1}{2}$	4	28	5
883	4	16	16	5	22	52 $\frac{1}{2}$	4	8	45
891	3	27	42	4	18	25	11	4	1
901	0	11	4	6	5	23	4	20	36

Multas etiam alias Eclipses Lunares se observasse testatur Author, quas cum Tabulis suis congruentes invenit; adhibita maximâ in Syzygiis æquatione 5 gr. 1 min. qualem eam statuit Ptolemæus, ac qualem etiam hoc nostro sæculo Cælo conformem experimur.

Stellarum autem fixarum Loca duo tantum reperiuntur, ab hoc Authore ad suum seculum verificata; ad annum scil. Dhilcarnajin 1191 sive Annum Christi 880: Invenit autem Cor Leonis tunc temporis occupare gradum 14°. 0'. Leonis; Boream vero frontis Scorpii  $\text{m}$  17°. 20'. seu potius 17°. 50'. Aliter non constabit intervallum 11°. 50'. inter loca, ante 783 annos iisdem à Ptolemæo tributa, ☽ à seipso observata, unde etiam statuitur Stellas fixas singulis 66 annis gradum unum progredi, atq; una Solis Apogæon. Quod si revera scripserit Locum hujus Stellæ  $\text{m}$  17. 20. ut habetur in libris impressis, majorem certe his observationibus fidem postulat, cum differentia locorum Cordis  $\text{m}$  ☽ Boreæ frontis  $\text{m}$ , certissimis nostris observandi Methodis 93°. 20'. proveniat, ubi Ptolemæi Catalogus dimidio gradu abundat. Albatênii Cap. LI.

Optassem quidem in aliqua ex instructissimis Europæ Bibliothecis Albatênii exemplar Arabicum reperiri posse; unde has nostras emendationes comprobare liceret; ac Linguam istam callentes exoratos velim, at hæc pauca saltem quæ observationes spectant, cum MSS. conferre ac nobiscum communicare non grave ducant. Non quod verear me errare posse in deducendis his numeris, fidissimis Astronomiæ principiis fretus; sed quia Doctis quamplurimis, quibus fortasse Argumentum de immutato Tempore annuo non displicebit, harum emendationum ratio minime patebit, nisi hujus Scientiæ principiis imbuantur. Hic vero obiter notare licet Æram Dhilcarnajin à plurimis Chronologistis pro Æra Mortis Alexandri assumi, nominis ratione reddita, quod Alexander vocaretur Bicornis, quasi in Orientem ac Occidentem utrinque propagato Imperio. Æra autem nostra duodecim annis Morte Alexandri posterior est; unde liquet, non ad eum sed ad ejus successores Vocabulum istud referri. Dhilcarnajin autem proprie dicitur Bicornis, unde conjectura est hanc Æram inchoasse à bipartito Orientis Imperio inter Antigonum & Ptolemæum, quod sub Persis ac Alexandro diu indivisum manserat. Vel fortasse ab initio Regni Seleuci Nicatoris dicti, cujus Statuæ Bicornes fugebantur teste Appiano. Idemque in Numismatis ejus etiamnum conspicitur. Cornu autem passim pro Gloriâ ac Majestate etiam apud Sacras Literas reperitur. Incepere vero Anni hujus Æræ à Mense Elul sive Calendis Septembribus Julianis, cæterique Menses Julianis ubique pares, ut ex his etiam observationibus constat.

V. *An Account of the true Cortex Winteranus, and the Tree that bears it.* By Hans Sloan, M. D. and S. R. S.

ONE of the Ships which went out with Sir *Francis Drake*, when he went round the World, whereof Captain *Winter* was Commander, brought into *England* from the Straits of *Magellan* an Aromatic Bark, which had been very helpful to those of his Ship, both used instead of other Spices, with their Meat, and as a Medicine very powerful against the Scurvy. *Clusius*, from some that came over in that Ship, describes and figures it in his *Exotics*, lib. 4. c. 1. p. 75. calling it, *Cortex Winteranus*, from the Commander of the Ship his Name, and the Tree *Magellanica Aromatica Arbor*, ib. p. 77. The Writer of the Journal of the *Dutch Ships*, that went to the Straits of *Magellan* about 1599. takes notice of it to grow there, calling it (*De Bry. Ind. Occid.* p. 9. p. 18.) *Lauro similis arbor licet procerior, Cortice piperis modo acri, & mordenti.* And *Sebald de Wert*, who was there, says, that both Leaves and Bark were used with their Meat and Muskles, to correct them in so cold a Climate. *Dalechampi*, in the *Historia Lugd.* describes and figures this Bark likewise, under the Name of *Cortex Winteranus*, p. 1858. and so does *Parkinson*, p. 1652. *Caspar Bauhin*, in his *Pin.* p. 461. calls it *Laurifolia Magellanica Cortice acri.* And *Jonston*, in his *Dendrologia*, p. 232. *Arbor Laurifolia Magellanica.* Those likewise who passed the *Magellanic Straits* with Sir *John Narborough* about 1669. took notice of this Tree and Bark. But no body that I have seen has given so good or full an Account of it as Mr. *George Handisyd*, who came from thence about two or three Years

Years since, and being very Curious and Understanding in these Matters, did bring with him a Specimen or Sample of its Leaves and Flowers on the Twig, which is figur'd N<sup>o</sup>. 1. and its Seed, figured N<sup>o</sup>. 2. and likewise told me the several Particulars relating to it, in the following Description, by which I cannot reduce it to any of our kind of Plants, so well as to the *Periclymenum*, and therefore shall call it, tho' it differs in many things from the Honyfuckle,

*Periclymenum rectum foliis laurinis Cortice acri Aromatico.*

He assured me that this Tree rose to be higher and larger than an Apple-Tree, spreading very much both in Root and Branches. The Twigs had on them Leaves of a light-green colour on their upper side, standing on  $\frac{1}{2}$ -Inch-long foot-stalks, are an Inch and half long, and an Inch broad in the middle where broadest, and whence they decrease to both ends, ending blunt. The Flowers come *ex alis foliorum*, standing on  $\frac{1}{2}$ -Inch-long foot-stalks, two, three, or more of them together, something like those of the *Periclymenum*; each of them are Milk-white, Pentapetalous, and smell like Jasmine, to which succeeds an Oval Berry, made up of two, three, or more Acins or little Berries, standing together on the same common foot-stalk, of a light-green colour with some black spots; and in these Berries are contained several black Aromatic Seeds, something like the stones in Grapes.

It grows in the middle of the Straits of *Magellan* very plentifully.

The Leaves of this Tree were used with other Herbs by Mr. *Handisyl* for Fomentations in several cases with very good success: But he admired most the use of the Bark inwardly, boyling half a Dram of it with some Carminative Seeds, and giving it so to those of the Ship who were under his Care, very much afflicted with  
the

the Scurvy : It usually sweated them, and they were very much relieved. The same Medicine likewise he administred to a great many of the Ship, who were very ill by eating a poysonous sort of *Seal* in those Parts, called a *Sea-Lion*, with which they had a very great Amendment, although they had been so ill with feeding on this Creature, as to loose most of their skins, which peeled off their Bodies by degrees, and in large pieces; so that the Antidote to this strange Poyson was to be had very near it, and was very much extolled by this Gentleman, who was put to a stand to know what to do in this strange case, although he very well understood the *Materia Medica*.

By the preceding Description, and Figures relating to it, compared with those of N<sup>o</sup>. 192. of these Transactions, it will very easily appear, that the *Cortex Winteranus*, commonly sold in the Shops, is not the True *Cortex Winteranus*. But I must needs say, tho' they are the Barks of two very differing Trees, and growing in very differing places, and appear quite another thing in their outward face, yet their taste is much the same, and I believe they may be used as a *Succedaneum* one for another, tho' if the true were to be had in plenty, it were much to be valued beyond the false, being much more Aromatic.

VI. *Pharmacologia seu Manuductio ad Materiam Medicam in qua Medicamenta Officinalia Simplicia, hoc est Mineralia, Vegetabilia, Animalia eorumque partes, in Medicina Officinis usitata, in Methodum naturalem digesta succinctè & accurate describuntur, cum notis generum Characteristicis, Specierum Synonymis, differentiis & viribus. Opus omnibus Medicis, Philosophis, Pharmacopœis, Chirurgis, & Pharmacopolis utilissimum.* A Samuele Dale.

THE use of the *Materia Medica* seems to be as old as Mankind, whose Infirmities springing up early, call'd for Remedies, which Instinct or Necessity first dictated, afterwards Observation and Experiment improv'd. The  *Egyptians*  inscrib'd their Medicines on Pillars in the High-ways, and on the Walls of their Temples in great Cities, for the publick Instruction and Preservation of the People. The  *Greeks*  taking their Rudiments from them, cultivated the  *Medicinal Art* , which by the peculiar Fertility of their  *Genius*  was rais'd to such a Perfection, that succeeding Ages being not able to continue its growth, suffered it to degenerate. The  *Romans*  (tho' extreamly civiliz'd) thought it Honour enough to Transcribe, or Epitomize the  *Greeks* ;  *Scribonius Largus* ,  *Celsus* , and  *Pliny*  were only  *Copists* .  *Hippocrates* ,  *Aristotle* ,  *Theophrastus* ,  *Dioscorides* , &c.  *Originals* ; which  *Galen*  afterwards did indeed refine upon, but the  *Latines*  invented little or nothing. The  *Arabians* , tho' very Luxurious in Fancy and Imagination,

corrupted the *Greek Purity*; so that the *Materia Medica* lay in great Disorder and Obscurity, till the Navigation to both *Indies* was detected and opened; then the *Spaniards* and *Portugueses* began to describe the Physical Drugs bought up by the Merchants, but their Histories are very lame and imperfect, and consequently *Schroder*, who compos'd out of them: Since his time many *Officinals* have been fully illustrated in Print, and in Manuscripts, both by the *Dutch* and *English*, out of which the Ingenious Author has compil'd the present Work in a most Natural, most Easie, and Perspicuous Method, being assisted by some learned Friends; so that very little (except a few Uses) is taken from *Schroder* (as will appear by comparing them) the Body and Frame being altogether different, and the Discoveries of a later date; the whole Piece therefore may be justly esteem'd new, and consequently very Useful, being the Result of many Voyages and Iteneraries to the Remote Parts of the World, and the Effect of many Admirable Observations daily made in the *Indian Colonies*.

The many Impostures and Cheats which the Dealers in *Drugs* and Physical *Herbs* do daily commit, gave occasion to our Author of Publishing this small Tract, in which, after having given an Explication of divers of the Terms of Art used among *Mineralogists*, *Botanists*, and *Zoologists*, and a short Description of most of the *Utensils* of the *Apothecary's* and *Chymist's* Shops, he doth premise something in General concerning the Collection, Duration, Time, Manner, and Place of Preserving *Simples*, together with their Vertues, Uses, and Chymical *Analysis*, with a short Account of the General Division or Method of the Book.

These being premised, our Author proceeds to the Work it self, which he divideth into four Books: The first of which Treats of *Minerals*, and contains six *Sections*. The first concerning *Waters*, which are either  
Simple



Fig: 4.

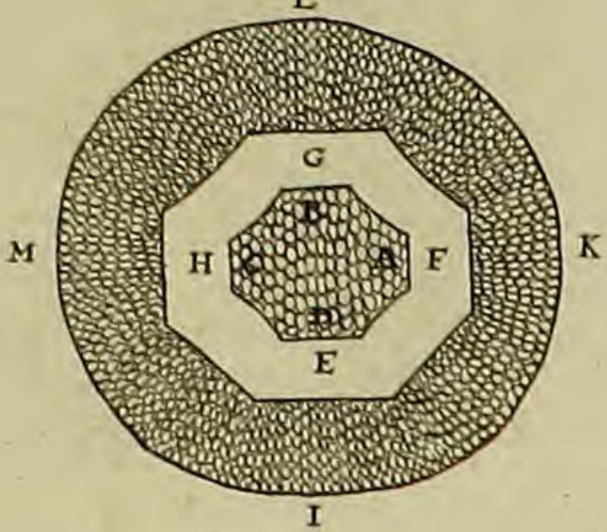


Fig: 8.

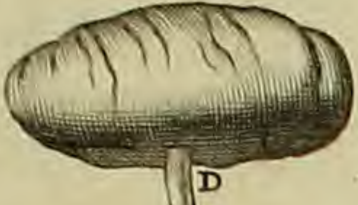


Fig: 18.

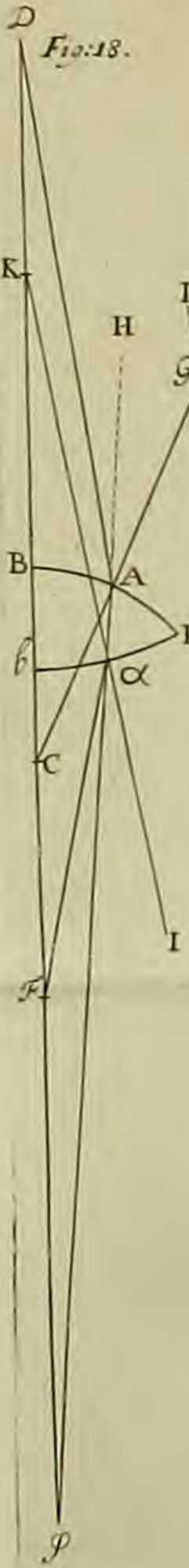


Fig: 9.

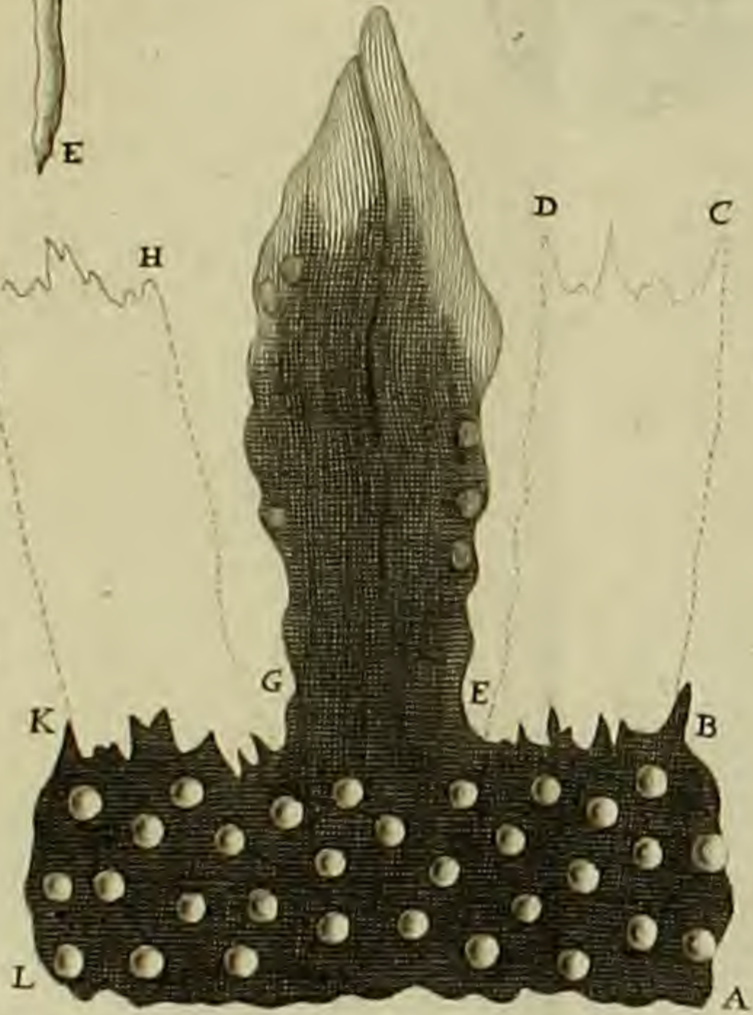


Fig: 10.

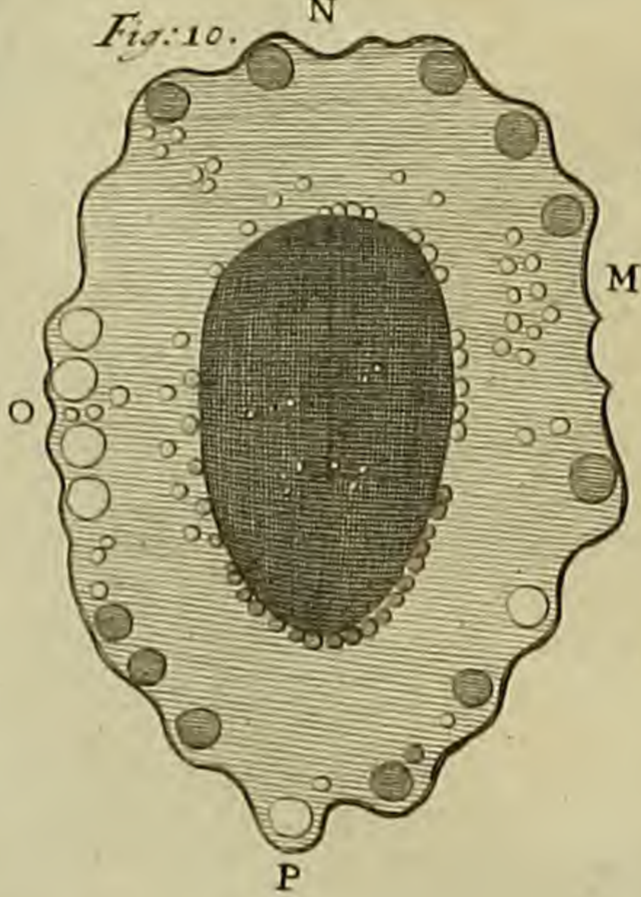


Fig: B.



Fig: 7.

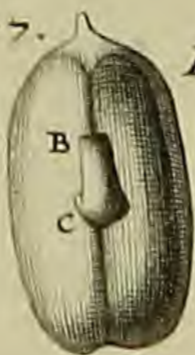


Fig: 6.



Fig: 5.



Fig: 3.

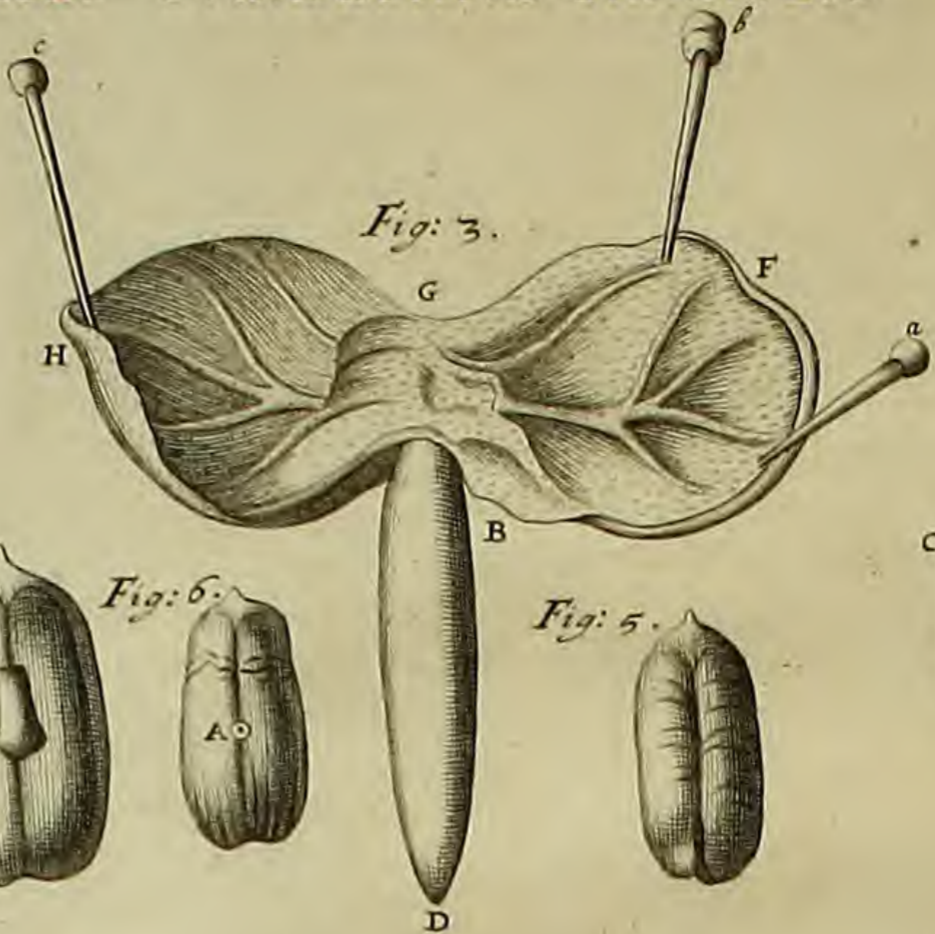


Fig: 1.



Fig: 2.

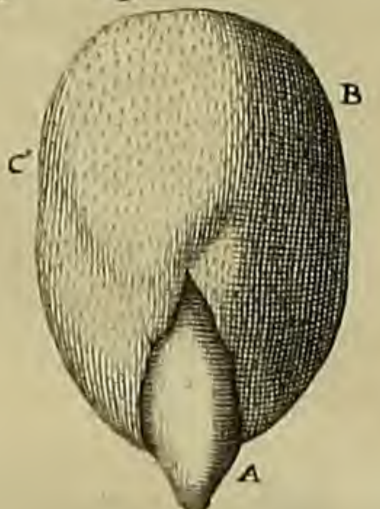


Fig: 17.

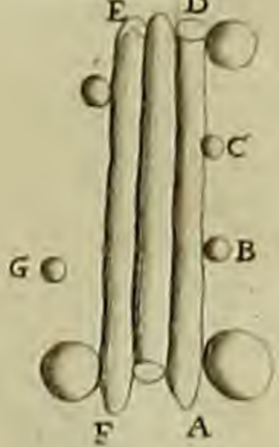


Fig: 14.



Fig: 12.



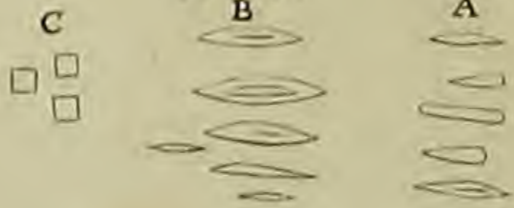
Fig: 11.



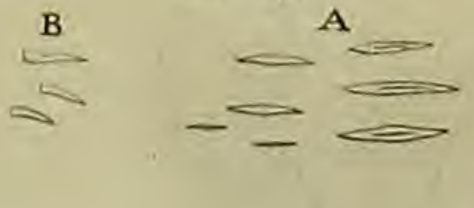
Fig: 13.



N° 16.



N° 15.



Simple or Mineral. Secondly, *Earths*, and they are of four sorts, *Boles*, *Clays*, *Marles*, and *Chalks*. The Third Section is of *Sulphurs*, *Arsenicks*, and *Bitumens*. The Fourth treats of *Salts*, as *Sal communis*, *Sal Gemmæ*, *Nitrum*, *Alumen*, *Borax*, and *Vitriolum*. The Fifth contains *Metallick Fossils*, which are divided either into *Oars*, as the *Cinnabaris*, *Hæmatitis*, &c. or *Bastard Metals*, as *Antimonium*; or *Perfect Metals*, as *Argentum*, *Plumbum*, *Cuprum*, &c. The Sixth and last Section is of *Stones*, which are either such as are not Precious, as *Lapis Calaminaris*, *Hybernicus*, &c. Or Precious, and they are either Opake or Diaphanous, which are generally called *Gems*.

The Second Book treats of *Plants*, and is divided into three *Classes*; the first of which is of such Plants as are of a stony Substance, as *Corallium* and *Corallina*.

The Second Class is of *Herbs*, and is divided into 25 Sections, in which our Author for the most part following the Method of that most Ingenious Botanist, the Learned and Judicious Mr. *John Ray*, in his Excellent *Historia Plantarum*, of which a large Account as to its Divisions, &c. having already been published in these *Transactions*, N<sup>o</sup>. 186. pag. 283. I shall in this place say no more, but shall refer the Curious thither.

The Third and last Class of this Second Book is of *Trees* and *Shrubs*, and contains 11 Sections. The first of which is of such Trees as have a single stem without any Branches, and produce but one Bud, as the *Palma*. Then our Author proceeds to such Trees and Shrubs as are branched, or have Boughs and Twigs; and in the second Section treats of such as have their Fruit disjunct from their Flower, and they are either *Nuciferous*, as the *Juglans*, and *Corylus*: Or *Glandiferous*, as the *Castanea*, *Quercus*, &c. Or *Coniferous*, as the *Abies*, *Sabina*, &c. Or *Bacciferous*, as the *Juniperus*.

Or Lastly, *Lanigerous*, as the *Populus* and *Salix*. After these he comes to treat of such Trees and Shrubs as have their Flower and Fruit contiguous. And in the Third Section, of such Trees and Shrubs whose Flower and Fruit are *Aggregate*, as the *Ficus*, *Morus*, *Piper Longum*, and *Liquid Amber*. The Fourth Section contains such Trees and Shrubs as have an *Umbelicated* Fruit; that is, such whose Flower stands upon the top of the Fruit, the *Calyx* whereof makes a sort of *Umbell*; and they are either *Pomiferous*, as the *Malus*, *Pyrus*, *Granatus*, &c. or *Bacciferous*, as the *Ribes*, *Myrtus*, *Garyophyllus*, *Cortex Winteranus*, &c. He then proceeds to such Trees and Shrubs as have their Flower at the bottom of the Fruit. And in the Fifth Section comprehends such which have the *Calyx* of their Flower *non deciduous*, in which the Fruit standeth as in a Cup, and these he calls *Calyculated* Fruits; as the *Sebestena*, *Agnus Castus*, *Sassafras*, *Cinnamomum*, *Camphora*, *Styrax*, and *Canella alba*. These being dispatch'd, our Author comes to treat of such Trees and Shrubs which have their Flowers and the *Calyx's* thereof *diciduous* together. And in the Sixth Section begins with the *Pruniferous*, that is, such as have a large Fruit covered with a tender Skin, containing one large stone within a Juicy Pulp, especially when ripe, as the *Prunus*, *Cerasus*, &c. The Seventh Section comprehends the *Bacciferous* Trees and Shrubs, that is, such whose smaller Fruit doth contain in a Pulpy Juice one, two, three, four, or many Seeds: Those with but one Seed or Stone, are the *Balsamum*, *Terebinthus*, *Cububæ*, *Coculus Judus*, &c. Those with two Seeds are *Jasminum*, *Ligustrum*, *Berberis*, &c. With three Seeds the *Sambucus*. With four, the *Vitis*, *Thea*, *Agrifolium*, &c. Lastly, with many Seeds, the *Rubus*, &c. The Eighth Section contains the *Pomiferous* Trees and Shrubs, and these are all *Polypyrene*, and they are either such as have a fleshy and tender Rind or Peel, as the

the *Aurantia*, *Citrus*, *Cambogium*, &c. Or such as have their Pulp contained in a hard shell, as the *Nux Vomica* and *Cacao*. The Ninth Section treats of such Trees and Shrubs whose Fruit when ripe is dry, as the *Laurus*, *Coffee*, *Piper rotundum*, *Guajacum*, *Ulmus*, *Fraxinus*, &c. The Tenth Section comprehends the *Siliquose* Trees and Shrubs, and they are either such as have a *Uniform* Flower, as *Senna*, *Glans Unguentaria*, *Cassia Fistula*, *Tamarindus*, &c. or such as have a *difform* or *Papilionaceous* Flower, as the *Genista*, *Acacia*, *Caroba*, *Brasilia*, &c. The Eleventh and last Section of this Book is of some parts of Plants which are of use in the *Shops*, which because for want of a good Account thereof they could not be reduced to the foregoing Method, are therefore ranged either as *Roots*, as the *Rhodium*, or *Barks*, as the *Cortex Thuris*; or *Woods*, as *Lignum Aloes*, &c. Or, lastly, *Gums*, as the *Olibanum*, *Bdellium*, and *Canca-mum*.

The Third Book contains *Animals*, which by our Author is divided into two *Classes*, and in the first treats of *Exanguious Animals*, which are divided into two Sections, in the first of which he comprehends *Insects*, which are either *Apoda*, as the *Sanguisuga* and *Lumbricus Terrestis*, or *Pedata*, which are either *Non Alata*, as the *Pediculus*, *Ricinus*, *Scorpio*, *Millepedes*, &c. or *Alata*, and they are either *Anelytra*, as the *Musca*, *Apes*, *Formica*, *Cicada*, *Bombix*, &c. or *Coleoptera*, which are either *Scarabæi*, as *Cantharides*, *Cochinilia*, &c. or the *Cicindela*; or lastly, the *Proscarabæus*. The Second Section contains the greater *Exanguious Animals*, which are either *Mollia*, as the *Sepia*; or *Testacea*, which are either *Univalvia*, as the *Dentalium* and *Entalium*; or *Turbinata*, as the *Cochlea*, *Blatta Byzantina*, *Buccinum*, and *Purpura*: or *Bivalvia*, as the *Ostreum*, *Mater Per-larum*, *Unguis Odoratus*, &c. Or, lastly, *Crustacea*, as the *Astacus fluviatilis*, *Cancer Marinus*, &c.

The

The Second Class is of *Sanguineous Animals*, and is divided into Four Sections; and in the first our Author treats of *Fishes*, and begins with such as are *Auguilliform*, or which have slender smooth Bodies without *Scales*, or at least very small ones, as the *Auguilla*, *Mustela*, and *Lupus Marinus*: He then descends to such as have a more contracted Body, and those are either *Marine*, having but one *Fin* on their backs, whose *Rays* are not *Aculeate*, as the *Harengus*, *Encrasicholus*, *Sturio*, and *Ichthyocola*. Secondly, such as are *Fluviatile* with but one *non aculeate Fin* on their backs, having *Teeth* in their Mouths, as the *Lucius*. Thirdly, *Fluviatile Fishes* as aforesaid, but without *Teeth*, as the *Cyprinus*, *Tinca*, and *Barbus*. Fourthly, *Fishes* which have two *non aculeate Fins* on their backs, as the *Thymallus* and *Trutta*. Fifthly, such as have two *Fins* on their backs *aculeate*, as the *Perca* and *Mugil*. Sixthly, *Cartilagineous Fishes*, as the *Galeus acanthias*. Seventhly, and lastly, *Cetaceous Fishes*, as the *Monoceros*, *Orca*, and *Balæna*.

The Second Section contains *Birds*, and they are either *Aquatick* or *Terrestrial*; the *Aquatick* are of two sorts, First, *Fissipedes*, as the *Grus*, *Ardea*, and *Ciconia*. Secondly, *Palmides*, as the *Cygnus*, *Anser*, and *Anas*. The *Terrestrial* are either *Majores* or *Minores*. The *Minores* are again divided according to their Bills, into, First, such as have *Long-Bills*, as the *Ispida*. Secondly, such as have slender or soft *Beaks* or Bills, as the *Alauda*, *Hirundo*, *Passer troglodytes*, &c. Thirdly, such as have hard *Beaks* or Bills, as the *Passer vulgaris*. The *Majores* are likewise divided into three sorts: As First, such as have thick, strong, and longish Bills, as the *Corvus*, *Pica*, &c. Secondly, such as have shorter and lesser Bills, as the *Gallinaceous* and *Columbaceous* kinds. And lastly, into those which have crooked *Beaks* or Bills, as the *Aquila*, *Vultur*, &c.

In the Third Section is comprehended the *Serpentine* kind, and they are either *Apoda*, as the *Serpens* and *Vipera*; or *Pedata*, which are either *Caudata*, as the *Lacertus*, *Scincus*, &c. or *non caudata*, as the *Rana* and *Bufo*.

The Fourth and Last Section is of *Quadrupedes*, which are divided into *Ungulata* and *Unguiculata*. The *Ungulata* are of three sorts (*viz*) First, *Solidungula*, as the *Equus*, *Asinus*, &c. Secondly, *Bifulca*, which are either *Ruminantia*, as the *Bovinum* genus, *Ovis*, and the *Caprinum* and *Cervinum* genera: Or *Non Ruminantia*, as the *Porcus* and *Aper*. Or Lastly, *Quadrisulca*, as the *Rhinoceros* and *Animal Moschiferum*. The *Unguiculate* are the *Elephas*, *Equus Marinus*, *Lepus*, *Castor*, *Ursus*, *Animal Zibethicum*, &c.

The Fourth and last Book is the *Anthropologia*, in which the Parts of a *Humane* Body which are of use in the *Shops* are enumerated; and these are divided into two *Sections*, and in the first are contained those which are taken from a *Living Body*. And Secondly, such as are taken from a *Dead Body*.

And Lastly, is added a small *Appendix* of some very few things omitted in the Work.

Having run over the *General Method* and *Division* of the Work, I shall descend to the particular Method thereof, which is this: At the beginning of each Book you have a *General Scheme*, or *Philosophick Table* of all the Heads or Sections in that Book: Likewise at the beginning of each subsequent Section you have a particular *Scheme* of all the Heads in that Section. Each Section doth likewise contain so many Chapters as there are distinct Heads: In each of which Chapters you have,

have, first, the *Characteristick* Note, whereby it may be distinguished from others, which are chiefly taken from the Extant Works of that great and learned Enquirer into Nature, Mr. *John Ray*. Secondly, you have the Names of each thing in *Latine* and *Englisch*, not only how it's called in the *Shops*, but by the latest and most *Classick* Authors. Thirdly, you have the Place where each thing is Naturally to be found, and in the *Herbs* the time of flourishing. Fourthly, you have an Account of what parts of each are used in the *Shops*, with short, but pertinent *Descriptions* thereof. And Fifthly, you have a *Compendious* Account of their *Vertues* and *Physick* Uses, which are chiefly excerpted from the learned *Schroder*. After which you have frequently many Useful and Curious *Observations*, some few of which I shall briefly present you with according to the Order of the *Books*, and for the rest refer you to the Work it self.

In the First Book, treating of *Earths*, our Author takes notice of Nine sorts of sealed *Earths*, which he hath observed to be sold by the Drugists of *London*, under the Title of *Terra Sigillata*, and doth not doubt but many more may be found among them. Among *Sulphurs* he observes, that if *Orpiment* be the Natural Oar of *Gold*, as some affirm, then that *Metal* cannot have those *Alexipharmick* and *Cardial* Vertues that are ascribed to it by *Authors*. *Amber* and *Amber-grise* he takes to be *Mineral* Juices, and therefore rangeth them among *Bitumens*. Among the *Salts*, he observes that our Modern *Nitre* is a *Fossil* Salt, differing from the *Nitre* of the *Ancients*; and that *Vitriol* is not properly a *Salt*, but a *CrySTALLIZED Metal*. And concerning *Stones*, especially *Gems*, he doth believe that there are many things affirmed concerning them by *Authors*,  
which

which are either Fabulous, Doubtful, or at least Superstitious.

In the Second Book he takes notice that the true *Rubarb* is not a *Dock*, but the Root of a Plant with a *Pentapetalous* Flower; and that the *Rhabarbarum* of *Alpinus*, which in our Gardens is called *Rubarb*, is the true *Rupontick*, which ought to be used in the *Shops* instead of the Root of a *Centaurium Majus*, which is frequently sold for it. Concerning the *Been album* & *rubrum*, he enumerates the many Controversies among Authors, both Ancient and Modern, and the Root of what Plant each would have it to be; and concludes, that if the *Papaver Spumeum* is not the *Been album*, and the *Limonium* the *Been rubrum*, which by reason of the imperfect Descriptions of the *Arabians*, he dares not aver, yet may they not improperly be used as their *Succedaneums*. *Contra-yerva* is the Root of a *Pomiferous* Herb; as are *China* and *Sarsaparilla* of *Bacciferous*: *Jalapium*, *Mechoacanna* and *Turpethum* are the Roots of divers Species of *Convolvuli*: *Opium* he proves to be the Concret Spontaneous Juice of a *Poppy*. He excellently proves the *Amomum verum* to be a sort of *Cardamomum*, as is also the *Malegneta*, or *Grana Paradisi*: Unto which Tribe also belongs the *Curcuma*, *Costus*, *Galanga*, *Zedoaria*, *Zerumbeth*, and *Zinziber*. *Nardus Indica* he makes the Root of a *Cyperus*.

Among Trees and Shrubs he demonstrates *Terra Japonica* not to be an *Earth*, but the condensed Juice of the Fruit of the *Fausel*; *Balsamum è Toly* the *Resine* of an *American Pine*. *Cocculus Indus*, and *Nux Vomica*, are, the one of a *Bacciferous*, and the other of a *Pomiferous Asa-fœtida*: *Benzoin*, *Cambogium*, *Catanna*, and *Tacamahaca*, &c. by what Trees they are produced. The *Cortex Winteranus* he proves not to be the *Canella Alba* which is sold for it in the *Shops*, but the Bark of another Tree with an *Umbilicated* Fruit growing in *Magellan*. *Manna*

and *Gum Lacca* he clearly shews to be Spontaneous *Exudations*; the first of the *Fraxinus*, and the other of the *Fujuba Indica*, and that by many undeniable Arguments.

In the Third Book he shews you what the *Cochinella* is, with many excellent Observations thereon. The *Blatta Byzantina* he proves to be an *Operculum* of a *Turbinated* Shell-fish, different from the *Unguis Odoratus* of *Dioscorides*, which he takes to be a sort of *Conchylum* or *Bivalve*. *Pearls* he affirms to be only the Diseases of *Bivalve* Shell-fish, and therefore doth not think them endued with those excellent *Vertues* ascribed to them by most Authors. He clears up what the *Dentalium*, *Entalium*, *Purpura*, &c. are. Among *Fishes*, he Observes that the *Lapides Bufonites* are the *Teeth* of the *Lupus Marinus*; and that the *Unicorn's* Horn of the *Shops* is not the Horn of a *Quadrupede* like a Horse, as some feign, but the *Tooth* of a *Fish* of the *Cetaceous* kind; he reckons up the many Opinions about *Sperma Ceti*, and affirms it to be an *Unctuous* Matter to be found in the Brain of a sort of *Whale*, and solves the Reason of its being found floating upon the Sea, as well as in its Natural place. In the Section of *Quadrupedes* our Author well observes the *Bezoar* to be a Stone, generated, or rather encrusted about divers things in the *Ventricles* or *Stomacks* of *Animals*, and is of divers sorts; as *Oriental*, found in a sort of *Goat*, the *Occidental* in an *American Deer*, and the *German* in a sort of *Goat*. Concerning the *Rhinoceros*, he is of Opinion, that he is the only *Unicorn* to be found among *Quadrupedes*, and perhaps may be the true *Unicorn* of the Ancients, whose Horn *Ælianus* affirms to be black, which Conjecture *Andreas Baccius* doth confirm. *Musk* he takes to be an *Excrementitious* Blood, secreted in its proper *Cystis* near the *Navil* of a *Quadrifid* Animal like a *Deer*. *Civet*

he

he affirms to be an *Excrementitious Succus*, by Nature secreted in its proper *Follicule* near the *Anus* of an *Animal* of the *Dog-kind*, and not the *Sperm*, as some have asserted. *Castor* he proves to be the *Scent-bags* adjoining to the *Intestinum Rectum*, and not the *Testicles* of the *Beaver*, as some assert.

In the Fourth and last Book our Author takes notice, that the *Sal Armoniac* of the Shops is a factious *Salt* made of *Human Urine*, *Soot*, and *common Salt*, and is not that of the *Ancients*, which *Pliny* and others affirm to be found among the Sands of *Lybia*. And lastly, Observes that *Mumia* is of four sorts; all which he doth demonstrate. And here I shall finish my Account, recommending to those which desire further Satisfaction in the *Materia Medica* the Book it self, which is of excellent Use to all *Physicians*, *Philosophers*, *Apothecaries*, *Chirurgions*, and *Drugsters*.

## Advertisements.

THE Reader is desired to Correct a Mistake in *Philosophical Transactions*, Numb. 202. p. 824. The *Truffles* there mentioned being discovered at *Rushton* in *Northampton-shire*, by the Learned Physician Dr. *Hatton* of *Harborough* in *Leicester-shire*.

*Libri quidam novi qui prostant apud S. Smith, & B. Walford, ad insignia Principis in Cœmiterio D. Pauli, Acta Eruditorum ab Anno 1682. ad 1692. inclusivè cum tredecem Supplementis.*

*Indices Generales Actorum & Rerum primi Actorum Eruditorum quæ Lipsiæ publicantur Decennii nec non Supplementorum Tomi primi.*

*Genesis five Mosis Prophetæ Liber primus, Translatione Joannis Clerici, cum ejusdem Paraphrasi perpetua, Commentario Philologico Dissertationibus Criticis quinque, & Tabulis Chronologicis. Amst. 1693. Fol.*

*Reliqui Mosis Libri quatuor sub prælo sudant, totum opus in omnes veteris & Novi Testamenti Libros cum Paraphrasi & Commentario ejusdem Authoris in sex Tomis prodibit.*

*Wilhelmi Ernesti Tentzelii Exercitationes selectæ in Duas Partes distributæ: Quarum Priori præter Symbolum Apostolicum, Clementis Romani, Ignatii, Polycarpi, Justinii Martyris, Athenagoræ, Theophili, Antiocheni, Tatiani, Hermiæ, Jacobi Nisibensis, & Ephremi Syri, Scripta expendantur, plerorumque vita præmissa; Tum Constantini Magni Baptismus, Natalitia Episcoporum, Hymnusque, Te Deum Laudamus, illustrantur: Posteriori, Disciplina Arcani in Apricum producitur, aliæque Antiquitatis Ecclesiasticæ Capita explicantur cum Indicibus. Quarto. 1693.*

L O N D O N :

Printed for S. Smith and B. Walford, Printers to the Royal Society, at the Prince's Arms in St. Paul's Church-yard, 1693.

---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of November, 1693.*

---

## The CONTENTS.

I. **A** *N Extract of a Letter from Sir Rich. Bulkeley, S.R.S. to Dr. Lister, concerning the Improvement to be made by the Cultivation of Maize in Ireland; with a Remark thereon, by Mr. John Ray, S.R.S.* II. *A Letter from Mr. John Clayton, Rector of Crofton in Yorkshire; being a Continuation of his Account of Virginia, touching the Earth and Soyl thereof; with some Observations on the Planting of Tobacco, promised in Transact. Numb. 201.* III. *An Extract of a Letter from Mr. Anth. Van Leeuwenhoek, S.R.S. to the Royal Society, containing his Observations on the Seeds of Cotton, Dates, Cloves, Currans, Gooseberries, &c. the Scales of Fish, Pores of the Skin, Salts in several Liquors, &c.* IV. *An Instance of the Excellence of the Modern Algebra, in the Resolution of the Problem of finding the Foci of Optick Glasses universally, by Mr. E. Halley, S.R.S.* V. *An Abstract of part of a Letter from Mr. Samuel Dale, to Mr. John Haughton, S.R.S. concerning the making of Turnep-bread, in Essex.* VI. *An Extract of a Second Letter from Sir R. B. concerning the Propagation of Elms by the Seed.* VII. *An Account of a Book entituled, Phalxinologia nova sive Observationes de Rarioribus quibusdam Balænis in Scotiæ Littus nuper ejectis, &c. Auth. Roberto Sibbald. Edinburgi in 4° 1692.*

I. *The Extract of a Letter from Sir Richard Bulkley, S. R. S. to Dr. Lister, concerning the Improvement to be made by Maize; with a Note on the same by John Ray, S.R.S.*

vid. *Philos.*  
*Transact.*  
Numb. 142

MY long Silence has only proceeded from my desire of having Matter worthy the communicating to you, which it was necessary for me to expect; I mean the Harvest of my *Maiz*, which notwithstanding that I sow'd it six Weeks later than I ought to have done, yet is it now, what is ripe, of so great profit, that it may, I verily believe, render useles the Cultivation of the Field White Pea, (to which Grain it is the most like in Taste and Figure). The greatest Profit that ever I have heard of White Pease, has been twenty Barrels reap'd for one sown; but this, I am sure, had I sown it in the middle of *April*, (whereas I sow'd it not 'till the end of *May*) it would have yielded me 1920 for one, perhaps twice or thrice so many for one, as you may judge by the following Computation: The *Grappe* I used for Seed, grew in *Brandenburg*, and it, and the rest that I did not yet sow, had eight Sides or Rows of Grain, each of which Rows has thirty Grains (perhaps, in its own Country, it may have more in a Row) so that each ripe *Grappe* has 240 Grains. I made Experiment with one of these in good Orchard Ground, (which had been indeed dung'd for some other Legumes the last Year) and sow'd them in Rows, each Row about a Yard asunder, and each Grain about a Foot asunder in the Row, taking care to preserve them from the Mice 'till above Ground. Now out of each Grain came up 3, 4, 5, or 6 Stems, (my *Suiss* says, he rarely has seen above two or three elsewhere) every of which Stems had four, three, or two of these *Grappes*. Now these Grains ripening gradually, that is those Grains  
first,

first, which are nearest the Stem, many of my *Grappes* have the Grains nearest the extremity or pointed end, but half or three quarters ripe; but, it may be, as far as the 15th or 16th, and in some to the 20th Grain from the Butt-end are quite ripe. So then, if you will for your fancy compute, what would certainly have been, had I sow'd them in time, that each Grain give but three strong Stems, (and let the rest be cut off) and each of these Stems three *Grappes* (but some of them never fail of four) and each *Grappe* 240 Grains, that makes 2160 for one: Profit enough of all Conscience. But there are some things very odd in the manner of its growth, to those who have not cultivated it, of which you will pardon me the recital. It first sends up a thick reedy Stalk about a Yard high, with long Leaves of a very thick woody substance, and half a Yard long enwrapping the Stalk just like the *Iris*. At the top of this Stalk, when the Leaves open, there appears twenty or thirty Ears, as it were, of our unripe Wheat; but this, when it is opened, must be plucked away, for it is nothing but the Flower; and what is most surprizing, the Fruit comes not where the Flower was, but on the inner-side of every Leaf, where it joyns to the stem, comes forth after a time, a large shoot, thicker than ones Wrist, at the end of which hangs out a bundle of fine strings, like a Horse-tail, which is the true Flower of the Plant: as this withers, the Fruit grows on within, being envelop'd in a great number of Leaves, which when they are withered, the Fruit is ripe, (but is never naked while on the stalks) and must then be taken off, and hung up to dry, or kept in Chests. It will serve for all the Uses of the White Pea, either in Bread (with Wheat) or Soupe, or Pudding, or with Pork. I reckon that eight or ten *Grappes* of it sown the next Year, will furnish me, God willing, with some Barrels of it. It must be earth'd up with the Howe twice or thrice in growing.

I am not yet ready to give you an Account of the *Hy-*

*metto*

*metto* Bee-hives, tho' I have receiv'd great Instruction from them, nor shall venture to do it, 'till another Year's Experience of the propagating of them. I am quite discouraged as to making a Vineyard : for the Vines of this Country burst the Grape, and render to no purpose our Endeavours, having great Winds, and little Sun, &c.

*Your affectionate humble Servant,*

R. Bulkely.

Mr Ray's Note on the former Letter concerning the Maize.

**I** Have not much to say : He hath made a commendable Essay ; but whether it will turn to Account to plant Maize in Ireland, I think there is some reason to doubt : If it be equal in goodnes to Pease, and an Acre planted with it will certainly yield more than one sown with Pease, without impoverishing the Land, then indeed it will be advantageous to plant it : but if only an equal quantity, then tho' one Grain should yield a thousand-fold, all the advantage will be in the difference of the Seed, which is not very considerable, and which the Compendium of Sowing above Setting may in some measure countervail. As for the Description of the Plant, all the Parts of it have been so particularly and exactly described in English as well as Latin, that I think it needless to publish a new Description ; only I am by this Description confirmed in my Opinion, That there are two really distinct Species of Maiz : for what I have seen cultivated in Gardens, and have my self planted, ariseth to double the stature he ascribes to this, that is 7, 8, or 10 Feet ; and besides, with us, never brings the Seed near to perfection : but that I have seen planted in the Fields in Germany, is of about the same height with Sir Richard's, and ripens the Seed. Lobel also acknowledges two sorts thus differing.

II. *A Continuation of Mr John Clayton's Account of Virginia.*

Vid. *Philos. Transact.*  
Numb. 201.

*Of the EARTH and SOYL.*

**W**hen you make the Capes of *Virginia*, you may observe it low Land, so that at some distance the Trees appear as if they grew in the Water; and as you approach nigher, to emerge thence. For a hundred Miles up into the Country, there are few Stones to be found, only in some places, Rocks of Iron Oar appear, which made me expect to have found many Waters turn Purple with Galls, but never met with any. Providence has supplied the common use of Stones, by making the Roads very good: so that they ride their Horses without shoeing them; which yet are more rarely beaten on their Feet, than ours are in *England*, the Country and Clime being dry, their Hoofs are much harder: for I observed, that take a Horse out of the wet Marshes, and Swamps, as they there call them, and ride him immediately, and he'll quickly be tender-footed. In some places, for several Miles together, the Earth is so intermix'd with Oyster-shells, that there may seem as many Shells as Earth; and how deep they lie thus intermingled, I think, is not yet known: for at broken Banks they discover themselves to be continued many Yards perpendicular. In several places these Shells are much closer, and being petrefied, seem to make a Vein of a Rock. I have seen in several places, Veins of these Rocky Shells, three or four Yards thick, at the foot of a Hill, whose Precipice might be twenty Yards perpendicular, whose Delf, I suppose, shot under the Hill, pieces of these Rocks broken off, lie there, which, I suppose, may weigh twenty or thirty Tuns a piece, and are as

difficult to be broken as our Free-stone. Of these Rocks of Oyster-shells that are not so much petrefied, they burn and make all their Lime; whereof they have that store, that no Generation will consume. Whether these were formerly Oysters, which left by the subsiding Seas, (as some suppose, that all that Tract of Land, now high Ground, was once overflowed by the Sea) were since petrefied, or truly Stones, *sui Generis*, I leave to the Honourable Society to determine. But when I consider the constant and distinct shooting of several Salts, Nature's Curiosity, in every thing, so far exceeding that of Art, that the most Ingenious, when referr'd thereto, seem only endued with an Apish fondness, I cannot think any thing too difficult or wonderful for Nature; and indeed, I do not apprehend, why it may not be as feasible to suppose them to have been Rocks, at first shot into those Figures, as to conceive the Sea to have amass'd such a vast Number of Oyster-shells one upon another, and afterwards subsiding, should leave them cover'd with such Mountains of Earth, under which they should petrefie: But not to launch forth too far into those Disputes, since I must modestly remember to whom I write. Often, in the looser Banks of Shells and Earth, are found perfect Teeth petrefied, some whereof I have seen, could not be less than two or three Inches long, and above an Inch broad: Tho' they were not Maxillary Teeth, the part that one might suppose grew out of the Jaw, was polish'd, and black, almost as Jett; the part which had been fasten'd in the Jaw and Gums, was brown, and not so shiningly polish'd, or smooth; if they were, as they seem'd to be, really Teeth, I suppose, they must have been of Fishes. The Back-bone of a Whale, and as I remember, they told me of some of the Ribs, were digg'd out of the side of a Hill, several Yards deep in the Ground, about four Miles distant from *James-Town*, and the River. Mr. *Banister*, a Gentleman pretty curi-

ous in those things, shew'd me likewise the Joynt of a Whale's Back-bone, and several Teeth, some whereof, he said, were found in Hills beyond the Falls of *James River*, at least, a Hundred and fifty Miles up into the Country. The Soyl in general is sandy : I had designed, and I think it might be worth a Critical Remark, to observe, the Difference of Soyls seem appropriated to the several sorts of Tobacco : for there is not only the two distinct sorts of a Sweet-scented, and Aranoko Tobacco, but of each of these be several sorts much different, the Seeds whereof are known by distinct Names, they having given them the Names of those Gentlemen most famed for such sort of Tobacco, as of *Prior-seed*, &c. Nay, the same sort of Seed in different Earths, will produce Tobacco much different, as to goodness. The richer the Ground, the better it is for Aranoko Tobacco, whose Scent is not much minded, their only aim being to have it specious, large, and to procure it a bright Kite's-foot colour. Had not my Microscopes, &c. Tools to grind Glasses, been cast away, with my other things, I had made some Critical Enquiries into their several Natures, I would have examin'd what Proportions of Salts, all the sorts of Earths had afforded, and how Water impregnated with their Salts, would have changed with infusing Galls, how with the Syrup of Violets, and how they would have precipitated Mercury, or the like, and so far forth as I had been able, examined them by the several Tryals of Fire. I conceive Tobacco to be a Plant abounding with Nitro-Sulphurous Particles ; for the Planters try the goodness of their Seed, by casting a little thereof into the Fire ; if it be good, it will sparkle after the manner of Gunpowder : so will the Stalks of Tobacco-leaves, and perhaps has something analagous to the Narcotick Sulphur of *Venus*, which the Chymists so industriously labour after. The World knows little of the efficacy of its Oyl, which has wonderful Effects in the

curing of old inveterate Sores, and Scrophulous Swellings, and some, otherwise applied and qualified. The goodnes of Tobacco I look on primarily consists in the volatility of its Nitre : And hence the sandy Grounds that are most impregnated therewith, and whose Nitrous Salt is most volatile, for such Grounds are quickliest spent, yield Tobacco's that have the richest Scent, and that shortly becomes a pleasant Smoak ; whereas, in Tobacco that grows on stiff Ground, the Salts seem more fix'd, and lock'd up in the Oyl, so that whilst new, 'tis very heady and strong, and requires some time for its Salts to free themselves, and become volatile ; which it manifests, by its having an Urinous Smell. The same Reason satisfies, why Tobacco that grows on low Lands as far as the Salts, tho' the Plant be never overflowed with Salt Water, yet the Ground that feeds the Plant being impregnated with Salt Water, that Tobacco smoaks not pleasantly, and will scarcely keep Fire, but do all that a Man can, will oft go out, and gives much trouble in frequent lighting the Pipe, 'till after it has been kept some considerable time : which may be assign'd to the fixeder Saline Particles of the Marine Salt in these Plants, which require more time e're they be render'd volatile. Here it might be worthy an Enquiry into the Nature of Filtration of Plants, since we may hence gather, Particles of the Marine Salt are carried along with the *Succus Nutritius* of the Plant ; concerning which, if it were not too much to deviate from the Matter in hand, I should offer some Reflections of my own, which the Learned Society might perhaps improve : for I think thence might be made many happy Conjectures as to the Virtues of Plants. So where we see Plants, or Trees, of an open Pore growing low, we shall find their Juice has subtile parts : So have all Vines, whether the Grape Vine, or Briony, or a Smilax, or the like. If a Gummous Plant or Tree, that grows low, and close pored,

pored, it abounds with acid Spirits, as *Lignum Vitæ*, &c. if it grow tall, and be open pored, it abounds with a subtile volatile Spirit, as your Firrs, and the Turpentine Tree. But to insist no further herein, than as this may be applicable to the present Discourse: for I have observed, that that which is called Pine-wood Land, tho' it be a sandy Soyl, even the Sweet-scented Tobacco that grows thereon, being large and porous, agreeable to Aranoko Tobacco; it smoaks as courly as Aranoko: wherefore 'tis, that I believe the Microscope might make notable Discoveries towards the knowledge of good Tobacco: for the closer the Composition of the Leaf, the better the Tobacco; and therefore the Planters and Merchants brag of the Substance of their Tobacco; which word, did they always take it in a true sence, for the Solidnets, and not mistake it for the Thickness, it would be more consonant to a true Observation: for as I said of the Pine-wood Tobacco, some of it is thick and not solid, and differs from the best Tobacco, as Buff does from Tann'd Leather; so that if the Tobacco be sound and not rotten, you may give a great guess at the goodness of Tobacco, when you weigh the Hogsheads, before you see them: for if an equal care be taken in the Packing of them, the best Tobacco will weigh the heaviest, and pack the closest. Now I said, that the Sweet-scented Tobacco most in vogue, which was most famed for its Scent, was that that grew on sandy Land; which is true, if you would smoak it whilst new, or whilst only two or three Years old; but if you keep the stiff Land Tobacco, which is generally a Tobacco of great Substance five or six Years, it will much excel: for tho' the sandy Land Tobacco abound with a volatile Nitre at first, yet the stiff Land Tobacco abounds with a greater quantity of Nitre, only that it is lock'd up in its Oyl at first, and requires more time to extricate itself, and become volatile; but the Pine-wood Land having little of the Nitro-

Sulphurious

Sulphurious Particles, neither is, nor ever will make any thing of a rich Smoak. Discourſing hereof ſome days ſince, to a Gentleman of good Obſervation, that has been verſed with Maulting, he aſſured me, to back this my Suppoſition, or Hypotheſis, he had obſerved, That Barly that grew on ſtiff Ground, required more time conſiderably to mellow, and come to perfection, than that that grew in light Land. Having proceeded thus far to ſpeak of Tobacco, I ſhall add one or two things more. The Planters differ in their Judgments about the Time of Planting, or Pitching their Crops: ſome are for Pitching their Crops very early, others late, without any diſtinction of the Nature of the Soyls; and 'tis from the different Effects that they find, in that, ſometimes early, ſometimes the late Planting ſucceeds: but they have not the Reaſon to judge of the Cauſe, to conſider the Accidents of the Year, and the Difference of the Soyls. In ſandy Grounds they need not ſtrive ſo much for early Planting, the looſeneſs of the Earth, and the kind natured Soyl, yielding all that it can, eaſily and ſpeedily, and Sand retaining the heat, makes the Plants grow faſter. But in ſtiff Soyls, if the Crops be not early pitch'd, ſo that during the Seaſon of Rains it have got conſiderable Roots, and ſhot them ſome depth, if early Droughts come, it ſo binds the Land, that the Roots never ſpread or ſhoot deeper, or further than the Hill that they are planted in: for they plant them as we do Cabbages, raiſing Hills to ſet every Plant in, about the bigneſs of a common Mole-hill: obſerving this on the Plantation where I lived, that it was ſtiff Ground, I adviſed them to plant their Crops as early as poſſible; and in order thereunto, I tried ſeveral ways to further the Plants; but not to trouble you with the ſeveral Experiments that I made, in reference thereto: What I found moſt advantageous was, by taking an infuſion of Horſe-dung, and putting thereon Soot, and then my Seeds; this I kept

Forty eight Hours in an ordinary digestive heat, I had two Beds left me to Sow, in the midst of those the People sow'd, and the quantity of Seed that they generally allotted to the same quantity of Ground ; when I sow'd, I mix'd Ashes with the Seed, having decanted the Liquor, that the Seed might sow the evenner : the effect was, that my Plants came up much sooner, grew swifter, and I had five Plants for one more than any of the other Beds bore ; I left the Country shortly after, and so had no certainty of the final Result. There be various Accidents and Distempers, whereunto Tobacco is liable, as the Worm, the Flie, Firing to Turn, as they call them, French-men, and the like. I propos'd several ways to kill the Worm and Flie, as by Sulphur and the like ; but had no opportunity to experiment it : I shall set down that I had most hopes of, which perhaps may give a hint to others to try or improve : Tobacco-seed is very small, and by consequence so is the young Plant at first, that if gleamy Weather happen at that time, it breeds a small Flie, which consumes the Plume of the Plant ; now it being early in the Year when they Sow the Seed, *viz.* about the 14th of *January*, they cover the Ground, to secure, as well as they can, their tender Plants, from the nipping Frosts, that may happen in the Nights ; they cover them only with a few Oak-leaves, or the like ; for Straw they find apt to harbour and breed this Flie : I therefore would advise them to smoak Straw with Brimstone, once in two or three Nights, and so they might cover them securely, with that which would preserve them infinitely beyond the Covering with Oak-boughs ; indeed, I would advise them to keep peculiarly so much of their *Indian* Corn-blades, which they gather for their Fodder, for this very purpose, being, as I conceive, much the best, there being no Chaff to foul their Beds, and prejudice them when they should weed them. What they call Firing is this : When Plants are of small Substance,

as when there has been a very wet and cold Season, and very hot Weather suddenly ensues, the Leaves turn brown, and dry to dust; the Cause I conceive to be hence: The Plant being feeble, and having a small quantity of Oyl, which makes the more solid part of the Plant, the Earth being suddenly heated by the Sun's fiercer Beams, the Roots are rather scorched and dried up in the Earth, than nourish'd; so that the Plant consisting only of watry parts, is consumed, as it were, by Fire: sometimes hopeful Plants, when by a sudden Gust some Master Veins are broken, if sudden heat ensues, they likewise Fire: for being not come to maturity, and being deprived of the Supports of Life and Vegetation, they likewise perish, are dried up, and fall to dust. *French-men* they call those Plants, whose Leaves do not spread and grow large, but rather spire upwards, and grow tall; these Plants they do not tend, being not worthy their Labour. Were they so Critical, I believe, they might have great Guess what Plants were most likely to turn *French-men*, by observing whether the Roots of the Plants run downwards, as those whose Branches are aptest to spire upwards: for tho' I have not made positive proof thereof, I have something more than bare fancy for my conjecture; I have pull'd up some of these *French-men*, and compar'd them with the Roots of some other Plants, and found them much longer than others; and 'tis observable, loose Soyls, and sandy Ground, are more subject thereto than the stiff Land. The Country of itself is one entire Wood, consisting of large Timber Trees of several sorts, free from Thickets or under Wood, the small Shrubs growing only on Lands, that have been clear'd, or in Swamps; and thus it is for several Hundreds of Miles, even as far as has yet been discover'd. But that shall be reserv'd 'till another opportunity.

*I am, &c.*

III. An

III. *An Extract of a Letter from Mr. Anthony Van Leeuwenhoek, to the R. S. containing his Observations on the Seeds of Cotton, Palm, or Date-stones, Cloves, Nutmegs, Gooseberries, Currans, Tulips, Cassia, Lime-Tree: On the Skin of the Hand, and Pores, of Sweat, the Crystalline Humour, Optic Nerves, Gall, and Scales of Fish: and the Figures of several salt Particles, &c.*

Since my former Observations on the Seeds of Plants, (Vide *Philosoph. Transact.* N<sup>o</sup> 199, p. 700.) I was surprized to find a Variety from what I then wrote concerning the Mealy and Oily Substance, as likewise the *Embryo-plant* itself, to be nourisht by them; in the Seeds of *Cotton*, which lie Eight or Nine in clusters, in the *Cotton-wool* that comes from *India*: For having opened the hard Shell or Rind, with which the Seeds are covered, and from whence the *Cotton* proceeds, and stripping them from that curious, thin, whitish Coat, which wraps up each Seed so as to look like a little round Egg, the Seed itself shew'd, as Figure 1. which I have drawn larger Fig. 2. *ABC*; dissecting and opening this, I found no Mealy Substance at all, but four small Leaves enwrapping one another, and compassing the Root that lay in the midst of them. These Leaves are represented Fig. 3. *DEFGH*, sufficiently large, to shew the Vessels and dark green Globules between them. *ED* is the Root, in which were but few Globules. Some of these Globules being dissected, some Particles of them were of the fairest light Green I ever saw, others were of a very dark Green: *a b c* are Three small Pins I fasten'd the Leaves down  
K k k
with.

with. These Leaves, as I said, were spotted all over with little Specks ; and enquiring of some that had seen the *Cotton* grow, they told me, the Leaves of the Plant itself were thus spotted. So that we see, that Nature in this Subject, does not only wrap up the future Plant, but such a little Plant whose very Leaves are the same as on the grown Tree, only smaller.

This brought to my Mind that I had observed in the Eggs of some Insects (taken out of their Bodies) none of that Substance designed for the Nutrition of the *Embrio* ; but that in these Eggs were contained perfect and living Animals : so that as these Animals are perfect in the Egg, even whilst it is yet in the *Uterus* of the Parent, so the Cotton-seed contains a perfect Plant, even whilst it yet hangs on the Tree ; and besides, that part whence the Root grows is very large. And as the forementioned Animalcules need no Yolk in the Egg, being already perfect and fitted to search their Food abroad, so the Seeds of this Plant contain such an *Embrio-plant* as is already fit to shift for itself, and as soon as it falls from the Tree, the wet it meets with bursts the Shell, and it strikes Root, and displays its Leaves.

I cut the little Root transverse ; and whereas the innermost part in others is round or oval, in this it was eight-sided, wherefore I have drawn it Fig. 4. *ABCD*. This part was full of Pores, and encompass'd with a smooth white Body, in which I could see no Pores, *EFGH*, and this again was environed with another Body like the innermost, full of Pores, only they were smaller, *IKLM*. Tho' some of the Seeds I examin'd were very old, yet they contained a great deal of Oyl, and in some the Embrio was so fresh, that I thought it might grow, tho' I could never yet meet with a Seed that would.

Before I had made any Observations on Date-stones, I thought no other, but that the hard shell was only the covering to the Seed or Kernel ; but I found it quite  
other-

otherwise : for that very hard part is furnisht with plenty of Pores, and little *Tubuli*, serving for the Nourishment of the *Embrio-plant* contained in the midst, which is soft and easily cut with a sharp Knife. Altho' I have often observed in that part which is to be the Root and Trunk, very many long slender Fibrous parts, like Vessels lying by one another, and some of them fill'd with a White substance, yet I could never discover that part which gives beginning to the young Leaves. Some of these Date-stones I kept in hot moist Sand , and after some time, that part which is to be the Root and Plant, was shot out half an Inch ; but for all this I could not discover the Rudiments of any Leaves, I only found the part shot out to consist of long slender Particles, something smaller than those that I had observed in the beginning of the stem. I found some larger Vessels also of another form, coming from the beginning of the stem. Fig. 5. shews, The Date-stone with that side upper-most, as it is to be sowed. Fig. 6. shews, That side that is to be placed downwards in the Earth ; *A*, a round crooked part whence the Embrio proceeds. Fig. 7. Shews it when it has lain so long in the Earth, till the stem was grown to the length *BC*. Fig. 8. As it shew'd when the Root and Stem was of the length *DE*. In this Stem I observed nothing remarkable, only some large wide Vessels, whence I judged the Palm-Tree consisted of a very brittle infirm Wood ; and from a cavity in the midst thereof, I judged the Tree to be hollow, as the Bamboo, and some other *Indian* Plants are ; and altho this part being still included in the other hard part, was increased one 36th part bigger than it was before it was put into the hot Sand, I could observe nothing material, I only saw that which makes the Root ; and indeed, the Origine of a Plant is more like to nothing than a little Mushroom, as it grows on the Ground.

I chose some of the largest Cloves I could find, called Mother-Cloves ; for they are usually gathered while unripe : in some very large ones, which I judged perfectly ripe, I examined the inside only, and found it to consist of two parts, lying one upon the other ; which tho' they lie with several Angles, and each in a different manner, yet they are the Kernels, or Medullary part : for between these the *Embryo-plant* is placed, and is joyned to them by Ligaments, by means of which it is nourish'd. The beginning of the *Embryo-plant* is delineated Fig. 9. wherein *EFG* shews the complicated Leaves. *BCDE* and *GHIK*, the Broken Ligaments which are joyned to every part of the Kernel or Medulla ; which manner of Union is in many Seeds, but in some Seeds the joyning is only where the Trunk and Root begins. *ABKL* is that part of the young Plant, whence the Stem or Root begins, of which this is but a sixth part : this was of a dark Green, full of several very shining Globules : I wetted that part whence the Stem proceeds, otherwise it was too brittle to cut, and then sticking to the Knife, it presently turned black, by reason of the Salt it contained, tho' before it was very white. Fig. 10. *MNOP* is one of these Pieces so cut off, in which the transparent shining Globules represented in the former Figure between *A* and *L*, are here seen cut through. I could discover but few Pores in the outward Skin, by reason most of them were shrunk and dried up. I endeavoured to make some of the Mother-Cloves to vegetate by sowing them in Sand ; but in vain only, one time I made the little Leaves of the Embryo begin to open themselves, as Fig. *B——QRS*, in which Leaves the aforementioned shining Globules were visible, tho' in the other Leaves they were not. The manner of curing Cloves in *India*, is by soaking them in Salt-water, and drying them in the Smoak, which makes them look so black, which when I heard of a Gentleman  
that

that had lived there, it put an end to my farther Tryals.

I examined Nutmegs, as well preserved, as dry ones, and found always under the Mace a thin Skin, before we come to the hard Shell, and in one place a Ligament by which it was united to the Tree, which entered the hard Shell, and was joynd to the Nut at that part whence the Root shoots out: which was all I could find, they being, as I suppose, gathered green, and spoil'd in the curing, so that they will not grow.

I took the largest Gooseberries, and in the Seeds of them, whereof there are sometimes near Sixty in one Berry, each nourisht with a peculiar Ligament; viewing the *Embrio-plant*, I not only found the foremention'd parts, but could discover the ascending Vessels, as Fig. 11. *ABCD*. Examining the proportion the *Embrio-plant* in these Seeds bears to the Seed itself, I found the Seed seven times longer, broader, and thicker than the *Embrio-plant*, that is Three hundred times the Bulk thereof.

Out of one of the largest Black Currans, I took Sixty three Seeds, each furnisht with a particular Ligament, the *Embrio-plant* in these, was such as is represented Fig. 12. *EFH*, is that part whence the Root and Stem proceed. *FGH* are the two Leaves: in this, I reckon, the Seed is above Sixty times bigger than the little Plant. Hence we may conclude, there is no Seed but what has its *Embrio plant*.

I have been often told, that the Flowers of the Tulip might be seen in the Bulb thereof; which I could never believe, and should rather look for it in the perfect Seed; however, I have cut open many Bulbous-roots, but could never meet with any thing material. Examining Tulip-seeds, I found the Origine of the Plant, oblong, and round at each end, furnished with ascending Vessels.

Since

Since many have doubted of the Truth of my Discoveries, and because I am a zealous Lover of Truth, for the satisfaction of the Incredulous, I made choice of two Seeds, *viz.* the Seed of *Cassia*, and of the small *Olive* : in the last whereof we may with our naked Eye discern, not only the young Plant in the Kernel, for it is very large, but the Membranes enwrapping it, and the Ligament, and that the better, because the Ligament is of a different colour from the Membrane. And in *Cassia-seed* are observable, the young Plant, and especially the Leaves, which I conceive are so large, for the better nourishing the Root, which is in this Seed very small, and by sowing it in wet Sand, the Root began to shoot down the Leaves, display themselves, and the young Plant appear between them.

The Seed of the Lime-Tree is the most pleasant Spectacle : for in these, the young Leaves neither lie plain, nor are wrapt up, but wrinkled like the first Leaves of Trees in the Spring of a pleasing green Colour, and with a Microscope, the Fibres of the Leaves are very visible, and contrary to most other Seeds, the Root of the Embryo grows next the Tree.

In the great heat of the Summer, I observed several little transparent Pimples on my Hand, containing a clear Liquor, which I supposed were caused by the Skin, not permitting the Sweat to pass through it ; wherefore I cleansed well, part of the Skin of my Hand, and by my Microscope, in a space not bigger than a Sand, I saw the Sweat issuing out at about Fifty places, which as they touched, joyned together into one little Bubble.

After drinking about a Quart of *French-Wine* over Night, I found my self a little out of order the next Morning, at Dinner I drank a Pint and half more, and after about Two Hours, I drank Half a pint of Tea very hot, that I might throw my self into a Sweat ; which taking off my Face as clean as I could, I examined it,

it, and found therein a great number of such Scales as constitute the outward Skin, and very many Globules about  $\frac{1}{2}$  of the bigness of a Blood-Globule, and yet a much greater number of much smaller Globules, and amongst these a great number of salt Particles very small, yet of a curious four-sided Figure, which as the moisture exhaled, joyned together in mishapen Figures, which with the least moisture of the Air turned to Water again, among these were some few of the shape of Willow-leaves, and like the Figures made by *Sal. Armoniac.* I made this Experiment, to see if any of the salt Particles to be found in my Sweat, were like those found in Wine; which tho' I attempted three days successively, yet I could not discover any.

Another day, after Dinner, when I had drank no Wine, I observed my Sweat, and found as before, the Scales, Globules, and salt Particles, which were square, and some pyramidal, others were longish, others branched, which was only by the uniting of several small ones.

A learned Person caused the little Furrows in his Hands to be designed, supposing them to be the Pores whence the Sweat issues forth; which I could never imagine: for I have observed the Sweat to come more from the Ridges than out of the said Furrows: and examining these Furrows, I found more and closer Scales in the Furrows than on the Ridges. Wherefore, I conclude, that these Indentings are the places where the Scarf-skin is most united to the Skin underneath it.

I examined the *Crystalline Humour* of an Horses Eye, and found it little different from an Oxes, Hogs, Sheeps, &c. only it was very large, so that its greater Axis was  $\frac{1}{2}$  of an Inch. I formerly observed, that there was no cavity in the *Optic Nerve* of an Oxes Eye, but that its substance was made up of very many Fibres or Threads, which were filled with gently flowing Globules, (and that if one of these Globules in one of these

these Threads) nearest to the Eye, were moved by the Object, by this means not only the next, and so successively all the Globules in that Thread; and lastly, the Brain itself would be moved. I have found the same since in the Optic Nerves of four Horses Eyes, and if it be not allowed that the sight is thus performed, yet it must be granted, that great plenty of new matter continually thus flows from the Brain for the nourishment and generation of the Eyes.

I examined the Gall of a Trout, and found therein a very great quantity of small Globules, lesser than Blood-gobules, and yet a greater number of much smaller ones scarce to be discovered by my best Microscopes, so that I think it impossible the Liquor should be so very fluid, unless these Globules sometimes changed Figure, and that easily as they pass by each other. But what Method soever I made use of, yet I could not discover any salt Particles therein, which was my aim.

I observed the Skin of a very large Eel, and found the Scales on the Back and Belly, in strait Rows one upon another, but those on the sides were some sloping towards the Belly, others towards the Back, but all downwards. Examining the Matter or Slime covering these Scales, which is generally thought to come from without to the Scales, whereas it is a real part of the Body itself, furnished with Capillary Vessels, and Veins admirably interwoven; of which some are so very slender, that if a common Blood-gobule were divided into a Thousand parts, one of these could yet scarce pass them. From which Observations I conclude, this Slime is but as the *Cuticula* that covers the Scales, and if these be rubb'd off by any external Accident, the Eel will not live long. This outward Skin of Eels, as I call it, I found cover'd with very small round Particles, not a fourth part so big as those whereof the Scales seem to be constituted.

That

That Slime also wherewith the *Bream* is covered, is nothing else but a kind of *Cuticula*, tho' the Vessels thereof are so very small as to require a very excellent Microscope; and this substance is likewise cover'd with extrem minute Globules, This commonly called Slime, does not only proceed from the innermost Skin of the Fish, but partly out of the Scales: for I discovered clearly that part of the represented Scales. Fig. 13. *BCD*, was united to a very great number of small Vessels, so that the remaining part of the Scale *AB, DE*, had no Vessels or Slime proceeding from it, which last part was covered only by the Vessels that proceeded out of the other Scales. The Vessels producing this Slime, proceeded not only from the outer part of the Scale, but from that side also which is next the Fish; which upper and under Vessels proceeding to the gibbous part of the Scale *BCD*, intermix there. The remainder of the Scale *AB, DE*, is partly covered by Vessels coming out directly from the Skin. Secondly, By Vessels proceeding from within, from *FGH*. Thirdly, By Vessels proceeding from the gibbous parts of the Scales 1, 2, 3. it is necessary, that no Vessels forming this Scarf-skin, should proceed from *AB, DD*, otherwise the Fish could not bend itself, if no part of the Scales were free, but that they were all closely united together; whereas, by this means, they can easily slip over one another. The Vessels that proceed from one Scale in Eels, extend themselves over at least Twenty five Scales, and interweave with others, whence proceeds that extraordinary toughness observed in their Slime.

Next I viewed the Scales of *Perch*, and found them likewise furnish'd with such a sort of Slime or Skin also, the difference being only in that the Vessels making it are much stronger, so that it is not so easily rubb'd off, and is defended by little Pricks that stick out at the ends of the Scales.

Being not fully satisfied with these Observations, I proceeded to search for these Vessels in the Scales themselves, and to represent the Make of the Scales, I have drawn a very small part of one which in the Microscope, shewed like clear Crystal, with several streaks one under another, *vs* Fig. 14, *IKLM*. *IM* is that part that is joyned to the Skin of the Fish, and is about as long as two ordinary Sands. I told five Ridges from *I* to *K*; the *Bream* from whence I took this Scale, I judged about twelve Years old. The Make of these Scales, with the Manner how the Streaks cross one another, is best understood by the Figure *KLN*.

I set some Beer-Vinegar in my Closet, and after eight or ten days, I found therein a great number of salt Particles, sharper than those I had formerly seen in Wine-Vinegar: I have drawn them Fig. 15. *A*. In some I saw a little cavity in the middle; - others were, as I thought, not perfectly formed, wanting one Point, as *B*. others were a great many joyned together: I put some Crabs-Eyes into the Vinegar, and then the salt Figures were so small, and all encompassed with little Particles, that I could not discover any perfect salt Particles.

Juice of Lemons and Citrons afforded me no salt Particles, but after freezing, and a little settling at the bottom of the Vial, the clear Juice yielded plenty of them, much like those of Wine and Beer-Vinegar, represented *AB*.

Spirit of *Sal Armoniac*, after a while exposing in my Closet, began to shoot, and examining the Figures, I found a great many small Particles coagulated into one little Mass, each of which were a little longer than broad, with a little cavity, so that it seemed as if they had been plain at first, and that the sides turned up. I viewed a little of this Spirit, 'till it shot into Salts before my Eyes, which it did in an instant, like Lightning; but the Figures by this means made, were like little irregular Pipes, so that I am not certain concerning the Figures in this Spirit.

I mixt some of this Spirit with an equal quantity of Blood, and at first could see no alteration: but in about  $\frac{1}{4}$  of an hour several of the Blood-globules were dissolved, and the Spirit mixt with the *Serum* lookt reddish; in another Quarter there were but few Globules undissolved, and the *Serum* lookt redder than before.

I got a little Phial of the famous *Sal volatile Oleosum*, and looking upon it in the open Air, I admired to see so great a quantity of Oyl get together in the little Globules, amongst which some were not bigger than Blood-globules swimming in a thin Water; so that it is this Oyl only which gives it the yellow colour. It is observable, that this Oyl did not separate from the watry part, 'till it had been expos'd to the Air, and some part evaporated. Next I examin'd the Figures of the Salts, of which some were so small, that I could not see their shape; others were such as is represent'd, Fig. 16. *A*; others like *B*, such as I have seen in Wine, and some of a Cubical Figure like common Salt, as *C*: there were a great number of other Particles, which by reason of their number, and the thick matter in which they were, could not well be discern'd, they were of a dark colour, and may be reckon'd Globules. Then I took  $\frac{1}{2}$  of this *SVO*, and put to it  $\frac{3}{4}$ , or more, of strong Wine-Vinegar, and having shook it well together, after an hour's time I view'd it; but the salt Particles were in as great a quantity in the Vinegar, as if no *S.V.O.* had been mixt therewith: the same happened when I put equal parts of both together. I tast'd this last mixture, and found it very sour; I repeated it with other *S.V.O.* bought at another place, with much the same success, only there happened to be a little bit of straw in the Phial, consisting of three little Pipes, Fig. 17. *ADEF*, about which were presently gathered several little Air-bubbles, *BCDG*, which growing bigger and bigger, separated themselves from the bit of straw and burst. I have often observ'd, that a small Glo-

bule of Air as *B* has been above a larger as *A*, which Globule has not risen upward to *C*, and so to *D*, but been thrust downwards to *A*, whence it was distant about two hair's breadths, and immediately upon touching united therewith. I have likewise observed, that a little Air-bubble as *G*, loosening itself from the straw, when a larger Bubble, as *F*. was underneath it, has there rested immovable in the Liquor, when at the same time other much smaller Bubbles have risen to the top thereof. The reason of the standing still of the Bubble *G*, I suppose was from a double motion it is impelled to, the one upwards from its being specifically higher than the Liquor, the other downwards, by which it was protruded, to joyn with the other larger Bubble *F*. Tho' I have seen several Effects of Sympathy, if we may so call it, yet I never saw any so manifest as this, of the descending of a Bubble contrary to its levity, to unite with another.

---

IV. *An Instance of the Excellence of the Modern ALGEBRA, in the Resolution of the Problem of finding the Foci of Optick Glasses universally.* By E. Halley, S. R. S.

THE Excellence of the *Modern Geometry* is in nothing more evident, than in those full and adequate Solutions it gives to Problems: representing all the possible Cases at one view, and in one general Theorem many times comprehending whole Sciences; which deduced at length into Propositions, and demonstrated after the manner of the *Ancients*, might well become the Subjects of large Treatises: For whatsoever Theorem solves the most complicated Problem of the kind, does with a due Reduction reach all the subordinate Cases. Of this

I now design to give a notable Instance in the Doctrine of *Dioptricks*.

This Dioptrick Problem is that of finding the *Focus* of any sort of *Lens*, exposed either to Converging, Diverging or parallel Rays of Light, proceeding from, or tending to a given Point in the *Axis* of the *Lens*, be the *ratio* of *Refraction* what it will, according to the nature of the Transparent Material whereof the *Lens* is formed, and also with allowance for the thickness of the *Lens* between the *Vertices* of the two Spherical Segments. This Problem being solved in one Case, *mutatis mutandis* will exhibit Theorems for all the possible Cases, whether the *Lens* be *Double-Convex* or *Double-Concave*, *Plano-Convex* or *Plano-Concave*, or *Convexo-Concave*, which sort are usually called *Menisci*. But this is only to be understood of those Beams which are nearest to the *Axis* of the *Lens*, so as to occasion no sensible difference by their Inclination thereto; and the *Focus* here formed is by *Dioptrick Writers* commonly called the principal *Focus*, being that of use in *Telescopes* and *Microscopes*.

Let then (in Fig. 18.)  $BE\beta$  be a double Convex *Lens*,  $C$  the Center of the Segment  $EB$ , and  $K$  the Center of the Segment  $E\beta$ ,  $B\beta$  the thickness of the *Lens*,  $D$  a point in the *Axis* of the *Lens*; and it is required to find the point  $F$ , at which the Beams proceeding from the point  $D$ , are collected therein, the *ratio* of *Refraction* being as  $m$  to  $n$ . Let the distance of the object  $DB = DA = d$  (the point  $A$  being supposed the same with  $B$ , but taken at a distance therefrom, to prevent the coincidence of so many Lines) the *Radius* of the Segment towards the Object  $CB$  or  $CA = r$ , and the *Radius* of the Segment from the Object  $K\beta$  or  $K\alpha = \rho$ , and let  $B\beta$  the thickness of the *Lens* be  $= t$ , and then let the Sine of the Angle of incidence  $DAG$  be to the sine of the refracted Angle  $HAG$  or  $CA\phi$  as  $m$  to  $n$ ; And in very small Angles the Angles them-

themselves will be in the same proportion; whence it will follow that,

As  $d$  to  $r$ , so the Angle at  $C$  to the Angle at  $D$ , and  $d+r$  will be as the Angle of incidence  $GAD$ ; and again as  $m$  to  $n$ , so  $d+r$  to  $\frac{dn+r n}{m}$  which will be as the Angle  $GAH = CA\phi$ . This being taken from  $ACD$  which is as  $d$ , will leave  $\frac{m-nd-nr}{m}$  analogous to the Angle  $A\phi D$ , and the sides being in this case proportional to the Angles they subtend, it will follow, that as the Angle  $A\phi D$  is to the Angle  $AD\phi$ , so is the side  $AD$  or  $BD$  to  $A\phi$  or  $B\phi$ : that is  $B\phi$  will be  $= \frac{m d r}{m-nd-nr}$  which shews in what point the beams proceeding from  $D$  would be collected by means of the first Refraction; but if  $nr$  cannot be subtracted from  $m-nd$ , it follows that the Beams after Refraction do still pass on diverging, and the point  $\phi$  is on the same side of the *Lens* beyond  $D$ . But if  $nr$  be equal to  $m-nd$  then they proceed parallel to the *Axis*, and the point  $\phi$  is infinitely distant.

The point  $\phi$  being found as before, and  $B\phi = B\beta$  being given, which we will call  $\delta$ , it follows by a process like the former, that  $\beta F$  or the focal distance sought,

is equal to  $\frac{\delta p n}{m-nd + m p} = f$ . And in the room of  $\delta$  substituting  $B\phi = B\beta = \frac{m d r}{m-nd-nr} - t$ , putting  $p$  for  $\frac{n}{m-n}$

after due reduction this following Equation will arise,

$$\frac{m p d r p - n d p t + n p r p t}{m d r + m d e - m p r e - m - n d t + n r t} = f.$$

Which Theorem, however it may seem operose, is

is not so, considering the great number of *data* that enter the Question, and that one half of the terms arise from our taking in the thickness of the *Lens*, which in most cases can produce no great effect, however it was necessary to consider it, to make our Rule perfect. If therefore the *Lens* consist of *Glass*, whose Refraction is

as 3 to 2, 'twill be 
$$\frac{6 dr \rho - 2 d \rho t + 4 r \rho t}{3 dr + 3 d \rho - 6 r \rho - d t + 2 r t} = f.$$

If of *Water*, whose Refraction is as 4 to 3 the Theorem

will stand thus 
$$\frac{12 dr \rho - 3 d \rho t + 9 r \rho t}{4 dr + 4 d \rho - 12 r \rho - d t + 3 r t} = f.$$

If it could be made of *Diamant*, whose Refraction is as 5 to

2, it would be 
$$\frac{10 dr \rho - 2 d \rho t + 4 r \rho t}{5 dr + 5 d \rho - 10 r \rho - 3 d t + 2 r t} = f.$$

And this is the universal Rule for the *foci* of double Convex Glasses exposed to Diverging Rays. But if the thickness of the *Lens* be rejected as not sensible, the Rule will be much shorter, *viz.*

$$\frac{\rho dr \rho}{dr + d \rho - r \rho} = f,$$
 or in *Glass* 
$$\frac{2 dr \rho}{dr + d \rho - 2 r \rho} = f.$$

all the terms wherein *t* is found being omitted, as equal to nothing. In this case, if *d* be so small, as that  $2 r \rho$  exceed  $dr + d \rho$ , then will it be  $-f$ , or the *focus* will be Negative, which shews that the Beams after both Refractions still proceed Diverging.

To bring this to the other Cases, as of Converging Beams, or of Concave Glasses, the Rule is ever composed of the same terms, only changing the signs of  $+$  and  $-$ ; for the distance of the point of Concourse of converging Beams, from the point B, or the first surface of the *Lens*, I call a negative distance or  $-d$ ; and the Radius of a Concave *Lens* I call a negative Radius or  $-r$  if it be the first surface, and  $-\rho$ , if it be the second surface. Let then converging Beams fall on a double Convex

vex of Glass, and the Theorem will stand thus

$\frac{-2 dr \rho}{-dr - d\rho - 2r\rho} = +f$ . which shews that in this case the *Focus* is always affirmative.

If the *Lens* were a *Meniscus* of Glass, exposed to diverging Beams, the Rule is  $\frac{-2 dr \rho}{-dr + d\rho + 2r\rho} = f$ . which is affirmative when  $2r\rho$  is less than  $dr - d\rho$ , otherwise negative : But in the case of converging Beams falling on the same *Meniscus*, 'twill be

$\frac{+2 dr \rho}{+dr - d\rho + 2r\rho} = f$ .

and it will be  $+f$  whilst  $d\rho - dr$  is less than  $2r\rho$ , but if it be greater than  $2r\rho$ , it will always be found negative or  $-f$ . If the *Lens* be double Concave, the *focus* of converging Beams is negative, where it was affirmative in the case of diverging Beams on a double Convex, viz.

$\frac{-2 dr \rho}{+dr + d\rho - 2r\rho} = f$ , which is affirmative only when  $2r\rho$  exceeds  $dr + d\rho$ : But diverging Beams passing a double Concave have always a negative *focus*,

viz.  $\frac{-2 dr \rho}{+dr + d\rho + 2r\rho} = -f$ .

The Theorems for Converging Beams are principally of use to determine the *focus* resulting from any sort of *Lens* placed in a Telescope, between the *focus* of the Object-glass and the Glass it self ; the distance between the said *focus* of the Object-glass and the interposed *Lens* being made  $= -d$ .

I here suppose my Reader acquainted with the Rules of Analytical Multiplication and Division, as that  $+$  multiplied by  $+$  makes the product  $+$ ,  $+$  by  $-$  makes  $-$ , and  $-$  by  $-$  makes  $+$ , so dividing  $+$  by  $+$  makes the Quote  $+$ ,  $+$  by  $-$  makes  $-$ , and  $-$  by  $-$  makes  $+$ , which will be necessary to be understood in the preceding Examples.

In case the Beams are parallel, as coming from an infinite distance, (which is supposed in the case of Telescopes) then will  $d$  be supposed infinite, and in the

Theorem  $\frac{p d \rho r}{d r \times d \rho - p r \rho}$  the Term  $p r \rho$  vanishes, as

being finite, which is no part of the other infinite terms and dividing the remainder by the infinite part  $d$ , the

Theorem will stand thus  $\frac{p \rho r}{r \times \rho} = f$ , or in Glafs,

$$\frac{2 r \rho}{r \times \rho} = f.$$

In case the *Lens* were *Plano-Convex* exposed to diverging Beams, instead of  $\frac{p d \rho r}{d r \times d \rho - p r \rho}$ ,  $r$  being infinite,

it will be  $\frac{p d \rho}{d - p \rho} = f$ . or  $\frac{2 d \rho}{d - 2 \rho} = f$ , if the *Lens*

be Glafs.

If the *Lens* be *Double-Convex*, and  $r$  be equal to  $\rho$ , as being formed of Segments of equal Spheres, then will

$\frac{p d \rho r}{d r \times d \rho - p r \rho}$  be reduced to  $\frac{p d r}{2 d - p r} = f$ ; and

in case  $d$  be infinite, then it will yet be farther con-

tracted to  $\frac{1}{2} p r$ , and  $p$  being  $= \frac{n}{m - n}$  the focal di-

stance in Glafs will be  $= r$ , in Water  $\frac{1}{2} r$ , but in Dia-

mant  $\frac{1}{3} r$ .

I am sensible that these Examples are too much for the compleat Analyst, though I fear too little for the less Skilful, it being very hard, if possible, in such matters, so to write as to give satisfaction to both; or to please the one, and instruct the other. But this may suffice to shew the extent of our Theorem, and how easy a Reduction adapts any one case to all the rest.

Nor is this only useful to discover the *focus* from the other proposed *data*, but from the *focus* given, we may thereby determine the distance of the Object, or from the *focus* and distance given, we may find of what Sphere it is requisite to take another Segment, to make any given Segment of another Sphere cast the beams from the distance  $d$  to the *focus*  $f$ . As likewise from the *Lens*, *focus*, and distance given, to find the *ratio* of Refraction, or of  $m$  to  $n$ , requisite to answer those *data*. All which it is obvious, are fully determined from the Equation we have hitherto used, *viz.*  $p d e r = d r f \mp d e f - p r e f$ , for to find  $d$  the Theorem is

$$\frac{p r e f}{r f \mp e f - p e r} = d, \text{ the distance of the Object.}$$

For  $e$  the Rule is  $\frac{d r f}{p d r \mp d f \mp p r f} = e$

But for  $p$  will be  $\frac{d r f \mp d e f}{d e r \mp f e r} = p$ , which latter determines the *ratio* of Refraction,  $m$  being to  $n$  as  $1 \mp p$  to  $p$ .

I shall not expatiate on these Particulars, but leave them for the exercise of those that are desirous to be informed in Optical Matters, which I am bold to say are comprehended in these three Rule, as fully as the most inquisitive can desire them, and in all possible cases; regard being had to the Signs  $\mp$  and  $-$ , as in the former cases of finding the *focus*. I shall only shew two considerable uses of them; the one to find the distance whereat an Object, being placed shall by a given *Lens* be represented in a *Species* as large as the Object it self, which may be of singular use, in drawing Faces, and other things in their true Magnitude, by transmitting the *Species* by a *Glass* into a dark Room, which will not only give the true Figure and Shades, but even the Colours themselves, almost as vivid as the Life. In this

case  $d$  is equal to  $f$ , and substituting  $d$  for  $f$  in the Equation, we shall have  $p d r \varrho = d d r + d d \varrho - d p \varrho r$ , and dividing all by  $d$ .  $p r \varrho = d r + d \varrho - p r \varrho$ , that is  $\frac{2 p r \varrho}{r + \varrho} = d$ ; but if the two Convexities be of the same

Sphere so as  $r = \varrho$  then will the distance be  $= p r$ , that is, if the *Lens* be *Glass*  $= 2 r$ , so that if an Object be placed at the Diameter of the Sphere distant, in this case the *focus* will be as far within as the Object is without, and the *Species* represented thereby will be as big as the *Life*; but if it were a *Plano-Convex*, the same distance will be  $= 2 p r$ , or in *Glass* to four times the *Radius* of the Convexity; but of this method I may perhaps entertain the Curious in some other Transacti- on, and shew how to magnifie or diminish an Object in any proportion assigned, (which yet will be obvious enough from what is here delivered) as likewise how to erect the Object which in this method is represented inverted.

A second use is to find what Convexity or Concavity is required, to make a vastly distant Object be represented at a given *focus*, after the one surface of the *Lens* is formed; which is but a Corollary of our Theorem for finding  $\varrho$ , having  $p$ ,  $d$ ,  $r$  and  $f$  given; for  $d$  being infinite, that Rule becomes  $\frac{r f}{p r - f} = \varrho$ , that is in *Glass*

$\frac{r f}{2 r - f} = \varrho$ , whence if  $f$  be greater than  $2 r$ ,  $\varrho$  becomes Negative, and  $\frac{r f}{f - 2 r}$  is the *Radius* of the *Concave* sought.

Those that are wholly to begin with this Dioptrical Science cannot do better than to read with Attention a late Treatise of Dioptricks, published by *W. Molineux*, Esq; R. S. S. who has at large shewn the Nature of

Optick Glasses, and the Construction and Use of Microscopes and Telescopes; and though some nicely Critical have endeavoured to spy faults, and to traduce the Book, yet having long since examined it with care, I affirm, that if I can judge, it hath but two things that with any Colour may be call'd faults; the one an over-careful acknowledgment of every Trifle the Author had received from other; and the other, that he labours to make easie this curious Subject, so little understood by most, in a manner perhaps too familiar for the *Learned Critick*, and which demonstrates that it was writ *cum animo docendi*, both which require but very little Friendship or good Nature in the Reader, to pass for Vertues in an Author.

But to return to our first Theorem, which accounting for the thickness of the *Lens*, we will here again resume, *viz.*

$$\frac{m p d r \rho - n d \rho t + n p r \rho t}{m d r \rho + m d \rho - m p r \rho - m - n d t + n r t} = f.$$

And let it be required to find the *focus* where a whole Sphere will collect the Beams proceeding from an Object at the distance  $d$ ; Here  $t$  is equal to  $2r$  and  $r = \rho$ . And after due Reduction the Theorem will stand thus,

$$\frac{m p d r - 2 n d r + 2 n p r r}{2 n d + 2 n r - m p r} = f; \text{ but if } d \text{ be infi-}$$

nite, it is contracted to  $\frac{m p r}{2 n} - r = \frac{2 n - m}{2 m - 2 n} r = f,$

wherefore a Sphere of Glas collects the Suns Beams at half the Semi-diameter of the Sphere without it, and a Sphere of Water at a whole Semi-diameter. But if the *ratio* of Refraction  $m$  to  $n$  be as 2 to 1, the *focus* falls on the opposite surface of the Sphere, but if it be of greater inequality it falls within.

Ano-

Another Example shall be when a Hemisphere is exposed to parallel Rays, that is  $d$  and  $e$  being infinite, and  $t = r$ , and after due Reduction the Theorem results

$\frac{r^2}{m m - m n} r = f$ . That is, in Glass it is at

$\frac{4}{3} r$ , in Water at  $\frac{5}{3} r$ , but if the Hemisphere were Diamond, it would collect the Beams at  $\frac{4}{3}$  of the Radius beyond the Center.

Lastly, As to the effect of turning the two sides of a Lens towards an Object; it is evident, that if the thickness of the Lens be very small, so as that you neglect it, or account  $t = 0$ , then in all cases the focus of the same Lens, to whatsoever Beams, will be the same, without any difference upon the turning the Lens: But if you are so Curious as to consider the thickness, (which is seldom worth accounting for) in the case of parallel Rays falling on a *Plano-Convex* of Glass, if the plain side be towards the Object,  $t$  does occasion no difference, but the focal distance  $f = 2 r$ . But when the Convex side is towards the Object, it is contracted to  $2 r - \frac{2}{3} t$ , so that the focus is nearer by  $\frac{2}{3} t$ . If the Lens be double Convex the difference is less; if a *Meniscus* greater. If the Convexity on both sides be equal, the focal length is about  $\frac{1}{2} t$  shorter than when  $t = 0$ . In a *Meniscus* the Concave side towards the Object encreases the focal length, but the Convex towards the Object diminishes it. A General Rule for the difference arising on turning the Lens, where the Focus is Affirmative, is this

$\frac{2 r t - 2 e t}{3 r + 3 e - t}$ , for double Convexes of differing

Spheres. But for *Menisci* the same difference becomes

$\frac{2 r t + 2 e t}{3 r - 3 e + t}$ ; of which I need give no other demon-

stration, but that by a due Reduction it will so follow from what is premised, as will the Theorems for all sorts of Problems relating to the foci of Optick Glasses.

V. *An Abstract of a Letter sent from Mr. Samuel Dale to Mr. John Houghton, S. R. S. concerning the making of Turnep-Bread in Essex.*

S I R,

THE dearness of all sorts of Corn hath occasioned many poor People to set their Wits, as it were, on Tenter-hooks, and to try many ways and methods of making Bread for the Sustenance of their Families, as in some places, of Pease, and frequently of Barley : so with us they have lately got a way of making it with Turneps, which not only for the novelty thereof, but also because it may be of general use and benefit to poor, mean and indigent people, I will beg your patience until I acquaint you with the way and manner of making it, which is this: They take pilled Turneps, and boyl them in Water until they are soft or tender; then pressing strongly out the Juice, they mix them; being beaten or pounded very fine and small, with their weight of Wheat-Meal. Then adding Salt *q. s.* and warm Water, they knead it up as other Dough, or Paste, which having lain a little while to ferment, they order it, and bake it as common Bread. Of this Turnep-Bread (for so they call it) I have both seen and tasted, and can assure you, that to the Eye it's not to be distinguisht from common Wheaten or Houshold Bread, neither doth the Scent much betray it, especially when cold; only to dainty and nice Palates the Turneps are a little, and but a little, perceived.

*Tours*

*Braintree, Dec. 6.*

1693.

*Samuel Dale.*

VI. *An*

VI. *An Extract of a Letter from Sir R. Bulkley concerning the Propagation of Elms by Seed.*

**T**HIS is to acquaint you that I have discours'd a poor meer *Irish* Labourer ( who by having work'd many years under a Head Gardiner in a Gentleman's Garden, has got a Genius of Planting ) who has follow'd the Propagating of Elms by the Seed ( a way, if known, totally neglected among all Planters ) which Seed he finds in the former part of the Year ; and he has rais'd in small Beds such vast numbers of them, that he sells them of three or four Foot long at Two Shillings a Hundred, and will carry them any where within Five Miles, and plant them into the Bargain.

VII. *An*

VII. *An Account of a Book Intituled, Phalæologia nova sive Observationes de Rationibus quibusdam Balænis in Scotia Littus nuper ejectis, &c. Aut. Roberto Sibbald, Edinburgi in Quarto, 1692.*

THE Author of that Excellent Book, Entituled, *Scotia Illustrata*; hath in this given us a Curious Specimen of the advance he hath made in the Natural History of that Kingdom; containing many Observations altogether new, and very well worthy to be known. In the Preface he proposes to treat only of such Whales as are found in the Seas of *Scotland*; and having prov'd from several Writers, that the *Brittish* Ocean was formerly frequented by Whales, he observes, that tho' the very large Whales, which were formerly found in the *Brittish* Seas, and were accounted the vastest in the World, seem since Navigation has been so much used in these Seas, to have retired to *Greenland*, yet there are still a great many smaller Whales, and some larger ones too, cast upon the Shores of *Scotland* every Year. He then gives the several distinctions of them; 1<sup>st</sup>, Some are very large, CXX, CXXXIV Feet long, some of a smaller size down to XXIV, XVIII Feet, or less. 2<sup>dly</sup>, Some have only two Fins, others have a third upon their Back. 3<sup>dly</sup>, Some have a Pipe or Spout in their Snout, others have Nostrils. 4<sup>thly</sup>, Some have Teeth, others have horny Plates, in their Mouths.

The Book is divided into Three Sections, in which he first treats of the smaller Whales, and so proceeds to speak of those that are larger. The First Section is concerning the lesser sort of Whales, both those that have a Spout, and those that have Nostrils, as well such as have Teeth in both their Jaws, as those that have them only in the lower.

The Second Section concerns the larger Whales, which have Teeth only in the lower Jaw. In the Third Section we have an Account of those Whales, that have horny Plates in their upper Jaw; which Plates we in *England* improperly call Whale-bone.

In the First Section he enumerates the several sorts of Whales that have Teeth, by way of Preface; and in the First Chapter speaks of the smaller sort of Whales, whereof he gives a large Description, as likewise he hath done of all; the rest that follow these, have Teeth in both their Jaws, by the *English* called the *Grampus*; they are voracious and fierce Enemies to other Whales, and it may be thought that their fury many times drives the large Whales upon the Shore: those have a Spout and Three Fins. The Second Chapter treats of a sort of Whales, that have Teeth only in their lower Jaw, and without any Fin on the Back, which have not been describ'd by any Author: these have Nostrils. The Third, of the least sort, of Whales, of an uncertain Class. He observes, That the Flesh of some of those being buried at the Roots of some Fruit-Trees, those Trees bore abundantly the next Year.

In the Second Section he treats of the larger Whales, which have Teeth only in their lower Jaw. In the Preface he takes notice of two sorts; but that which has but one Tooth, and is taken for the Unicorn, not being ever

seen in those Seas, the Author says nothing of it. He shews wherein the several sorts of the larger Whales that have Teeth do agree, and wherein they differ.

In the first Chapter he speaks of the great Whales, with a very large Head, that have only two lateral Fins. These as all the rest of the Whales treated of in this Section, have a Spout. The length of them is from 50, to 80 Feet. The Oyl of these Whales is easily coagulated with Cold into a hard and white substance like fat, and is of great use in Wounds, Aches, and hard Tumours.

In the Second Chapter we have an Account of the Whale with a large Head, that has a Fin upon his Back, and hookt Teeth in the lower Jaw. In this Whale is found the best *Sperma Ceti*, which lies both within, and on the outside of the Skull; and this last is sometimes two Feet thick.

The Third Chapter concerns the large headed Whale with three Fins, that has streighter Teeth, that are plain at the end. This has been found to have a great quantity of *Sperma Ceti*, of the better sort.

In the Fourth Chapter the Author gives us an Account of the *Sperma Ceti*, which is of two sorts; that which is found floating on the Sea, and that which is found in the Whale. He concludes this Chapter with the Vertues of it, and affirms it to be a true natural *Sal Volatile Oleosum*.

The Fifth Chapter is concerning the Teeth of these Whales, where he proposes the Experiment of them in those cases, where the Horn of the Sea-Unicorn is so much commended.

In the Third Section he treats of the large Whales, that have horny Plates in their upper Jaw, which he begins with a Preface concerning these Whales in general, and endeavours to prove, that there are no Whales, that have these horny Plates in both their Jaws.

The First Chapter is of those kind of Whales which have but two Fins, both those which have a Spout, and those that have none; where the Author makes mention of one that was seventy Foot long.

The Second Chapter concerns in general that sort of Whales that have three Fins, and Nostrils.

In the Third Chapter we have an Account of the sort of Whale with three Fins, which has a sharp Snout, and folds in the Belly, and no Spout, but Nostrils. He observes, that the lateral Fins of it being excarnated, are like the whole Arm, with a Plate-bone, Shoulder-bone, *Radius*, and *Ulna*, *Metacarpus*, and Fingers.

In the Fourth Chapter he treats of the Whale with horny Plates, and three Fins, which has the lower Jaw round, and much broader than the upper. This Whale has no Spout; but two Holes near his Forehead.

In the Fifth Chapter we have some Account of a very large Whale of this sort, cast upon the Shoar of *Boëna*, in which they found no *Sperma Ceti*.

The Sixth Chapter is of the horny Plates, the Folds, and the Oyl of this sort of Whales. The Oyl of them is us'd for making of Soap, &c. but not in Physick.

At the end of the Book we have an Appendix, where the Author first makes a short Preface concerning those things

things that are common to Whales; he observes, that they are great Lovers of Ambergrise, and that it is sometimes found in their Stomachs. Whether the Ambergrise is found only in those that have Teeth in their lower Jaw, or in some others, or in all, he cannot determine. He observes, that they all have a great Love for their Young, carrying them when they are very young, under their lateral Fins, and following them when they are bigger: which he thinks may have given the occasion of that Fable of the Fish that guides the Whale.

The First Chapter of the Appendix is concerning the Fat of Whales. The Second of their Flesh. The Third of the Whale's Pizzle, and its Use in Physick. In the Fourth Chapter the Author gives us an Account of Ambergrise, of its Original, Nature, and Vertues. The last Chapter is of the Time when the Whales are seen.

Of all these Whales the Author hath given an exact Description in the several Chapters wherein they are mentioned.

---

L O N D O N :

Printed for *S. Smith* and *B. Walford*, Printers to the *Royal Society*, at the *Prince's Arms* in *St. Paul's Church-yard*, 1693.

---



---

# PHILOSOPHICAL TRANSACTIONS.

---

*For the Month of December, 1693.*

---

## The CONTENTS.

I. **A** Letter from Mr. John Clayton, Rector of Crofton at Wakefield in Yorkshire, to the Royal Society, giving a farther Account of the Soil of Virginia, and Planting of Tobacco there, with the Draining of Swamps, &c. As likewise a Description of the several Species of Birds observed there by himself, with several Curious Remarks on the Heads of Fowl, more particularly of their Ears, compared with those of the Mole, &c. II. Some Queries concerning the Nature of Light and Diaphanous Bodies, proposed to the Royal Society by Mr. Edm. Halley, S. R. S. III. An Account of two Books. 1. Pharmacopœia Bateana, English'd by Mr. William Salmon, Professor of Physick. 2. Phthisiologia Lancastriensis cui accessit Tentamen Philosoph. de aquis Mineralibus, &c. Auth. Carolo Leigh, M. D.

I. Mr. John Clayton, Rector of Crofton at Wakefield, his Letter to the Royal Society, giving a farther Account of the Soil, and other Observables of Virginia.

I Shall here present you with a Continuation of my Remarks on the River, Soil, and Plants of *Virginia*. And first, as to the River on the other side the Mountains, said to Ebb and Flow. I have been assured by Col. *Bird*, who is one of the Intelligentest Gentlemen in all *Virginia*, and knows more of *Indian* Affairs than any Man in the Country, that it was a Mistake; for that it must run into a Lake, now called *Lake Petite*, which is fresh Water; for since that time a Colony of the *French* are come down from *Canada*, and have seated themselves on the back of *Virginia*, where *Fallam* and the rest supposed there might be a Bay, but is a Lake, to which they have given the Name of *Lake Petite*, there being several larger Lakes 'twixt that and *Canada*. The *French* possessing themselves of these Lakes, no doubt will in short time be absolute Masters of the Beaver Trade, the greatest number of Beavers being catch'd there. The Colonel told me likewise, that the common Notion of the Lake of *Canada*, he was assured was a Mistake, for the River supposed to come out of it, had no Communication with any of the Lakes, nor the Lakes one with another, but were distinct. But not to ramble after hear-say, and other matters; but to return to the Parts of *Virginia* inhabited by the *English*, which in general is a very Fertile Soil, far surpassing *England*, for there *English* Wheat (as they call it, to distinguish it from *Maze*, commonly called *Virginia* Wheat) yields generally 'twixt Fifteen and Thirty

Thirty fold, the Ground only once plow'd ; whereas 'tis a good Crop in *England* that yields above Eight fold, after all their toil and labour. And yet in truth 'tis only the barrenest Parts that they have cultivated, Tilling and Planting only the High-Lands, leaving the Richer Vales unfir'd, because they understand not any thing of Draining. So that the Richest Meadow-Lands, which is one third of the Country, is Boggy, Marsh, and Swamp, whereof they make little Advantage, but loose in them abundance of their Cattle, especially at the first of the Spring, when the Cattle are weak, and venture too far after young Grass. Whereas vast Improvements might be made thereof ; for the generality of *Virginia* is a Sandy Land with a shallow Soil. So that after they have cleared a fresh piece of Ground out of the Woods, it will not bear Tobacco past two or three Years, unless Cow-pen'd ; for they Manure their Ground by keeping their Cattle, as in the South you do your Sheep, every Night confining them within Hurdles, which they remove when they have sufficiently dung'd one spot of Ground ; but alas ! they cannot Improve much thus, besides it produces a strong sort of Tobacco, in which the Smokers say they can plainly taste the fulsomness of the Dung. Therefore every three or four Years they must be for clearing a new piece of Ground out of Woods, which requires much Labour and Toil, it being so thick grown all over with Massy Timber. Thus their Plantations run over vast Tracts of Ground, each ambitioning to engross as much as they can, that they may be sure to have enough to Plant, and for their Stocks and Herds of Cattle to range and feed in, that Plantations of 1000, 2000, or 3000 Acres are common, whereby the Country is thinly inhabited ; their Living solitary and unfociable ; Trading confused and dispersed ; besides other Inconveniencies : Whereas they might Improve 200 or 300 Acres to more Advantage, and would make  
the

the Country much more Healthy ; for those that have 3000 Acres, have scarce cleared 600 Acres thereof, which is peculiarly termed the Plantation, being surrounded with the 2400 Acres of Woods ; so that there can be no free or even motion of the Air, but the Air is kept either stagnant, or the lofty Sulphurous Particles of the Air, that are higher than the tops of the Trees, which are above as high again as the generality of the Woods in *England*, descending when they pass over the cleared spots of Ground, must needs in the violent heat of Summer, raise a preternatural Ferment, and produce bad Effects. Nor is it any Advantage to their Stocks, or Crops ; for did they but drain their Swamps, and Low-Lands, they have a very deep Soil, that would endure Planting 20 or 30 Years, and some would scarce ever be worn out, but be ever longer better, for they might lay them all Winter, or when they pleased in Water, and the Product of their Labour would be double or treble, whether Corn or Tobacco ; and that this is no fond Projection, ( though when I have discoursed the same to several, and in part shewn them how their particular Grounds might be drained at a very easie rate ) they have either been so conceited of their old way, so sottish as not to apprehend, or so negligent as not to apply themselves thereto. But on the Plantation where I lived, I drained a good large Swamp, which fully answered expectation. The Gentlewoman where I lived, was a very Acute Ingenious Lady ; who one day Discoursing the Overseer of her Servants, about pitching the ensuing Year's Crop. The Overseer was naming one place where he designed to Plant 30000 Plants, another place for 15000, another for 10000, and so forth the whole Crop, designed to be about 100000 Plants: Having observed the Year before he had done the like, and scattered his Crop up and down the Plantation, at places a Mile, or a Mile and a half asunder, which was  
 very

very inconvenient, and whereby they lost much time. I interposed, and asked, why they did not Plant all their Crop together? The Fellow smiled as it were at my Ignorance, and said, there was very good Reason for it. I replied, that was it I enquired after. He returned, the Plantation had been an old planted Plantation, and being but a small Plot of Ground, was almost worn out, so that they had not Ground altogether that would bring forth Tobacco. I told him then they had better Ground than ever yet they had planted, and more than their Hands could manage. He smiled again, and asked me, where? I then named such a Swamp. He then said scornfully, he thought what a Planter I was; that I understood better how to make a Sermon, than managing Tobacco. I replied with some warmth, tho' I hoped so, that was Impertinence, and no Answer. He then said, that the Tobacco there would drown, and the Roots rot. I replied, that the whole Country would drown if the Rivers were stopt, but it might be laid as dry as any Land on the Plantation. In short, we discoursed it very warmly, till he told me, he understood his own Business well enough, and did not desire to learn of me. But the Gentlewoman attended somewhat better to my Reasoning, and got me one day to go, and shew her how I projected the draining of the Swamp, and thought it so feasible, that she was resolved to have it done; and therefore desired me I would again Discourse her Overseer, which I did several times, but he would by no means hearken thereto, and was so positive, that she was forced to turn him away, to have her Servants set about the Work; and with three Men in thirteen days I drained the whole Swamp, it being Sandy Land, soaks and drains admirably well, and what I little expected, laid a Well dry at a considerable distance. The Gentlewoman was in *England* last Year, and I think *Dr. Moulin* was by when she asked me. Now to teach her how she might

make her Tobacco that grew in that Swamp less, for it produced so very large, that it was suspected to be of the *Aranoko* kind: I told her, though the Complaint was rare, yet there was an Excellent Remedy for that, in letting every Plant bear Eight or Nine Leaves instead of Four or Five, and she would have more Tobacco, and less Leaves. Now you must know, they top their Tobacco, that is, take away the little top-bud, when the Plant has put forth as many Leaves as they think the Richness of the Ground will bring to a Substance; but generally when it has shot forth four or six Leaves. And when the top-bud is gone, it puts forth no more Leaves, but Side-branches, which they call Suckers, which they are careful ever to take away, that they may not impoverish the Leaves. I have been more tedious in the Particulars, the fullier to evince how resolute they are, and conceitedly bent to follow their old Practice and Custom, rather than to receive Directions from others, tho' plain, easie, and advantageous. There are many other places are as easie to drain as this, tho' of larger extent, and richer Soil, for some of which I have given Directions, and have only had the return perhaps of a flout afterwards: Even in *James Town Island*, which is much what of an Oval Figure, there's a Swamp runs Diagonal wise over the Island, whereby is lost at least 150 Acres of Land, which would be Meadow, which would turn to as good Account as if it were in *England*: Besides it is the great annoyance of the Town, and no doubt but makes it much more unhealthy. If therefore they but scour'd the Channel, and made a pretty ordinary Trench all along the middle of the Swamp, placed a Sluce at the Mouth, where it opens into the back Creek; for the Mouth of the Channel there is narrow, has a good hard bottom, and is not past two Yards deep when the Flood is out; as if Nature had designed it before hand: They might thus drain all the Swamp absolutely

solutely dry, or lay it under Water at their pleasure. I have talked several times hereof to Mr. *Sherwood*, the Owner of the Swamp, yet nothing is essayed in Order thereto. And now since we are speaking of *James Town*, give me leave to adjoyn some Reflections as to the Situation and Fortifications of the place. The Natural Situation of the place is such, as perhaps the World has not a more Commodious place for a Town, where all things conspire for Advantage thereof.

*James Town Island* is rather a *Peninsula*, being joyned to the Continent by a small Neck of Land, not past Twenty or Thirty Yards over, and which at Spring-Tides is overflow'd, and is then an absolute Island. Now they have built a silly sort of a Fort, that is, a Brick Wall in the shape of a Half-Moon, at the beginning of the Swamp, because the Channel of the River lies very nigh the Shoar; but it is the same as if a Fort were built at *Chelsey* to secure *London* from being taken by Shipping. Besides Ships passing up the River are secured from the Guns of the Fort, till they come directly over-against the Fort, by reason the Fort stands in a Vale, and all the Guns directed down the River, that should play on the Ships, as they are coming up the River, will lodge their Shot within Ten, Twenty, or Forty Yards in the rising Bank, which is much above the Level of the Fort; so that if a Ship gave but a good Broad-side, just when she comes to bear upon the Fort, she might put the Fort into that confusion, as to have free Passage enough. There was indeed an Old Fort of Earth in the Town, being a sort of *Tetragone*, with something like Bastions at the four Corners, as I remember; but the Channel lying further off to the middle of the River there, they let it be demolished, and built that new one spoke of, of Brick, which seems little better than a blind Wall, to shoot Wild Ducks or Geese.

If they would build a Fort for the Security of the Town and Country, I conceive it should be on *Archer's Hope Point*, for that would stop the Ships from passing up the River, before they came to the Town, and would secure the Town from being block'd up by Sea. The Channel at *Archer's Hope Point* lies close by the Shoar, and makes such an Angle there by reason of *Hog Island*, that going up or down the River, let the Wind be where it will, they must there bring the contrary Tack on Board, and generally when they About the Ship as they call it, they are so nigh the Shoar, that a Man may almost sling a Finger-stone on Board. How much this hinders the motion of a Ship, and what Confusion it must be to them to bring a contrary Tack on Board, whilst they have all the Guns of a Fort playing so nigh upon them, may readily be conceived. *Archer's Hope* is a Neck of Land, that runs down three Miles long, not much past half a Mile broad betwixt the Main River and *Archer's Hope Creek*, which has large Marshes and Swamps; so that a Citadel built upon the Point, would almost be Impregnable, being it could be attack'd no way but one, which is so narrow a slender Neck of Land, that it would be difficult to take it that way: And it would secure *James Town* from being block'd, being it would not be past a Mile by Water, to the Point of *James Town Island*. The Island is so surrounded with Water and Marshy Land, than the Town could never be Bomb'd by Land. But now to return to the Reflections of Improving, and Manuring of Land in *Virginia*; hitherto, as I have said, they have used none but that of Cowpenning; yet I suppose they might find very good Marle in many places, I have seen both the red and blew Marle at some breaks of Hills: This would be the properest Manure for their Sandy Land, if they spread it not too thick, theirs being, as I have said, a shallow, Sandy Soil, which was the Reason I never advised any to use Lime,

tho'

tho' they have very good Lime of Oyster-shells; but that's the properest Manure for cold Clay Land, and not for a Sandy Soil. But as most Lands have one Swamp or another bordering on them, they may certainly get admirable Slitch, wherewith to Manure all their uplands. But this, say they, will not improve Ground, but clods and grows hard; 'tis true, it will do so for some time, a Year or two at the first; but did they cast it in heaps, and let it lye for two or three Years after a Frost or two had seized it, and it had been well pierced therewith, I doubt not it would turn to good Account: And for this too I have something more than bare conjecture; for Discourfing it once with a good notable Planter, we went to view a heap thereof, that casually he had cast up 'twixt three and four Years before, and we found it not very binding, but rather a fine Natural Mold, whereupon he did confess, he then remembered that out of a ridge of the like Mold he had had very large Plants, which must have been of the like Slime or Slitch cast up before: But said, that himself and others despaired of this Manure, because they had taken of this Slitch fresh and moist out of the Swamp, and filled Tobacco Hills with it, and in the midst of it planted their Plants, which so bound the Roots of their Plants, that they never came to any thing. But he said, he then saw his Error, yet I have not heard he has remembered to Correct it. But 'tis strange in how many things besides they are remiss, which one would think *English* Men should not be guilty of. They neither House nor Milk any of their Cows in Winter, having a Notion that it would kill them; yet I perswaded the afore-mentioned Lady where I lived, to Milk four Cows the last Winter that I staid in the Country, whereof she found so good Effect, that she assured me she would keep to my Advice for the future; and also as I had further urged, House them too, for which they have mighty Conveniencies, their Tobacco Houses  
being

being empty ever at that time of the Year, and may easily be fitted in two or three days time without any Prejudice; whereby their Cattle would be much sheltered from those pinching sharp Frosts that some Nights on a sudden become very severe. I had another Project for the Preservation of their Cattle proved very successful; I urged the Lady to sow her Wheat as early as possibly she could, so that before Winter it might be well rooted, to be early and flourishing at the first of the Spring: So that she might turn thereon her weak Cattle, and such as should at any time be swamp'd, whereby they might be recruited and saved, and it would do the Wheat good also. I advised her likewise to save, and carefully gather her *Indian* Corn-tops, and blades, and all her straw, and whatever could be made Fodder, for her Cattle; for they get no Hay, tho' I was urging her to that too, and to sow *Saintfoin*; for being a Sandy Soil, I am confident it would turn to very good Account. They have little or no Grass in Winter, so that their Cattle are pined and starved, and many that are brought low and weak, when the Spring begins, venture too far into the Swamps after the fresh Grass, where they perish; so that several Persons lose 10, 20, or 30 Head of Cattle in a Year: I observed this was much owing to their Inadvertency and Error in their way of Managing and Feeding them; for they get little Fodder, but as they think Corn being more Nourishing, feed them with their *Indian* Corn, which they give them Morning and Evening; they spend thus a great quantity of Corn, and when all's done, what signifies two or three Heads of Corn to a Beast in a Morning? It makes them only linger about the Houses for more; and after that sweet Food they are not so prompt to brouze on the Trees, and the coarse Grass which the Country affords. So that thus their Guts shrink up, and they become Belly-shot, as they call it. I advised therefore never to give  
them

them any thing in a Morning, whereby as soon as they were set forth of the Cow-pens, they would fall a feeding, and tho' they filled their Bellies only with such course stuff as had little Nourishment in it, yet it would keep out their Bellies, and they would have a better Digestion; and then when they were come home at Nights, to Fodder them, beginning with Straw and their coursest Fodder, which they would learn to eat by degrees, before they tasted that that was more delicate, and whilst their Digestion was strong, would yield them Nourishment to keep them still so, afterwards when the Winter pinched, their fine Fodder then would stand them instead; and hereby they might preserve their weakest Cattle, by these Methods, and the help of the Wheat-patch. She, the Gentlemowan where I lived, saved all her Cattle, and lost not one in Two Winters after, that I staid there; besides she saved above Twenty Barrels of Corn, as I remember that she told me she used to spend upon her Stock; and a Barrel of Corn is commonly worth Ten Shillings. Nay further, The last Spring she fed Two Beasts, a Bullock and a Cow, fat, upon her Wheat, with the addition only of a little boild Corn, and yet the Wheat was scarce eat down enough, but to return again to the nature of the earth, which may be pretty well gathered from what I have already said. I have observed, that at Five or Six yards deep, at the breakes of some banks, I have found veins of Clay, admirable good to make Pots, Pipes, or the like of, and whereof I suppose the *Indians* make their Pipes, and Pots, to boil their Meat in, which they make very handsomly, and will endure the Fire better then most Crucibles: I took of this Clay, dryed, powdered, and sifted it; powdered and sifted potsheards, and glasse; Three parts, Two parts and One part as I remember, and therewith made a large Crucible, which was the best I yet ever tried in my Life; I took it once red hot out of the Fire, and clapt it im-

immediately into Water, and it started not at all. The Country abounds mightily with Iron Oare, that as I have been assured by some upon tryal, has been found very good. There are Rocks thereof appear at the precipice of Hills, at the foot whereof there runs a River fit for a Forge, and there's Wood enough to supply it with Charcoal; as I have heard there was formerly some Persons undertook the Work, and when they had made but a small quantity of Iron, which proved very good, the *Indian* Massacre happened, and they being higher seated then the then Inhabited part of the Country, were all cut off, and the Works demolished; so that it has frightened others I think from the like attempt; besides, such a work requires a greater Fund, and Bank of Money to carry it on, then any there are able to lay out; and for Persons in *England* to meddle therewith, is certainly to be cheated at such a distance, some *Indians* brought *Coll. Bird* some Black Lead, whereof he has told me there was great store. There's very curious Talk towards the falls of *Rapahanock* River, which they burn and make a delicate white Wash of it. The Secretary of State *Coll. Spencer*, has assured me, there were Vitriolick or Alluminous Earths on the Banks of *Potomack*; and thus far of what my Memory supplies me, referring to the Earth, in the next place I shall give a short account of the Birds.

### Of the BIRDS.

I had indeed begun once whilst I was in that Country to have made a Collection of the Birds, but falling sick of the Griping of the Guts, some of them for want of care Corrupted, which made them sling others away that I had thoroughly cured; for I was past taking care of them my self, there remaining but small hopes of my Life.

There

There are Three sorts of Eagles, the largest I take to be that they call the Grey Eagle, being much of the colour of our Kite or Glead.

The Second is the Bald Eagle, for the Body and part of the Neck being of a dark brown, the upper part of the Neck and Head is covered with a white sort of Down, whereby it looks very bald, whence it is so named.

The Third is the Black Eagle, resembling most the *English* Eagle; they build their Nests much after the manner that Dr. *Willoughby* describes, and generally at the top of some tall old Tree, naked of Bows and nigh the River side, and the People fall the Tree generally when they take the young; they are most frequently sitting on some tall Tree by the River side, whence they may have a prospect up and down the River, as I suppose to observe the fishing Haukes; for when they see the Fishing Hawk has struck a Fish, immediately they take Wing, and 'tis sometimes very pleasant to behold the Flight, for when the Fishing Hawk perceives her self pursued, she will scream and make a terrible noise, till at length she lets fall the Fish to make her own escape, which the Eagle frequently catches before it reach the Earth or Water. These Eagles kill young Lambs, Pigs, &c.

The Fishing Hawk is an absolute Species of a Kings-fisher, but full as large, or larger than our Jay, much of the Colour and Shape of a Kings-fisher, tho' not altogether so curiously Feather'd; it has a large Crop, as I remember, there is a little Kings-fisher much the same in every respect with ours.

If I much mistake not, I have seen both Goss, Hawk, and Falcon; besides there are several sorts of the lesser Kind of Stannels.

There is likewise the Kite and the Ringtale.

I never heard the Cuckow there to my remembrance.

There's both a brown Owl and white Owl, much what as large as a Goose, which often kills their Hens and Poultry in the Night; the white Owl is a very delicate feather'd Bird, all the Feathers upon her Breast and Back being Snow-white, and tipp'd with a Punctal of Jet-black: Besides there is a Barn Owl much like ours; and a little sort of Scritch Owl.

There's both the Raven, and the Carrion Crow; I do not remember I ever saw any Rooks there, *Dr. Moulin* and my self, when we made our Anatomies together, when I was at *London*, we shew'd to the *Royal Society*, that all Flat-bill'd Birds that groped for their Meat, had three Pair of Nerves, that came down into their Bills; whereby as we conceived they had that acuracy to distinguish what was proper for Food, and what to be rejected by their Taste when they did not see it; and as this was most evident in a Duck's Bill and Head; I draw'd a Cut thereof, and left it in your Custody: A Duck has larger Nerves that come into their Bills than Geese, or any other Bird that I have seen, and therefore quafer and grope out their Meat the most: But I had then discover'd none of these Nerves in Round-bill'd Birds: But since in my Anatomies in the Country, in a Rook I first observed two Nerves came down betwixt the Eyes into the upper Bill, but considerably smaller than any of the three Pair of Nerves in the Bills of Ducks, but larger than the Nerves in any other Round-bill'd Birds; and 'tis remarkable these Birds more than any other Round-bill'd Birds seem to grope for their Meat in Cow-dung and the like: Since I have found in several Round-bill'd Birds the like Nerves coming down betwixt the Eyes, but so very small that had I not seen them first in a Rook I should scarce have made the discovery; in the lower Bill there are Nerves have much  
the

the same situation with the Flat-bill'd Birds, but very small, and scarce discernable, unless to the Cautious and Curious.

The Night Raven, which some call the *Virginia* Bat, is about the bigness of a Cuckow, feather'd like them but very short, and short Leg'd, not discernable when it flies, which is only in the Evening scuding like our Night Raven.

There's a great sort of ravenous Bird that feeds upon Carrion, as big very nigh as an Eagle, which they call a Turkey Bustard, its Feathers are of a Duskyish black, it has red Gills, resembling those of a Turkey, whence it has its Name; it is nothing of the same sort of Bird with our *English* Turkey Bustard, but is rather a Species of the Kites, for it will hover on the Wing something like them, and is carnivorous; the Fat thereof dissolved into an Oil, is recommended mightily against old Aches and Sciatica Pains.

I think there are no Jackdaws, nor any Magpyes; they there prize a Magpye as much as we do their Red Bird.

The *Pica Glandaria*, or Jay, is much less than our *English* Jay, and of another colour, for it is all blew where ours is brown, the Wings marbled as curiously as ours are, it has both the same Cry, and suddain jetting Motion.

There are great Variety and Curiosity in the Wood-peckers, there's one as big as our Magpye, with blackish brown Feathers, and a large Scarlet Tuft on the top of the Head: There are four or five sorts of Wood-peckers more, variegated with green, yellow and red Heads, others spotted black and white, most lovely to behold. There's a Tradition amongst them, that the Tongue of one of these Wood-peckers dryed will make the Teeth drop out if pick'd therewith, and cure the Tooth-ach (tho' I believe little of it, but look on it ri-

diculous) yet I thought fit to hint as much that others may try ; for sometimes such old Stories refer to some peculiar Vertues, tho' not to all that is said of them.

There be wild Turkies extream large; they talk of Turkies that have been kill'd, that have weigh'd betwixt fifty and sixty Pound weight ; the largest that ever I saw, weigh'd something better than thirty eight Pound ; they have very long Legs, and will run prodigiously fast. I remember, not that ever I saw any of them on the Wing, except it were once : Their Feathers are of a blackish shining Colour, that in the Sun shine like a Dove's Neck, very specious.

Hens and Cocks are for the most part without Tails and Rumps ; and as some have assured me our *English* Hens after some time being kept there have their Rumps rot off ; which I'm the apter to believe, being all their Hens are certainly of *English* breed. I'm sorry I made no Anatomical Observations thereof, and Remarks about the Use of the Rumps in Birds; which at present I take to be a couple of Glands, containing a sort of Juice for the Varnishing the Feathers ; having observed all Birds have much recourse with their Bills to the Rumps when they dress their Plumes, whereby they scud through the Air more nimbly in their Flight.

Partridges there are much smaller than ours, and resort in Covies as ours do ; their Flesh is very white, and much excels ours in my mind, *Sed de gustibus non est disputandum.*

Their Turtle-doves are of a duskyish blew colour, much less than our common Pidgeon, the whole Train is longer much than the Tails of our Pidgeons, the middle Feather being the longest. There's the strangest Story of a vast number of these Pidgeons that came in a Flock a few Years before I came thither ; they say they came through *New England, New York and Virginia,*

*ginia*, and were so prodigious in number as to darken the Sky for several Hours in the place over which they flew, and brake massie Bows where they light; and many like things which I have had asserted to me by many Eye-witnesses of Credit, that to me it was without doubt, the Relaters being very sober Persons, and all agreeing in a Story: nothing of the like ever happen'd since, nor did I ever see past Ten in a Flock together that I remember. I am not fond of such Stories, and had suppressed the relating of it, but that I have heard the same from very many.

The Thrush and Feldefire are much like ours, and are only seen in Winter there, accordingly as they are here.

Their Mocking Birds may be compared to our Singing Thrushes, being much of the same bigness; there are two sorts, the Gray and the Red, the gray has Feathers much of the colour of our gray Plovers with white in the Wings like a Magpye; this has the much softer Note, and will imitate, in its singing, the Notes of all Birds that it hears, and is accounted much the finest Singing Bird in the World. Dr. *Moulin* and I made in our Anatomy many Observations of Singing Birds to this effect: The Ears of Birds differ much from those of Men or Beasts, there's almost a direct passage from one Ear to the other of Birds, so that prick but the small Membrane called the Drum on either Ear, and Water poured in at one Ear will run out at the other: But this is not all, but what is much more remarkable, they have no Coclea, but instead thereof there's a small Cocleous or twisting Passage that opens into a large Cavity, that runs betwixt two Sculls, and passes all round the Head, the upper Scull is supported by many hundreds of small Thred-like Pillers or Fibers, which as we supposed had another use also, to brake the Sound from making any confused Eccho, and to make it one and distinct; this passage

passage we observed betwixt the two Sculls was much larger in Singing Birds than in others that do not sing, so very remarkable that any Person that has been but show'd this may easily judge by the Head what Bird is a Singing Bird, or has aptitude thereto, tho' he never saw the Bird before, nor knew what Bird it were: This has often made me reflect how much the Modification of Voices depends upon the acuracy of the Ear, and how deaf Persons become dumb: And since I have observed that many Children that have an acute Wit enough that are slow of Speech, that is long before they speak are much longer before they can pronounce those Letters that are sharps, as *g. b. r.* and never have an aptitude to learn to sing. Hence I judge that Songs that have many Sharps in them are the difficultest to sing well, and discover any Person's Skill upon the tryal of Musick most. This I suppose only, having no Skill in Musick my self, nor having ever discoursed any Person about it, as I remember we show'd some of these things to the *Royal Society*, and I drew some Cuts thereof, and gave the Doctor upon promise that he would put these and many other our joynt Observations in Print, but I hear he is since dead. I have Anatomized most sorts of Creatures, and never found any Four-footed Creature with an Ear like a Bird, unless a Mole; and a Mole has an Ear much like them, with a very thin double Scull, and great Cavity like a Bird, and is very acute of hearing, the Scull by reason of the large Cavity is very slender and easily crush'd, so that a Mole is quickly kill'd with a bruise on the Scull like a Lark, and upon the bruise the Membranes of the Scull turn black; whence *Segerus* mistake *Membranæ Cerebri in superficie exteriori omnino nigræ visæ*: But when I have taken care not to bruise the Scull the Membranes were not black at all, both *Segerus* and *Severinus* I think had some perceptions of the different Structure of a Mole's Ear, but not any thing

thing of its Analogy to a Bird's Ear; they speak of a Bone *Egregie pumicosum*: And *Segerus* says there's a *Ductus ad ossis usque petrosi cavitatem protensus, plurimis fibrillis Membraneis annectabatur*. But to return, this Mocking Bird having its Name from *Mimicking*, all other Birds in singing is a wonderful mettled Bird, bold and brisk; and yet seems to be of a very tender Constitution, neither singing in Winter, nor in the midst of Summer, and with much difficulty are any of them brought to live in *England*.

The Red Mocking is of a duskyish red, or rather brown; it sings very well, but has not so soft a Note as the gray Mocking Bird.

Of *Virginia* Nightingale, or red Bird, there are two sorts; the Cocks of both sorts are of a pure Scarlet, the Hens of a Duskyish red; I distinguish them into two sorts, for the one has a tufted Cops on the Head, the other is smooth feather'd: I never saw a tufted Cock with a smooth headed Hen, or on the contrary; they generally resorting a Cock and Hen together, and play in a Thicket of Thorns or Bryars in the Winter, night to which the Boys set their Traps, and so catch them and sell them to the Merchants for about Six Pence apiece; by whom they are brought for *England*; they are something less than a Thrush.

There's a Bird very injurious to Corn, they call a Blackbird; I look on it a sort of Starling, for they cry something like them but do not sing, are much what of the same bigness, have Flesh blackish like theirs; they resort in great Flocks together, they are as black as a Crow all over their Bills and all, only some of them have scarlet Feathers in the Pinions of their Wings, *Quære* whether a distinct Species.

They have a Lark nothing differing from our common Lark; they have another Bird which they call a Lark that is much larger, as big as a Starling, it has a  
soft

soft Note, feeds on the Ground; and as I remember has the Specifical Character of a long Heel, it is more inclined to yellow, and has a large half Moon on its Breast of yellow; if it have not a long Heel, *Quære*, Whether a Species of the Yellow-hammer.

They have a Martin very like, only larger than ours, that builds after the same manner. The honourable Col. *Bacon* has remarked for several Years, that they constantly come thither upon the Tenth of *March* one or two of them appearing before, being seen hovering in the Air for a Day or two then go away, and as he supposed return'd with the great Flock. The Colonel delighted much in this Bird, and made like Pidgeon holes at the end of his House with Boards purposely for them.

Their Swallow differs but little from ours.

They have a Bird they call a Blew-bird, of a curious azure colour about the bigness of a Chafinch.

There be other sorts of Goldfinches variegated with red, orange and yellow Feathers, very specious and beautiful.

Sparrows not much different from the *English*, but build not in the Eaves of Houses that ever I saw.

The Snow-bird which I take to be much the same with our Hedge Sparrow; this is so called because it seldom appears about Houses but against Snow or very cold Weather.

The Humming Bird that feeds upon the Honey of Flowers: I have been told by some Persons, that they have kept of these Humming Birds alive, and fed them with Water and Sugar; they are much the smallest of all Birds, have long Bills and curious coloured Feathers, but differ much in colour.

Hearons three or four several sorts, one larger than the *English*, feather'd much like a *Spanish* Goose.

Another

Another sort that only comes in Summer Milk white, with red Legs very lovely to behold.

The Bittern is there less than in *England*, and does not make that sounding Noise that ever I heard.

Curlews something less than our *English*, tho' bigger than a Wimbrel.

The Sandpiper much resembling the *English*.

The Snipe, two sorts, one resembling ours, the other much less.

The Tewits are smaller than the *English*, and have no long Toppins, but just like a young one that begins to flie.

There are great numbers of wild Swans.

Wild-geese and Brent-geese all Winter in mighty flocks, Wild-ducks innumerable, Teale, Wigeon, Sheldrakes, Virginia-Didapers, the Black-diver, &c. r

In my return home for *England*, May 1686. off of the Banks of *New-found-Land*, when we were according to account, a Hundred Leagues from the Shoar, we saw several prodigious floating Islands of the Ice, no less to our wonder than Terror, for they were very dangerous: I got the Master to sail one day as nigh one of them as we securely durst, which we judged to be full a League in length, and was higher above Water than the top of our Main-mast; the Snow drove to and fro upon it as upon a large Plane. There was a great Flock of small Black-divers, that were not much bigger than a Feldifire, came to us a little before, but all of them then left and betook themselves to this Island of Ice. They dived the constantly'st, and the longest at a time of any Bird that I ever saw. We saw, as I remember, nigh Thirty of these Islands of Ice. Captain *Rider* being some few days later in his Passage, and bearing more to the *Nore*, told me, he saw many more of these Islands of Ice, and some much larger.

There are in *Virginia* a great many Cormorants; several sorts of Gulls, and in about the Bay many Bannets.

Thus much for the Birds.

*Tours, &c.*

## II. *Some Queries concerning the Nature of Light, and Diaphanous Bodies. Proposed to the Royal Society by E. Halley.*

THE late Curious Book of Mr. *Hugen's* having revived the Disquisitions that have formerly been made about the Nature and Phænomena of Light, I thought it not amiss to propose some Difficulties that have occur'd to my Thoughts upon this Subject, by way of Query: Which may perhaps not seem unworthy of the Consideration of this Honourable Assembly, *viz.*

1. In what consists the Transparency of Glass, Crystal, Water, &c. And whether the Notion of *right Pores* be enough to answer all the Appearances of it, especially those of Refraction, and of the Transparency of Bodies in all Positions; whereas the Rectitude of Pores seems to argue an orderly or regular Position of the constituent Parts, according to the three Dimensions?

2. Why in Bodies that have much more Pores than Glass or Water; as Deal-shavings or brown Paper, the Passage of Light is wholly obstructed, though several gross Particles will penetrate them?

3. Whether or no the Light is easier propagated through Glass, Water, &c. than Air or Æther, as *des Cartes* and Mr. *Hook* have maintained; and wherein Mr. *Hugens* differs from them, asserting that the Beams

of

of Light are retarded in passing those Diaphanous Bodies ; and thereby so naturally explicating the Laws of Refraction ?

4. Supposing Light to be propagated in a Wave, how it comes to pass that this Propagation being either retarded or accelerated in a Diaphanous Body, as Glass, &c. does, upon its going out of that *Medium*, acquire again the same degree of Velocity it had before it came on, there being no new impulse or impediment to alter the Velocity it had in the other *Medium* ?

5. Why *Mercury* being so pure, simple and homogeneous a Fluid, is almost the only one that is not transparent ?

6. Whether the Reflexion of Light on the Surfaces of Glass, Water, and the Shade of the most perfect Pellucid being always very discernable, be not Arguments that the Beams pass their *Media* with more difficulty than they do the Air ?

7. Whether any Texture of Atoms of the same *materia Prima* can be supposed to answer to the *Phænomena* of the Pellucidity of heavy and Opacity of light Bodies ?

8. Whether, if light (as it is most likely) be a Tremour, Shake, or Undulation of the *Æther*, as Sound is of the Air ; and if the *Æther* do consist of so rarified Parts, as to penetrate all Bodies with full liberty, as is generally supposed ; most if not all Bodies ought not to be transparent ?

9. Whether the Matter of the Universe be not of several Kinds in *Minimis*, and not constituted by the various Texture and Coalition of the same sort of Atoms, as it has been held by the *Epicurean* and *Atomical Philosophers*, which at present obtain in the World.

## An Account of 2 Books.

I. Pharmacopœia Bateana ; or, Bate's Dispensatory, Translated into English by William Salmon, Professor of Physick: Lond. Printed for S. Smith and B. Walford, 1694. in 8vo.

THE Translator of this Work, in his Preface, gives first an Account of the Original, that it is a Collection of most excellent *Recipe's* made by Mr. James Shipton, who was the Preparer and Maker up of the greatest part of them, tho' their Author was the Famous Dr. Bate, whom to name is sufficient, by whose Knowledge and Experience this Work was produced.

The first Edition was so well received by the Learned, that they were soon presented with a second, with an Addition of not only above 100 more of Dr. Bate's *Recipe's*, but also of the *Arcana Goddardiana* from the Author's own Mss. which much advanced the Value of the Book, so that at least 6000 of this Latin Edition were sold; which was digested in an Alphabetical Method with the *Arcana Goddardiana* at the end thereof, which were only *nominal* without their Preparations: Whereas in this *English* Edition they are at large, and interspersed in their proper places: The Method of the Book is likewise altered classically, according to the Method and Order of the Chapters of the *London Dispensatory*.

The Work in the *Latin* being thus approved of by the Learned, and especially Physicians induced our Author to publish this *English* Edition, as he says, for its more general Use and Entertainment. Adding some Preparations never before Printed, as *Goddard's Drops*, *Russel's Powder*, *Emplastrum Febrisugium*, with near 50 more valuable *Recipe's* out of the *Collectanea Chymica*,  
and

and other Authors, of which he gives a Catalogue both of the Ancient and Modern which he has consulted in this Undertaking : Which is not a bare Translation, a Comment being added upon each particular, especially upon all the *Chymical Processes* which he has searched out from their original Fountains, and explicated the *Process* it self, adding as a Supplement a *Rationale* upon the same, and having examin'd the Prescripts of other Authors, he shews wherein they chiefly differ from these, and gives their *Processes* at large, if new.

He promises also a second Part, being the *Officina Chymica*, or a Compleat Body of *Chymistry*, explicating,  
 1. The Principles of Natural Bodies. 2. The Fornaces and Instruments of Art described with their Figures in Copper Plates. 3. The Operations of Chymistry *per se*. 4. The Preparations of Metals and Minerals. 5. The Preparation of certain Vegetable and Animal Substances.

Next, he obviates some Objections against the Publishing this Work in *English*, and discovering the Secrets of the Art to the Vulgar, which he hopes he has made some amends for, by divulging several Secrets not generally known even by the Learned ; amongst which is the *Prince's Powder*, once accounted a great Secret, and sold for above 5*l.* a Dose ; the Preparation whereof is *Lib. 1. Cap. 9. Sect. 80. Pag. 526.* which happens to be omitted in the Table. And as a general Answer adds, that all particular Interests should be sacrificed to the Common Good, which ought to be preferr'd before any Private one how dear and valuable soever. And justifies himself in this, by the Examples of *Hippocrates, Gallen, Paracelsus, Celsus* and others, who all publish a System of Physick in their own Languages ; as likewise from the present Usage of the *French*, who now treat of all Subjects in their own Tongue ; and as he conceives, they are not to be imitated only in their Vices.

II. Phthiſiologia Lancaſtriensis , cui acceſſit  
 Tentamen Philoſophicum de aquis Mineralibus, &c. Ant. Carolo Leigh, M. D. Lond.  
 Impenſis S. Smith & B. Walford, &c. In  
 8vo. 1694.

THE Author divides the Medicinal part of this Treatiſe into ſeveral Heads; and Diſcourſes firſt of the various Kinds and Cauſes of the *Phthiſick*, obſerved by himſelf in that County, which are either *Scorbutic Strumofe* or *Chyloſe*, and are often the attendants of Fevers epidemic or intermittent, Dropsies, Rickets, Drunkenneſs, Stoppages *Fluores albi*, Jaundice, Rheumatifms, &c. He begins with the Scorbutic proceeding from the ill Temperature of the Air, the Parents or *Errores ſex non naturales*: Giving ſome Experiments of the Alteration of the *Saliva* by a few Drops of ſeveral Vitriolic Liquors, he infers that the Air being fill'd with ſuch Steams, and conveigh'd to the Blood is a great occaſion of this Diſtemper: He obſerves farther that Maritime places are infeſted with Sulphureous ſteams, as well as Salt ones diſcoverable by the *Ignes fatui* in the Night, Stinks, &c. and pronounces ſuch places unhealthy. As to the Hereditary, by the way he obſerves, that this Diſeaſe is generally owing to the Father, and that tho' the Mother were of an healthy Conſtitution. He proceeds to give the Symptoms and their Cauſes in the beginning of the Diſtemper, ſuch as want of Appetite, Sweats, Turbid Urine, Diarrhoea's, &c. touching in Tranſitu at the Proclivity of the People of *Briſtol* to this Diſtemper. Next, of the Symptoms when the Diſeaſe has gotten more ſtrength, copious ſpitting, Aſthma's, Shiverings and irregular Fevers, &c. in the 4th. Chapter he propoſes ſeveral general Rules according to the ſeveral

ral States of the Disease, and proceeds to the Method of Cure both in the beginning, the confirmed State, and more desperate State of the Disease, delivering the Forms of several *Recipe's* proper for each particular State. Then he presents the Reader with several curious Observations of Persons under the several States of the Disease, with the Remedies made use of and Success. The other Species of the Distemper being explicable by the same Causes, he passes them over, and gives an account of the several particular Phthisicks, and Observations thereon, as Phthisicks from Spitting of Blood, vomiting of Blood, *Hæmorrhagia uterina*, an *Impetigo*, or red Pimples and itching Scurf on the Face and other parts of the Body, from a Scorbutic Rheumatism, the Rickets, *Fluor albus*, Obstructions, &c. and concludes this Treatise with the Chylose Phthisick.

Our Author divides his Philosophical Essay on Mineral Waters into several Chapters; and in the first treats of a Vitriolick Spring near a Cole-Pit, which grows black with Galls, which in 24 Hours is precipitated, and the Water turns greenish, it ferments with an Alkali, &c. This Water as he affirms against Dr. *Lister*, contains a perfect Vitriol. The Second Chapter is of the *Acidulæ* in general; in many of which he likewise affirms a true green Vitriol is found, which with Ocre and Sulphur he makes the Principles of these Waters. The Third Chapter treats of several particular Springs in *Lancashire*, in the bottom of one whereof Sea-shells are found; of all these he made Experiments before and after Distillation, and affirms them Vitriolic. In the Fourth Chapter he tells us, That in the Parish of *Brindel*, near the River *Darwen* is a Mineral Rock, which from the Taste and other *Phænomena* he says is Vitriolic; this macerated in common Water gives it the Qualities of the several Medicinal Springs he had before described. Of which he gives many Experiments; from all which he draws several

ral Conclusions of the Vitriolick Nature of Waters, &c. and answering some Objections proceeds to Salt Springs, none of which, except Vitriolic, give a blackish Tincture with Galls as he avers. He treats next of a Sulphureo-saline Spring, a Sulphureous Spring, a Spring impregnated with the Natron of the Ancients, &c. Lapidescient Springs, he says are from a certain *Halitus* rising from Alum and Vitriol, which passing through takes along with it some Particles of the Lime-stone, which being mixt with the Water *per Minima* seems to give it the petrifying Quality; this he confirms by some Observations and Experiments. He speaks in the next place of Acid Springs, and ends with an Appendix of cold Baths, the Diseases for which they seem most proper; and the Manner or Reason of their Cure by these Baths. So much may suffice for a short Account of this Book, which it were to be wisht the Author had wrote in *Englisb*.

F I N I S.

E R R A T A.

**N** Umb. 202. p. 844. l. 21. r. *in*, p. 847. l. 15. r. *Zenith*,  
 n. 204. p. 933. l. 29. r. *Tolu*, l. 30. r. *are the Fruits*, l. 31.  
 r. *Pomiferous-Tree*; *What Asafetida*, l. 33. r. *&c. are*, and by, n.  
 205. p. 970. l. 20. r. *Salt and Yeast of each*, q. s.

A  
GENERAL INDEX:

O R,  
Alphabetical Table

To all the  
PHILOSOPHICAL  
TRANSACTIONS,

From *January 1678.* to *December 1693.*

ALSO, A  
CATALOGUE of the BOOKS  
Mentioned and Abbreviated in these *Transactions*,  
in an Alphabetical Order.

---

L O N D O N :

Printed for *S. Smith* and *B. Walford*, Printers to the *Royal Society*, at the *Prince's Arms*, in *St. Paul's Church-yard*. 1694.

GENERAL INDEX

Alphabetical Table

1840

PHOTOGRAPHY  
TRANSACTIONS

1841

1842

CATALOGUE of the Books

published by the Society for the Diffusion of Useful Knowledge

1843

1844

---

A GENERAL  
INDEX  
OF THE  
PHILOSOPHICAL TRANSACTIONS.

---

From *January 1687*. to *December 1693*. beginning at Number 137. where that Index to Mr. *Oldenburg's* Transactions ended, and ending at Number 206. inclusive.

---

A

**A** *Bacus* of the Chinese and Romans, n. 180. p. 66.  
*Accension* by *Borrichius's* Experiment refuted, n. 150. p. 292.  
*Achmet* *Kuprioli* the great and wise Vizir at the Siege of *Candia*, to whom *Panageotti* a Learned Greek translated many ancient Books, n. 155. p. 440.  
*Acoustic* or *Phonical* Sphere, the *Semiplane* of it, n. 156. p. 486.  
*Acus Magnetica* Variatio vid *Magnet.*  
*Equations* vid *Algebra.*  
*Aged Persons* vid *Craven.*  
*Agriculture*, see *Plants.*  
*Agues* vid *Diseases.*  
*Air*, the Cause of the growth of

*Stones, Metals*, n. 156. p. 496.  
 how to estimate the *Dryness* and *Moisture* thereof by *Oil* of *Vitriol*, n. 156. p. 505. A *Discourse* concerning its *Gravity*, observed in the *Baroscope* n. 171. p. 1002. Its opposition to *Projects*, n. 179. p. 19. Shooting by its *Rarefaction*, n. 179. p. 21. *Specifick Gravity* of *Air*, n. 181. p. 104. How fast the *Air* rushes into an exhausted *Receiver*, n. 184. p. 193. *Air's* effect on *Colours*, n. 204. p. 398. *Resistance* of the *Air* to *Bodies* moved in it measured, n. 186. p. 269. *Observations* of the *Motion* of *Air-Bubbles* in  
 S 2 Fluids

Fluids, n. 205. p. 960. Of the Air of Virginia, n. 201. p. 784. Contagious Diseases communicated by the Air, n. 204. p. 906. See more in Barometer and Winds.

*Albat nius* corrected, n. 204. p. 913.

*Alcoran* not to be met with in the Turkish Language, but in Arabick; frequent Copies among the Persians in their own Language, Opinion therein of our Saviour and the Christian Religion; with several Passages of the old Testament perverted, Pseudochronismes committed, &c. with the Turks Superstition towards it, n. 155. p. 433. &c.

*Alga marina*, and other Sea-Plants the Causes of fresh Water, n. 156. p. 493.

*Algebra* the defects thereof, n. 159. p. 575. Cubic equations resolved, n. 159. p. 580. The use of Curves in equations, n. 159. p. 581. An instance of its Excellence in the Resolution of the Problem of finding the Foci of Optic-glasses, n. 205. p. 960.

*Altar*, see Inscriptions.

*Allum-works* in England, an Account of them, n. 142. p. 1052. Petrifications usual found in Alum mines, ib. Microscopical Observations of *Allum*, n. 173. p. 1075.

*Almond Furnace*, see Furnace.

*Alphabet* universal, n. 182. p. 126.

*Ambergrise* what by some supposed to be, n. 172. p. 1031. n. 205. p. 976.

*Amulets*, see Chamaili.

*Anatomy* of a Chameleon, n. 137. p. 930.

*Anatomical* Observations on the

Structure of the Nose, n. 139. p. 977.

*Anat. Observat.* of an Abscess in the Liver, four Ureters, &c. n. 142. p. 1035.

*Anatomy* of an Hydropical Body, n. 140. p. 1000. A new Method of dissecting the Brain, n. 140. p. 1013.

*Anatomy* of a Rattle snake, n. 144. p. 25. Of the *Aper* Mexicanus

*Molchiferus*, n. 153. p. 359.

Arteria aorta strangely formed.

n. 153. p. 371. *Kidney* of an unusual shape. See *Kidney*.

*Lungs* of a Salamandra aquatica. See *Lungs*. Of the *Mesaraic* Vessels, n. 153. p. 368.

Three *Stomachs* in the *Tajacu*, n. 153. p. 365. The *Vesica fellea*

wanting, p. 368. The *Ureters* inserted into the *Rectum*, n. 147.

p. 189. Structure of the *Uterus*, n. 161. p. 630. An Account

of a large Preternatural Glandulose Substance between the

Heart and *Pericardium* of an

*Ox*, n. 167. p. 860.

A prodigious *Os frontis*, n. 168. p. 880. Observations on the

Chrystalline Humour. See Chrystalline Observations on

the Body of one dead of an *Apoplexy*, n. 173. p. 1068. Observations on Monsters. See

Monsters.

A Glandulous Liver, n. 178. p. 1266.

A Morbid Spleen, n. 194. p. 543.

*Anat. Observ.* on the Heads of Fowl, n. 199. p. 711. and

n. 206. p. 993. *Observat.* on the Testicles. See Testicles. Of the Structure and Use of

the Parts of the Body, n. 196. p. 614.

- p. 614. Of the Ovaries of Animals, n. 196. p. 615.
- Animalcules* in Pepper-water, n. 139. p. 187. in *Male-seed* first observed, n. 142. p. 1040. In Salt-brine, n. 145. p. 97. In the *Milts* of Fish, n. 148. p. 207. In *Male-seed*, n. 145. p. 76. and n. 155. p. 347. In the *Scurf* of the *Teeth*, n. 197. p. 646. In *Pepper-water* proved to be living Creatures, n. 203. p. 861. In the *Testicles* of a Rat, n. 196. p. 593.
- Animals* not meer Machines, n. 202. p. 853.
- Animals* of Persia, n. 137. p. 943. How generated. See Generation. All Species created at first. n. 202. p. 853. A Table of *Animals*, n. 202. p. 855.
- Antidote* to the Poyson of the Viper, n. 144. p. 49.
- Antimony*. See Gold and Refining.
- Antiquities*, Roman Monument, n. 145. p. 70. Roman Ant. at Kirbythore in Westmoreland, n. 158. p. 555. An Earthen Vessel found at York, n. 171. p. 1017. Figures of Pieces of Antiquity, n. 175. p. 1159. n. 176. p. 1201. Two Runic Inscriptions, n. 178. p. 1287. and 1291. See Characters and Inscriptions. Saxon Coins found at *Honedon* in *Suffolk*, n. 189. p. 356. n. 203. p. 874. An Ancient *Gaulish Sepulcher*, n. 185. p. 221. Arms on a Stone buried in France, n. 185. p. 223. See *Aqueducts* *Arches*, *Inscriptions*.
- Ants* of an extraordinary size, n. 139. p. 978.
- Aqua Fortis* how made, and its use in Refining Metals, n. 142. p. 1046.
- Aqueducts* near Rome, n. 155. p. 466. Of the 14 seen by *Procopius*, but 4 now left, n. 155. p. 468. An Account of the *Aqueduct* for carrying the River *Eure* to *Verfailles*, n. 171. p. 1016. n. 176. p. 1206.
- Ararat*. See Mountains.
- Arches* of the Bridge at *St. Esprit* in France, n. 160. p. 584. A peculiar sort of *Arch* in two Stone Chimneys in *Northamptonshire*, n. 166. p. 800.
- Arithmetical Paradox* concerning the Chances of Lotteries, n. 198. p. 677. See *Algebra*.
- Arteria*. See Anatomical Observation.
- Astronomy*. Its use in ascertaining the Times of memorable Actions, n. 193. p. 495. Eclipses of the Planets. See Eclipses and Planets. A Table of the *Parallaxes* of  $\psi$ 's Orb. and an *Ephemeris* of his *Geocentric* places for the Year 1686. n. 177. p. 1215. An Instrument for finding the distances of  $\psi$ 's *Satellites* from his *Axis*, n. 178. p. 1262. *Albatenius* corrected and amended, n. 204. p. 913. See more under Stars.
- Atheism* confuted, n. 137. p. 938. *Democritus* and *Leucippus* the first *Atheizens* of the *Atomick* Philosophy, n. 137. p. 937.
- Atmosphere*, the common Reception of Particles of all Figures from whence new weight, increase, &c. of Bodies, n. 156. p. 496. The height of the *Atmosphere*, n. 181. p. 107.

*Atomic Philosophy* defended, n. 137. p. 937.  
*Aurum potabile* no desirable Medicine, n. 157. p. 515.

## B

*Bajozid* (first) his Sepulcher, &c. n. 155. p. 433.)

*Barbarossa's* Tomb, n. 152. p. 345.

*Barometer*, how the Mercury stands at given Altitudes from the Earth, n. 181. p. 106. Principal Phænomena of the *Barometer*, n. 181. p. 110. The Cause of the same, p. 111. See *Quicksilver* and *Winds*. A new sort of *Barometer* increasing the Divisions *ad libitum*, n. 185. p. 241. See *Atmosphere*.

*Barometers* height observed at *Oxford* for a whole Year, n. 169. p. 932.

*Barrenness*, see *Bath*.

*Bassa*, who commonly raised to that Power among the *Turks*, n. 155. p. 436.

*Baths* (hot) much frequented, at *Checkerghe* near *Constantinople*, n. 155. p. 433. The effect of the *Bath* in curing the *Palsie* and *Barrenness*, n. 169. p. 944.

*Bees*, a strange sort in the *West-Indies*, n. 172. p. 1030. Concerning the *Proboscis* of *Bees*, n. 175. p. 1148.

*Bernacles* described, n. 137. p. 925. n. 172. p. 1036.

*Birds*. *Chickens* how hatcht at *Cairo*, n. 137. p. 923. *Ducks* bred under Ground, n. 191. p. 425. *Fowls* how taken in *Hirta*, n. 137. p. 927. *Hawks*

taught to fly at the wild *Boar*, n. 137. p. 943. *Anatomical Observations* on the Heads of *Birds*, n. 199. p. 711. n. 206. p. 993. The *Humming Bird* described, n. 200. p. 760. A *Quere* concerning it, n. 202. p. 815. Particulars that may be added to *Willoughby's Ornithology*, n. 175. p. 1159.

*Birbs*, an extraordinary Birth in *Staffordshire*, n. 150. p. 281. See *Monsters*.

*Blatta Byzantina* what, n. 197. p. 640.

*Blood*, evacuated periodically at the *Fingers ends*, n. 171. p. 989. Its Colour whence, n. 204. p. 901. See more in *Circulation*.

*Bloody Snow*, n. 139. p. 976.

*Bodies* dissolved in corroding *Menstrua*, why they swim therein, n. 181. p. 88.

*Bogs* in *Ireland* discoursed of, n. 170. p. 948.

*Bones*, in *Man* of a closer *Texture* than the *Calculus Humanus*, n. 157. p. 531. Twice as heavy as their bulk of *Water*, n. 157. p. 532. *Microscopical Observations* on *Bones*, n. 140. p. 1002. n. 202. p. 838. A very large *Os frontis*, n. 168. p. 188. A Discourse of the *Bones*, n. 194. p. 544. *Skulls* of *Foul*, n. 199. p. 711. 206. 993. *Bones* hardly dissolved by nitrous *Acids*, n. 157. p. 532.

*Books*. See *Catalogue* of *Books*.

*Borier*, what it is, n. 167. p. 854.

*Boyling Fountains*. See *Fountains*.

*Brain*, a new Method of dissecting it, n. 140. p. 1013. *Microscopical Observations* on the

*Brains*

- Brains* of several Animals, n. 168. p. 883. &c. among the Turks, n. 155. p. 449.
- Bread* made of Turneps, n. 205. p. 970.
- Bricks* Roman, their Measure, n. 149. p. 240.
- Bridg* of St. Esprit described, n. 160. p. 584. n. 163. p. 712.
- Description* of a Bridge that may be built 70 Foot long without any Pillar under it, n. 163. p. 714.
- Brimstone* but one Species of it, at least in England, it comes from the Pyrites, that which they call Sulphur Vive found about Vulcano's, is caus'd by Sublimation, n. 157. p. 513. The Matter supposed to be *Brimstone*, found after Rain, is only the yellow Dust of the Blossoms of the Fir, Pine and Hazel-Trees, blown off by the Winds, n. 168. p. 911.
- Brine Pits*. See Salt-springs; many of them stink of *Sulphur*, and turn black with Galls, n. 156. p. 489.
- Bubbles* of Air in Fluids, n. 204. p. 960.
- Buck-skins* how dress'd in Virginia, and Carolina, n. 194. p. 531.
- Buffalo's* of great Service to the Turks, n. 155. p. 444.
- Burials*, a general Bill of the Burials and Christ'nings in London, 1685. n. 177. p. 1245. The same for the Years, 1686. and 87. n. 191. p. 445. Observations on the Breslaw Bills of Mortality, n. 196. p. 596. n. 198. p. 654.
- Burning Speculum*, its great force, n. 188. p. 352.
- Bram* time, the great Festival

C

- Cabal*, a sort of Drink made of Raisins and White-wine, n. 163. p. 734.
- Cæcum* cut out of a Bitch, n. 151. p. 324.
- Cæcum* of the same Structure with the Colon, n. 153. p. 367.
- Place of *Cæsar's* first landing in Britain, n. 193. p. 495.
- Calculus humanus*, a Treatise of it, with an Index of the Experiments made thereon, its Nature near that of Bone, not dissoluble by any but nitrous Acids, n. 157. p. 523. &c.
- Calculi humani* of extraordinary bigness, n. 157. p. 534. n. 178. p. 1269. n. 202. p. 817.
- Calesh* of a new sort, n. 172. p. 1028.
- Cameleon*, Observations on it, and its Colours, n. 157. p. 930.
- Camels* endure Labour 4 Days without Water, n. 155. p. 444.
- Camphire* observed Microscopically, n. 173. p. 1080.
- Cancer* in the Eye cured, n. 167. p. 839.
- Canon Precipuarum è stellis fixis*. See Stars.
- Cape* of good hope, its Longitude, n. 185. p. 253.
- Carduus benedictus*, its Salt observed by the Microscope, n. 173. p. 1073.
- Cardans Canons* their defect supplied, n. 159. p. 577.
- Carpets* and Mats the Turks chief Furniture, n. 155. p. 444.

- Carriages* several ingenious Experiments relating to them, n. 161. p. 666.
- Cartesian* Philosophy censured, n. 137. p. 939.
- Cartilages*, Observations on them, n. 194. p. 553.
- Carvels*, what, n. 201. p. 783.
- Casting* Statutes very thin, n. 186. p. 259.
- Castoreum*, what, n. 153. q. 377. how cured, n. 193. p. 501.
- Cat* monstrous. See *Monsters*.
- Catalogue* of Experiments drawn up by Sir Will. Petty, n. 167. p. 849.
- Causeway* Giants, in Ireland, n. 199. p. 708.
- Celerity* of the *Circulation* of the Blood, n. 191. p. 433.
- Ceruss* how made, n. 137. p. 935.
- Chamaili*, a kind of Amulets or Spells among the Turks, n. 155. 440, 445.
- Chalk* in the Gout observed Microscopically, n. 168. p. 891.
- Chanes* in Prusa, n. 155. p. 433.
- Chaos* discoursed on, n. 196. p. 615.
- Characters* unknown, a *Persepolis*, n. 201. p. 775. at the Hills of Canara, n. 203. p. 872. See *Chinese*.
- Cbeckergbe*. See *Bath*.
- Child* monstrous. See *Monsters*.
- Chickens* how hatch'd at *Cairo*, n. 137. p. 923.
- Chinese* Character considered, n. 108. p. 63. *Chinese* Abacus, n. 180. p. 66.
- Chinese* Wall, n. 180. p. 55. n. 189. p. 378.
- Chinese* Calendar and Chronology, n. 189. p. 377. Emperor of *China* his manner of Hunting, n. 180. p. 44.
- Chorographick* Problems. See *Mathematicks*.
- Chronology* not known nor observed by the Turks, n. 155. p. 439. See *Medails*.
- Christ'nings* and Burials. See *Burials*.
- Chrystalline* Humour of the Eyes of a Man, n. 168. p. 889. Of an Horse, n. 205. p. 955.
- Chyle* upon what account white, n. 149. p. 242. Its Passage not yet demonstrated, n. 143. p. 6.
- Chymistry* a Contest between Mr. Kuncle and Dr. *Veight*, n. 168. p. 896.
- Cicidela Volans* described, n. 167. p. 841.
- Cinnamon* of a white sort, n. 172. p. 1031.
- Cinnabar* observed Microscopically, n. 200. p. 754.
- Cios*. n. 155. p. 431.
- Circular* Magical Needle, n. 188. p. 344.
- Clays*, a Table of their different kinds, n. 164. p. 745.
- New way of *Cleaving* Rocks, n. 167. p. 854.
- Cloath* incombustible, n. 172. p. 1049.
- Clock* ascendent on an inclined Plane, n. 140. p. 1006.
- Clouds* passing over cause Gripings, n. 201. p. 786.
- Coals* burn the longer the more they partake of the *Pyrites*, n. 157. p. 517.
- Cochineel* fly, n. 176. p. 1202. what and how cured, n. 193. p. 502.
- Coffee-houses* ordered to be shut up in *Constantinople*, as places of Idleness

- Idleness and Sedition, n. 155. p. 441.
- Coins* very coarse and drossy among the Turks, &c. n. 155. p. 442. Foreign Coin current with them but not with the Indians and Persians, ib. Saxon *Coins* found at Honedon in Suffolk, n. 189. p. 356. n. 203. p. 874.
- Colon* not fastened to the Mesentery, n. 153. p. 367.
- Colours* of the Chameleon observed, n. 137. p. 930. A Catalogue or Table of simple and mixt *Colours*, n. 179. p. 26. *Colours* how caused, n. 142. p. 1074. *Airs* effect on *Colours*, n. 204. p. 898. Colour of the Arterial Blood whence, n. 204. p. 901. Reds advanced by volatile Salts, n. 204. p. 906.
- Comets* in 1664, 65, and 77. n. 139. p. 186.
- Comet* in 1682. n. 143. p. 16. In 1683. n. 154. p. 416. In 1684. n. 169. p. 920. In 1686. n. 186. p. 256.
- Comier's* Problem, which is only doubling the Cube shewn the Algebraical way, n. 162. p. 676.
- Sea *Compass* changing its Poles in a Thunder-storm, n. 158. p. 20.
- Concoction* explained by Putrification, n. 158. p. 529.
- Conjunctions*. See Planets.
- Connough* worme described, n. 168. p. 876.
- Congo*, Observations thereof, n. 139. p. 977.
- Constantinople*, a Discourse concerning it, n. 152. p. 335.
- Construction* of æquations by a given Parabola, n. 188. p. 335.
- Convulsion* vid. Diseases.
- Copperas* how made, n. 142. p. 1054.
- Corn* trodden out by Oxen, n. 155. p. 444.
- Cortex*. See Plants and Diseases.
- Craven* in Yorkshire, a Catalogue of some very aged Persons in those parts, n. 160. p. 597.
- Creatures*. See Animalcules.
- Cubick* æquations. See Algebra.
- Culture*. See Plants.
- Cupels* made of calcin'd Bones, n. 158. p. 531. An under *Current* at the Streights-mouth in the Baltic, and the Downs, a Conjecture about it, r. 159. p. 564.
- Cures*. See Diseases.
- Curves* their use in æquations, n. 159. p. 581.
- Customs* of those of *Hirta*, n. 137. p. 929. Of the Persians, n. 137. p. 943. Of the People of Goodhope, n. 137. p. 944.
- Cuticula* scaley. See Microscopical Observations and Scales.

D

- Damps*. See Steams.
- Deluge* generally discoursed of, n. 196. p. 616.
- Derivices*, a sort of Religious among the Turks, n. 155. p. 448.
- Digestion*, a Discourse of it, with several Experiments about it, n. 162. p. 694.
- Diseases*, incident to the Cerus-makers, n. 137. p. 936. *Falling-sickness*. See Worms *Hydrophobia*. See *Hydrophobia* Hysterical Fits. See Hysterical *Diseases*

- in *Jamaica*, n. 141. p. 1031. *Diseases* cured by the *Bath*, n. 169. p. 944. *Ca:us* *cujusdam* *rarioris* *de* *Juvene* *vespere* *cæcutiente*, *Philosophica* *solutio*, n. 166. p. 804. *Cancer* in the *Eye* cured, n. 167. p. 839. *Periodical Convulsions*, n. 174. p. 1113. and 1115. *Cure* for the *Murrain*, n. 145. p. 94. n. 199. p. 699. *Hydatides* in *Morbid Bodies*, a *Species* of *Worms*, n. 193. p. 506. *Mercury* an *Enemy* to the *Lungs*, n. 192. p. 486. *Tertian* and other *Agues* explained, n. 197. p. 659. *Agues* cured by *Sal Vol.* *Oleo.* and by *Tee*, n. 145. p. 80. *Disorder* of the *Animal Spirits* the *Cause* of most *Diseases*, n. 199. p. 717. *Of the Cure* of *Agues* and *Fevers* by the *Cortex*, n. 199. p. 719. and 722. *Diseases* in *Virginia*, n. 201. p. 78. *Gout* not caused by *Wine*, n. 170. p. 979. *Gripings* caus'd by the *Clouds* passing over, n. 201. p. 786. *A Proposal* to examine the *Weight* of *Urine* in *Diseases*, n. 201. p. 794. *Observations* on the *Moon's Influence* on the *Motions* of *Diseases*, n. 202. p. 815. *A very great Stone* voided without cutting, n. 202. p. 817. *Scurvy* cured by the *Cortex Winteranus*, n. 204. p. 924. *Contagious Diseases* communicated by the *Air*, n. 204. p. 906. *The Effect* of eating *Dog Mercury*, n. 203. p. 875. *Dissolution* of the *World* by *Fire* at last, n. 196. p. 617. *Of the Divisibility* of *Matter*, n. 194. p. 540.
- Dogs* mad how cured; and those bitten by them, n. 187. p. 298. n. 191. p. 408.
- Dog Mercury*. See *Diseases* and *Plants*.
- Ducks* bred under *Ground*, n. 191. p. 425.

## E

- Ears* of *Fowl* how formed, n. 199. p. 714. n. 206. p. 993.
- Earth* that it is more or less hollow from the *Experience* of *Miners*, n. 157. p. 512. *An Hypothesis* the *internal Structure* of the *Earth*, n. 195. p. 563. *A Proposal* to discover the *Earth's Motion*, n. 202. p. 844. *Primalval Earth* and *Paradice*, n. 203. p. 890.
- Earthquake* at *Oxford*, n. 151. p. 311. *Earthquakes* of their *Nature*, the *Origine* of the *Matter* of them from the *Pyrites* alone, n. 157. p. 511. *One* at *Constantinople*, Oct. 26. 1669. at *Ancyra* in the *lesser Asia* the *Earth* shook for 47 *Days* together, An. 1668. ib.
- A discourse* of *Earthquakes* particularly in *England*, Sept 1692. n. 196. p. 617. *That* in *Sicily* in Jan. 169<sup>2</sup>/<sub>3</sub>. described with an account how they are probably caused, n. 202. p. 827. &c. *The Cœlestial Causes* of them, n. 203. p. 893.
- Earthen Vessels*. See *Antiquities*.
- Echos* of all sorts discoursed of, n. 156. p. 483.

*Eclipses of the Moon*, n. 141. p. 1015. n. 143. p. 15. n. 145. p. 89. n. 146. p. 145. n. 162. p. 689. n. 178. p. 1282. n. 182. p. 146. n. 184. p. 206. n. 192. p. 452. n. 185. p. 236. and 252. Of the *Sun*, n. 141. p. 1020. n. 162. p. 691. n. 164. p. 747. n. 189. p. 370. n. 203. p. 858. Of *Jupiter's Satellites*, n. 151. p. 322. n. 154. p. 404. and 413. n. 165. p. 759. n. 177. p. 1215. n. 184. p. 200. n. 191. p. 435. Of *Jupiter* by the *Moon*, n. 181. p. 86. n. 183. p. 175. 177. n. 184. p. 206. Of *Saturn* by the *Moon*, n. 139. p. 969. n. 186. p. 370.

*Eeles* their *Scales* microscopically discovered, n. 186. p. 893. Those in *Vinegar* described, n. 170. p. 964

*Eggs*, of *Egg-branches*, n. 145. p. 74.

*Eggs* in the *Cornua Uteri* of a *Worm*, n. 147. p. 157. *Eggs* affixed to the *Mesentery*, &c. n. 147. p. 186.

*Equations*. See *Algebra* and *Geometrical Key*.

*Elements of Euclid*, a new and easie way of demonstrating several *Propositions* therein, n. 162. p. 672.

*Elms*. See *Plants*.

*Engine* to make *Linnen Cloth*, n. 140. p. 1007.

*Enthalia* and *Dentalia*, what, n. 197. p. 639.

*Experiments of Poyson*. See *Poyson*. Of *Digestion*. See *Digestion*. A *Catalogue* of such of such as are mean, vulgar, cheap, simple, &c. By *Sir Will. Petty*, n. 167. p. 849. Of *Trees*. See *Plants*.

*Eyes*. Remarkable *Diseases* in them. See *Diseases*. Concerning the *Christaline* and *Vitrious Humours* with their difference, n. 165. p. 790. See *Christaline*. *Scleroticis* in *Fowl* and *Fish* a *Cartilage*, n. 199. p. 715. *Observations* on the *Optic Nerve*. See *Nerves*.

F

*Fætus*. See *Anatomy* and *Generation of Animals*.

Of the *Perpendicular Fall* of *Bodies*, n. 179. p. 9.

*Falling-sickness* accompanied with *Worms* in the *Water*, n. 140. p. 1009. and n. 167. p. 839.

De *falsa Graviditate*. See *Generation of Animals*.

*Feathers* of *Insects*. See *Microscopical Observations*.

*Ferment* in the *Stomach*. See *Digestion*.

Of the *Fibres* of the *Optic Nerve*. See *Nerve*.

*Numeral Figures* how ancient in *Europe*, n. 154. p. 401.

*Fire* produced by the *Mixture* of two *Liquors* actually cold, n. 150. p. 291. See *Accension*. *Fire* in *Sepulchral Lamps* not perpetual, n. 140. p. 1012. See *Lamps*. Of the last *Dissolution* of the *World* by *Fire*, n. 196. p. 617.

*Fish* pass twice a *Year* through the *Bosphorus*, n. 152. p. 344. *Observations* on the *Purple Fish*, n. 178. p. 1278. See *Purpura*. *Fish* under *Ground*, n. 191. p. 417.

T t t 2      *Shell-fish*

*Shell fish* of an odd Species in the East-Indies, n. 203. p. 870. See Shells. *Eeles*. See *Eeles*. *Scales* of several *Fish*. See Microscopical Observations. *Jack*. See *Glands*. *Bubbles* in *Fluids*, n. 205. p. 960.

*Flying Glow-worm*. See *Cicidela Volans*, an Apex under the Wings of *Flies*, n. 198. p. 691. *Flowing* and *Ebbing Spring*. See *Spring*.

*Foci* of *Glasses*. See *Opticks*.

*Foot Roman*, its measure, n. 155. p. 466.

*Force* of the *Air* rushing into an exhausted Receiver, n. 184. p. 193.

*Fortification*. See *Books*.

*Fountains*, Observations on Boiling and other *Fountains*, n. 169. p. 922. n. 172. p. 1036. Their expence of *Water* computed, n. 181. p. 122. See *Springs*.

*Fox Hydrophobia* caused by the Bite of a mad *Fox*. See *Di-seases*.

*Frog-spawn*, Observations thereon, n. 193. p. 523.

*Frost*. A Discourse of its effects on *Trees*, and other *Plants*, An. 1683. wherein several material *Queries* are solved explaining the *Nature* and *Force* of *Cold*, n. 165. p. 766. Experiments on *Freezing*, n. 167. p. 836.

*Fruit*. See *Plants*.

*Furnaces* for *Refining* described, n. 142. p. 1050.

## G

*Generation*, a Theory thereof, n. 192. p. 468.

*Fœtus* 26 Years in *Utero*, n. 139. p. 979.

*Generation* supposed to be by an *Insect*, n. 174. p. 1120. See *Animalcules*. Observations on the *Generation* of *Frogs*, n. 193. p. 523. Of *Impregnation* from a subtle *Effluviu*m of the *Male* seed, n. 196. p. 613. Observations on the *Testicles* of *Rats*. See *Testicles*. Of the *Ovaries* of *Females*, n. 196. p. 615. Of the *Propagation* of *Animals*, n. 199. p. 708. *Queries* concerning *Generation* discuss'd, n. 202. p. 853. No spontaneous *Generat.* ib. The *Seeds* of all *Animals* in the *Eggs* of the *Females*. ib. *Epistola* de *Graviditate falsa*, n. 172. p. 1045.

*Geometry*. See *Mathematicks*.

*Giants Causeway* in *Ireland* of natural *Stone Pillars*, n. 199. p. 708.

The *Scent-Gland* of the *Tajacu* describ'd, n. 153. p. 373. A *Bed* of *Glands* in the *Stomach* of a *Jack*, n. 162. p. 699. *Liver Glandulose* to the naked *Eye*, n. 178. p. 1266. *Glandula Pinealis* petrify'd, n. 185. p. 228. See *Anat.*

*Glass*, the way of making it found out accidentally, *Pliny*, &c. n. 160. p. 617.

*Globe*, Earl of *Castlemains*, 139. p. 988.

*Glow-worms.* See Cicindela. *Idea*  
of God declared, n. 137. p. 939.

*Gold.* See Metals.

*Gout* not caused by Wine, n. 170.  
p. 979.

*De Graviditate falsa.* See Gene-  
ration.

*Grasshoppers* a great swarm of  
them in Languedoc. n. 182. p.  
p. 147.

*Gravity Specifick* of several Bodies,  
n. 169. p. 926. n. 192. p. 488.  
n. 199. p. 694. See *Medicina*  
*Hydrostatica* in Books. The  
Properties of Gravity conside-  
red, n. 179. p. 3. The Specific  
*Gravity* of the Air, n. 118. p.  
104.

*Greatab,* a River in Yorkshire,  
somerimes under Ground for  
about a Mile, n. 163. p. 729.

*Gripings.* See Diseases.

*Gun,* an Instrument used by Mi-  
ners in cleaving Rocks, n. 167.  
p. 854. Experiments of trying  
the Force of *Great Guns*, n. 173.  
p. 1090. A Problem of great  
use in *Gunnery* solved, n. 179.  
p. 15.

Observations on the firing of *Gun-*  
*powder*, and the remaining of  
the Cole Sulphur and Niter,  
n. 200. p. 754, 757. fired ex-  
pands it self, 2080 times, p.  
759.

*Guts* the Anatomy of the Slime  
within them, n. 160. p. 586.  
A Spiral Gut in several Animals,  
n. 153. p. 368. See *Cæcum*  
*Colon*, &c.

H

*Hæmatites* treated of, n. 199. p.  
695.

*Haggi* or Pilgrims to Mecca, n.  
155. p. 446.

*Hail* of extraordinary bigness, n.  
203. p. 858.

*Hair* Bones, &c. found in the O-  
vary, n. 150. p. 283. Of the  
Structure of the *Hair*, n. 140.  
p. 1003. Of the Proportion of  
*Heat* in all Latitudes, n. 203.  
p. 878. Expansion by *Heat*, n.  
197. p. 650.

*Hawks* taught to fly at the wild  
Boar, n. 137. p. 943.

*Heads* of Birds, Observations there-  
on, n. 199. p. 711. See *Anat. Obs.*

*Heads* of a Treatise of Navigation.  
See Navigation.

*Hearing* direct & refracted reflex'd,  
&c. n. 156. p. 481. See  
Sounds.

*Herbs.* See Plants.

*Hermaphrodite*, an Account of one  
from Tholose, n. 186. p. 282.

*Herstol*, n. 159. p. 577.

*Hirta* Island with the Manners of  
of the People described, n. 137.  
p. 927.

*Historia.* See Diseases.

*Horns* of the Womb, of a Bitch stuff  
with Bones, n. 147. p. 185.

*Horn* hanging at the Neck of  
an Ox, in a Letter from Mal-  
pighi, n. 160. p. 601. *Horns*  
growing on a Girl's Body, n.  
176. p. 1202.

*Humming* Bird. See Birds.

- Humours* of the Body how made from the Chyle and Serum, n. 159. p. 580.
- Hydatides* found obstructing the Ureters, n. 188. p. 332. *Hydatides* in Morbid Bodies a Species of Worms, n. 193. p. 506. *Hydrophobia* described, n. 147. p. 162. An Account of one caused by the Bite of mad Fox, n. 169. p. 916.
- Hydrops oculi* cured, n. 167. p. 840.
- Hydropicus Lumbricus*. See Worms.
- Hydropic Testicle*, with other Observations on an Hydropical Body, n. 140. p. 1001.
- Hygrosopes* of several kinds, as Oil of Vitriol, &c. 156. p. 505. Mr. Molyneux his new one, n. 172. p. 1032.
- Hydrostatical Examination* of several Bodies, n. 192. p. 488. See Books and Specifick Gravity.
- Hydrostatical Method* of examining Water as to freshneis, n. 197. p. 637.
- Hyperbolick Logarithm*, n. 159. p. 579. See Algebra.
- Hypothesis* of the internal Structure of the Earth, n. 195. p. 563.
- Hysterical Fits* explained, n. 150. p. 295.
- Yellow-Jaundice* why caused by the biting of a Viper, n. 144. p. 49.
- Jamaica* described with the Diseases there, n. 141. p. 1031.
- Ice* of fresh Water wherein different from that of salt, n. 167. p. 836.
- Ject d'eau*. See Fountain.
- Ignes fatui*, and other Meteors in Virginia, n. 201. p. 789.
- Imagination* and Instance of its force in Women with Child, n. 188. p. 334.
- Indico* queries concerning it, n. 193. p. 503.
- Ingresses* of the Planets. See Planets.
- Injection* of Mercury into the Blood, n. 192. p. 486.
- Incombustible Cloth*, n. 172. p. 1049.
- Influence* of the Planets. See Planets.
- Infinite quantity*, a Discourse thereof, n. 195. p. 556.
- Inscriptions*, of an Altar found near the Roman Camp, near Manchester, n. 155. p. 457. Roman Inscriptions at Bath, ib. An old one on the Basis of a Pillar at Rome, n. 183. p. 172. See Antiquities.
- Insect*. See Generation, Flies, &c.
- Intestinum Cæcum* of its Use and Necessity in some Animals, n. 155. p. 455. See Guts.

## I

- Fanizaries*, in what Bravery they appear when they attend on Christian Ambassadors to their Audience, n. 155. p. 446. *Fatzüh*; the time in the Evening when all People in Constantinople are to go to their Lodgings, n. 155. p. 446.
- An *Instrument* for finding the distances of  $\psi$  Satellites from his Axis, n. 178. p. 1262. An *Instrument* to make Linnen Cloth of it self, n. 140. p. 1007. A *Clock* ascendent on an inclined Plane, n. 140. p. 1006. *Mariner's Compass*. See Compass. An  
In

- Instrument to measure Time, n. 161. p. 647.
- Iron.* See Metals. *Ireland.* See Giants Cawseway.
- Itching of the Skin* how caused, n. 202. p. 838.
- Jupiter.* See Planets.
- Ivory* examined Microscopically, n. 140. p. 1003.
- K
- Kelp* its use in Alum-works, n. 142. p. 1054.
- Kidney* of an unusual shape taken out of a Man, n. 160. p. 601.
- Kirckbythore.* See Antiquities.
- Kuprioli* Achmet. See Achmet.
- Kuprioli* Mahomet had the Charge of the Turkish Empire, caus'd his Father a Greek Priest to turn Turk, n. 155. p. 436.
- L
- Lacteal* Veins tinged with blew, n. 143. p. 9. A Discourse to prove that they frequently conveigh Liquors that are not white, n. 166. p. 812.
- Lacteal* and *Lymphatic* Vessels seem to have no Anastomosis for receiving the Chyle, n. 160. p. 589.
- Lake* of *Cirknitz* accurately described, n. 191. p. 411. *Lake* of *Natron.* See *Natron.*
- Laminulae* in the Sculls of Birds, n. 199. 713. n. 206. p. 993.
- Lamps* Sepulchral of the Ancients, a Discourse shewing the possibility of their being made several ways, n. 166. p. 806. One found in a Sepulcher at Rome, n. 185. p. 227. See *Sepulchers.*
- Latitude* of Constantinople, n. 152. p. 341. n. 178. p. 1295. Of Rhodes, ib. Of Nurenburgh unaltered these last 200 Years, n. 190. p. 403. *Latitudes* of several places in Russia, n. 192. p. 454. See *Mathematicks.*
- Natron*, a Lake in Egypt of 6 or 7 Acres whence arises a great deal of *Natron* or Nitre, n. 160. p. 613.
- Leak* of a Ship found out by the means of the Speaking Trumpet, n. 201. p. 782.
- Liege.* See *Herstol*, *Lemons.* See *Salt.*
- Lepers*, Observations on them, n. 168. p. 892.
- Leucippus.* See *Atomic Philosophy.*
- Lice.* Poux de Pharaou, a sort of Louse, n. 139. p. 979.
- Light*, Queres concerning it, n. 206.
- Light'ning* Instances proving the Cause of it, and that it is Magnetic, n. 157. p. 519. Changes the pointing of a Sea Compass, n. 157. p. 520. The effects of it, and Thunder at Portsmouth, n. 177. p. 1212. Storm of Light'ning and Thunder in the Bay of Biscay, Aug. 12. 1693. n. 204. p. 911.
- Lime*, Salt of it view'd, n. 173. p. 1084. See *Salt.* *Limits* in the Roots of solid æquations, n. 190. p. 387.
- Linnen* Cloth. See *Instruments.*
- Linum.* See *Paper.*
- Liver.* See *Anatomical Observations*, and *Glands.*
- Liquor*, an Account of a *Self-moving Liquor*, n. 176. p. 1188.

*Lodoicea Sidera*, n. 181. p. 85.

London bigger than *Paris*, the Number of People and Houses in London, n. 185. p. 238.

*Longitude* more likely to be found by the Eclipses of Jupiter's Satellites than of the Moon, n. 154. p. 406. *Longitude* of the Cape of Good Hope, n. 185. p. 253. Of Nurenburgh, n. 182. p. 147.

An Arithmetical Paradox in the Chances of *Lotteries*, n. 198. p. 677.

*Loughs* and Bogs in Ireland, a Discourse of them, n. 170. p. 948.

*Lough neagh* in Ireland, an Account of its petrifying Qualities, n. 158. p. 554. An Answer to some Queries concerning it, n. 174. p. 1108.

*Lumbricus*. See Worms.

*Lunaris defectus*. See Eclipses.

*Lungs*. See Mercury.

*Lungs* of the *Salamandra aquatica*, n. 144. p. 30.

*Lympha* its use, n. 149. p. 243.

## M

*Macreuse* a French Fowl, n. 172. p. 1036. and 1041.

Animals not meer *Machines*, n. 202. p. 853.

*Madness* in Dogs how cured. See Dogs.

*Mad Fox*. See Fox.

*Magia*. A Disquisition concerning its division into Humane and Diabolical, Natural and Transnatural, n. 162. p. 706.

*Magnetical compass*, a Theory of its variation, n. 148. p. 208. A new sort of *Magnetical Needle*,

with an Hypothesis thereon, n. 188. p. 344. Observations of the respect of the Needle to a piece of Iron held, &c. n. 177. p. 1213. An Account of the Variation of the Variation, n. 195. p. 463. *Variation* on the Coast of Guinny, n. 159. p. 578.

*Mahomet* 1st, his Sepulcher, n. 155. p. 433.

*Mahomed Bassa* in the time of *Achmet*, the first natural Turk made Grand Vizir, n. 155. p. 436.

*Mahot Kuprioli*. See Kuprioli. *Mahomet* the false Prophet, with the Veneration the Turks pay to any Relique of his, his Banner, &c. n. 155. p. 440. and 448.

*Maize*. See Plants.

*Malt*. See Plants.

*Mankind* how best increased, n. 198. p. 656.

*Mamble-Tree*, with Numerical Figures, n. 154. p. 399.

*Map*, a Proposal for a new sort, which shall contain the different Soils of each Country, n. 164. p. 739.

*Map* of Tartary, n. 193. p. 492.

*Marrow*, its use to the Bones, n. 194. p. 548.

*Matter*, its Divisibility, n. 194. p. 540.

*Mathematicks* little understood or regarded by the Turks, n. 155. p. 438. Concerning the Collection of *Secants* and the true division of Meridians in Sea-Charts, n. 176. p. 1193. *Latitude* of Places. See Latitude and Longitude. *Astronomical Observations*. See Astronomy and Planets. Earl of Castlemain's

- main's Globe, n. 139. p. 988.
- Geometry.* See Maps. Mathematical Paradoxes. See Paradoxes. Of the Earth's Motion. See Astronomy and Paralax. The Florentine Problem of the Quadrable Arched Roof, n. 196. p. 584. The Solution of three Chorographical Problems, n. 177. p. 1231. *Solid Problems.* See Solid.
- Medails.* See Coins and Books.
- Medicina.* See Diseases and Books.
- Memory* the strength of it when applied with due attention, n. 178. p. 1269.
- Mercurial Standard.* See Barometer.
- Mercurius* in sole. See Planets.
- Mesaraic Vessels,* n. 153. p. 368.
- Metals.* The Art of Refining them, n. 142. p. 1046. Why *Metals* swim in corroding *Menstrua,* n. 181. p. 88. Mercury an Enemy to the Lungs, n. 192. p. 486. Hydrostatical Examination of several *Metals.* See Hydrostaticks. *Gold* its thickness upon Gilt Wyar, n. 194. p. 540. *Gold* how Refined with *Antimony,* n. 138. p. 953. *Ironworks,* and Ore in the Forest of *Dean* described, n. 137. p. 931. *Iron Ore,* *Hæmatites* and *Ironworks* described, n. 199. p. 694. Digging and preparing *Lapis Calaminaris,* with the making of *Brass* out of *Copper,* n. 198. p. 672. n. 200. p. 734. *Steel,* n. 199. p. 695. n. 203. p. 865. *Tinmines Works* and Ore in *Cornwall* described, n. 138. p. 949.
- Bell-metal,* *Gun-metal* and *Pot-metal* wherein their difference, n. 200. p. 736. See *Mines.*
- Meteors.* See ignes fatui.
- Microscopes,* single ones how made, n. 141. p. 1026. A Description of *Microscopes,* n. 139. p. 987.
- Microscopical Observations* on the *Teeth,* n. 140. p. 1002. On the Grain of *Ivory;* and Structure of the *Hair,* n. 140. p. 1003. *Animals* in Pepper-water. See *Animals.* On the *Fleshy Fibres,* On the *Feathers* of the Wings of *Insects.* On the *Bloodglobules,* &c. n. 145. p. 80. On *Animals* in the Scurf of the *Teeth,* *Worms* in the *Nose* and *Scaleyness* of the *Skin,* n. 159. p. 568. On the *Brain,* n. 168. p. 883. On the *Chrystalline Humour* of the *Eye,* n. 168. p. 889. n. 197. p. 646. and n. 205. p. 955. On *Moxa,* n. 168. p. 890. On the *Chalk* in the *Gout,* 891. On *Salts.* See *Salts.* On the *Seeds* of *Plants.* See *Plants.* Of the *Texture* of *Wood.* See *Wood* and *Plants.* Of the *Slime* and *Scales* of *Fish,* and *Scales* on the *Skin,* n. 186. p. 893. n. 205. p. 956. of *Vinegar* *Eeles,* n. 170. p. 964.
- Milium* of *Guinee* described, n. 172. p. 1031.
- Minerals,* those that are *Sulphureous* are wholly or in part *Pyrites,* n. 157. p. 513. Some inflammable besides the *Pyrites,* ib. p. 515. *Mineral Waters.* See *Waters.*
- Tin Mines* in *Cornwall* described, n. 138. p. 949. *Alum Mines,* n. 142. p. 1052. Of the *Mines*

- of *Lapis Calaminaris*, n. 198.  
 p. 672. Queries and Answers  
 as to *Copper Mines*, n. 200. p. 737.  
 See *Metals*.
- Moles*, Observations on their  
 Heads, particularly the Ears,  
 n. 206. p. 993.
- Monsons* in the Indian Seas, their  
 History, and Cause inquired,  
 n. 183. p. 158.
- Monsters*. A *monstrous Birth* at  
*Perworth* in *Suffex*, n. 138. p.  
 961. A *monstrous double Cat*,  
 n. 174. p. 1135. A Girl with  
 Horns on her Body, n. 176. p.  
 1202. Two *monstrous Births*,  
 at *Aberdeen*, n. 175. p. 1156.  
*Hermaphrodite*. See *Herma-*  
*phrodite*. *Monstrous Child* in  
*Futland*, n. 160. p. 599.
- Montanea*. See *Cios*.
- Moon*. See *Planets*, its effect on  
 Diseases, n. 202. p. 815.
- Monuments*. See *Antiquities*.
- Morad*, 1st. and 2d. their Sepul-  
 chers, n. 155. p. 432. *Morad*  
 3d. his Cruelty, p. 453.
- Mortality*. See *Burials*.
- Moschs*, n. 155. p. 124.
- Movement*, a peculiar one to mea-  
 sure Time, n. 161. p. 647.
- Mountain* of a vast height in *Chi-*  
*na*, n. 180. p. 59. *Ararat* hid  
 in the Clouds for three Months,  
 n. 137. p. 942. The use of the  
*Mountains*, n. 196. p. 615.  
*Burning Mountains*. See *Vol-*  
*canos*.
- Mouths* in the Joynts of the *Lum-*  
*bricus latus*, n. 146. p. 132.
- Moxa*, the Production of a Fruit  
 like the Down on a Peach,  
 Cotton its best Succedaneum,  
 n. 168. p. 890.
- Musti* among the Turks, n. 155.  
 p. 448.
- Murren*. See *Diseases*.
- Muskcods*, not the Testicles, n. 173.  
 p. 377.
- Muscle Spiral* in the Earth-worm,  
 n. 147. p. 155. Muscles and  
 Tendons described, n. 194. p.  
 550.
- Musical Room*, how one might  
 be contrived so that one In-  
 strument should make a Con-  
 fort, n. 156. p. 486.
- Musical Notes* of the Trumpet-  
 marine, n. 195. p. 559. A Con-  
 jecture at the Tempers of Per-  
 sons from the Musicalness of the  
 Voice, n. 140. p. 1010.

## N

*Natron*. See *Latron*.

*Navigation*, not much minded by  
 the natural Turks, their Com-  
 pass consists but of Eight Points.  
 Side Winds of no use to them,  
 n. 155. p. 439. Heads for a  
 Treatise of *Navigation*, n. 198.  
 p. 657.

*Needle*. See *Magnet*.

*Nerves*, Fibres of the Optic Nerve  
 how capable of Tension, n. 147.  
 p. 175. Observation of the  
 Optic Nerve, n. 205. p. 955.

*Nerves* in the Bills of Water Fowl,  
 n. 199. p. 714. n. 206. p. 990.

*Neurographia*. See *Books*.

*Neuruz*, or New Year of the  
 Turks. See *Year*.

*Nicopolis*. See *Cios*.

*Nitre*, so call'd from *Nitria* in  
 Ægypt, its Principles and their  
 Rise, its use in Physick agri-  
 culture, &c. wherein it differs  
 from *Sal Armoniac*, &c. n. 160.  
 p. 609. See *Salt-peter*.

*Nose*,

*Nose*, its Structure, n. 139. p. 977. *Paradice*, and Primæval Earth, n. 201. p. 811. n. 203. p. 890.  
*Nammaria*. See Books. *Paradoxes* in several Sciences, n. 198. p. 677.  
*Nurenburg*, its Longitude. See Longitude. *Paralax* of the fixt Stars to discover the Earth's Motion, n. 202. p. 844.

O

*Oaky-Hole*, n. 157. p. 513.  
*Objects*. See Telescopes.  
*Observations*. See Planets.  
*Observations* in the Practice of Physick, n. 167. p. 839. *Observations* Anatomical. See Anatomy. Microscopical. See Microscopes.  
*Oculi cancer*. See Diseases.  
*Opticks*, the Problem of finding the Foci of all Glasses, n. 205. p. 960.  
*Ore*. See Minerals.  
*Orpiments* poysonous, tho' all Gold Ores, n. 157. p. 515.  
*Ornithology*, Particulars to be added to it, n. 175. p. 1159.  
*Os frontis* very large, n. 168. p. 880.  
*Otacousticks*. See Hearing.  
*Ovary*. See Eggs, Generation, and Hair.  
*Oil* of Vitriol, whence the increase of its weight when exposed to the Air, n. 156. p. 496.

P

*Palsie*. See Diseases.  
*Paper*, a sort made of *Linum Asbestinum*, n. 166. p. 800.  
*Papin's Engine* for raising Water defended against Mr. *Nuis*, n. 186. p. 263.  
*Paradice*, and Primæval Earth, n. 201. p. 811. n. 203. p. 890.  
*Paradoxes* in several Sciences, n. 198. p. 677.  
*Paralax* of the fixt Stars to discover the Earth's Motion, n. 202. p. 844.  
*Paralax* of the Moon how best observed, n. 141. p. 1034.  
*Pearl fishing* in Ireland, and some of great Value found there, n. 198. p. 659. *Transparent Pearl*, n. 137. p. 943.  
*Pen Park-hole* in Gloucestershire, n. 143. p. 2.  
*People* of London how many, n. 185. p. 238.  
*Pepper Water* Animalcules. See Animalcules.  
*Periodical* Bleeding at the Fingers, n. 171. p. 989.  
*Perpetual Motion*, a Discourse concerning it, n. 177. p. 1240. Refuted, n. 182. p. 138. and n. 186. p. 267.  
*Petrified Glandula Pinealis*, n. 185. p. 228. *Petrifications*. See figured Stones.  
*Philosophy Atomic* discoursed of and defended, much older than *Democritus* or *Leucippus* who were the first Atheizers of it, n. 137. p. 937. *Des Cartes Philosophy* censured, n. 137. p. 939. *The Pagan Theogony*, a Cosmogony. ib. *Of the ancient State of Philosophy*, n. 201. p. 796.  
*Phosphorus* like Lightning, n. 150. p. 289. How made by Mr. *Boyle*, n. 196. p. 583.  
*Physick* how practiced by the Turks, n. 155. p. 437.

*Physical Observations*, n. 167. p. 839.

*Pillars of Porphyry in Egypt*, n. 161. p. 624. and n. 178. p. 1252.

*Pillars of the Giants Cawleway*. See Giant.

*Pine*. See Plants.

*Pinealis*. See Petrification.

*Pimienta*. See Plants.

*Piscuita* its use, n. 142. p. 1072.

*Plague* got but by Infection, n. 165. p. 790.

*Planets*. Eclipses of the Planets.

See Eclipses. Transit of Mercury under the Sun, n. 141.

p. 1033. and n. 192. p. 483.

How to observe the *Moon's* Paralax, n. 141. p. 1034.

Theory of the *Moon* most defective, ib.

of *Jupiter's* Satellits. See Eclipses, and Instruments.

Two new Satellits of *Saturn* discovered, n. 181. p. 79. and 187.

p. 299. Occultation of *Saturn* by  $\text{J}$  n. 139. p. 969.

*Jupiter's* Geocentrick place for the Year, 1687. n. 184. p. 204.

Three Conjunctions of *Saturn* and *Jupiter* calculated, n. 149. p. 244.

How many possible in one Year, n. 149. p. 247.

De tribus Conjunctionibus magnis, n. 151. p. 325.

Ingresses of *Jupiter's* Satellits into his Shadow, n. 151. p. 322.

Conjunction of *Mercury* and *Venus* with the Sun, n. 193. p. 511.

Tables of the Motions of the 5 Satellits of *Saturn*, n. 187. p. 301.

Spots in the *Sun*, n. 157. p. 535.

*Sun* why it appears bigger near the Horizon, n. 187. p. 314.

*Plants* in *Brazel* whose Leaves are large enough to cover a Man, n. 139. p. 978.

*Sorbus pyriformis*

described, ib. *Kelp* its use in Alum-works, n. 142. p. 1054.

*Maize* its description, n. 142. p. 1065.

planted in *Ireland*, n. 205. p. 928.

*Plants* of *Persia*, n. 137. p. 943.

*Saffron* how ordered, n. 138. p. 945.

*Malt* how made in *Scotland*, n. 142. p. 1069.

Experiments concerning the Growth of *Trees* by Mr. Brotherton, n. 187. p. 307.

of the Art of Pruning of *Fruit-Trees*, n. 163. p. 733.

*Milium* of *Guiney* described, n. 172. p. 1031.

The most seasonable time for felling *Timber*, n. 192. p. 455.

best if barkt the Year before, p. 457.

*Pimienta* or *Jamaica* *Pepper-Tree* described, n. 192. p. 462.

Supposed *Cortex Winteranus* described, ib.

*Jesuits* Bark. See Diseases. *Silver-pine* with another Species of *Pines* described, n. 198. p. 665.

*Virginia* *Plants*, ib. p. 169.

*Seeds* of *Plants*. See Seeds. *Truffles* found in *Northamptonshire*, n. 202. p. 824.

*Texture of Wood*. See Microscopical Observations and Wood. True *Cortex Winteranus* described, n. 204. p. 922.

Observations on the Planting of *Tobacco*, and of its several sorts, n. 205. p. 943. and n. 206. p. . . A hint at a Method of conjecturing at the Vertues of *Plants*, n. 205. p. 944.

*Embrio* *Plants* in the Seed. See Microscopical Observations and Seeds.

Effects of eating *Dog-Mercury*, n. 203. p. 875.

Of the Propagation of *Elms* by Seed, n. 205. p. 971.

Continuation of the Species of *Plants* from a Plastic nature,

nature, n. 196. p. 612. Why Water-Plants grow flat, ib. p. 611. no Plants at great depths in the Sea and why, n. 196. p. 615. *Sampire*. n. 156. p. 494. *Pliny*, Emendations of him, n. 194. p. 535.  
*Polypus* in the Heart, its Cause, Effects and Cure, n. 158. p. 548.  
*Pont Esprit*. See *Bridg*.  
*Pools hole*, n. 157. p. 513.  
*Pores* in the Skin, their Figure and Use, n. 159. p. 566.  
*Porosity* of Bodies. See *Books*.  
*Porphyry Pillars*. See *Pillars*.  
*Pot-ashes* examined microscopically, n. 173. p. 1078.  
*Powder*. See *Guns*.  
*Poisons*. See *Orpiments*. *Poisonous bites*. See *Teeth*. Experiments of the Poisons of several Serpents shewn by an Indian, n. 144. p. 49.  
*Pressure*. See *Sea*.  
*Priests* of Mahomet may be Seculars when they please. See *Derives*.  
*Primer universal*, n. 182. p. 134.  
*Primeval Earth*, n. 203. p. 890.  
*Problem*. See *Mathematicks*.  
*Process verbal* on an ancient *Gaulish* Sepulcher, n. 185. p. 221.  
*Proboscis* of Bees, n. 175. p. 1158.  
*Projectiles* their motion in a Parabola, made out, n. 179. p. 11.  
*Prusa* in Bithinia, n. 155. p. 431.  
*Punishments* for Robbery, Murder, &c. among the Turks, n. 155. p. 443.  
*Purple-fish*, Observations on it, n. 178. p. 1278. *Purpura* of the Ancients, n. 197. p. 644.  
*Pyrites*, wholly Sulphur, takes fire of it self is the only known Mineral yielding an inflammable

Vapour, the probable Cause of Damps in Mines, Earthquakes, Thunder, &c. n. 157. p. 512. Sulphur sublimed from *Pyrites* in *Ætna*, n. 169. p. 924.

Q

*Quadratic* Æquations. See Æquations and Algebra.  
*Quadrature* of Figures comprehended by curve and right Lines improved, n. 183. p. 186.  
*Quantity* of Vapour raised out of the Sea by the Sun, n. 189. p. 366. A Discourse of infinite Quantity, n. 195. p. 556.  
*Quicksilver*, a Discourse concerning its Motion in the *Barometer*, Whether its great Rise in frosty Weather is any sign either of an healthy or sickly Season? Its natural State whether when expanded? Whether great Frosts as well as great Warmth will not bring it nearer to its own Nature? Whether the Humours of our Body are not after the same manner affected? The Plague and other Exotic Distempers not caused by the Weather but by Infection, n. 165. p. 790. &c. See *Barometer*.  
*Quicksilver* hurtful to the Lungs, n. 192. p. 486. its use in Refining, n. 142. p. 1052.  
*Quinet* what it is, n. 167. p. 854.

R

## R

- Rain*, that it rained in some places  
Iron, Copper, Stones, why those  
and not Silver or Gold, n. 157.  
p. 518. *Raining of Wheat in  
Wiltshire*, n. 186. p. 281. *Raining  
of Brimstone*. See *Brimstone*.
- *Raising Water*, a new Way pro-  
posed, n. 173. p. 1093. ex-  
plained, n. 177. p. 1238. and  
n. 178. p. 1254. with its full  
description, n. 178. p. 1274.
- Receipts for mad Dogs*. See *Dogs*.
- Refining the Art*, n. 142. p. 1046.
- Resistance of the Air to Bodies  
measured*, n. 186. p. 269.
- Respiration* how made with its use,  
n. 142. p. 1072.
- Rivers*, their number in Virginia,  
the Reasons of so few Towns  
there, n. 201. p. 792.
- River Greatah*. See *Greatah and  
Water*.
- Rocks*, a new way of cleaving  
them, n. 167. p. 854.
- *Roots*, their number in Cubic and  
Biquadratic æquations, n. 190.  
p. 387.
- Rock Plants* a farther account of  
them, n. 150. p. 276.
- Ruines of a Roman Wall* described,  
n. 147. p. 238.
- Ruminating Man*, n. 193. p. 525.
- Runic Inscriptions*, n. 178. p. 1287.  
and 1291.

## S

- Saliva*. See *Pituita and Books*.
- Salts*. A *Salt-plain* of 12 Hours  
riding, n. 137. p. 942. *Salt-*

- springs* at Droytwich in Wor-  
cestershire, n. 142. p. 1059.
- Sand in Salt-brine*, n. 145. p.  
97. *Microscopical Observati-  
ons on the Salts of Wine and  
Vinegar*, n. 170. p. 963. n. 205.  
p. 958. on those of several o-  
ther Substances, n. 173. p.  
1073. Of those of Juice of *Le-  
mons* *Sal Armoniac* and *Sal  
Vol. Oeo.* n. 205. p. 858. &c.
- Salt-peter* observed microscopical-  
ly, n. 173. p. 1075. *Queries  
concerning Salt-Petre*, n. 193.  
p. 503.
- Salt-peter* a very fixt Salt, n. 204.  
p. 904.
- Salt Armoniac* and *Soda*, or *Pot-  
ashes* observed microscopically,  
n. 173. p. 1089. *Salt of Ambar  
no Volatile Salt*, n. 204. p. 905.
- Saltneß* and freshness of *Water* ex-  
amined, n. 197. p. 627. and  
637. A *standard of Salts*, n.  
204. p. 904. *Volatile Salts* ad-  
vance red Colours, n. 204. p.  
906. *Salts* in the *Sweat* after  
drinking *Wine* observed mi-  
croscopically, n. 205. p. 954.  
Of the Difference between *Sea-  
salt* and common Salt, n. 156.  
p. 489. 492. *Salt-springs* Mid-  
land of *Worcestershire*, *Staf-  
fordshire*, *Chestire*, n. 156. p.  
489.
- Sampire*, n. 156. p. 494.
- Sandals* found in *Westmoreland* for  
*Men*, *Women*, &c. n. 158.  
p. 558.
- Sand*, a Table of such as are found  
in the North of England, n.  
164. p. 743. One sort whereof  
is true *Tarso* of which the *Ve-  
netian Glas* is made, n. 162.  
n. 742.

- Virginia* black Sand Experiments made thereon, n. 197. p. 624.
- Sargosse*, or *Lenticula marina*, n. 156. p. 494.
- Satellites*. See Planets and Eclipses.
- Saturn*. See Planets.
- Saxon* Coins found in Suffolk, n. 189. p. 356. See Coins.
- Scales* on the Skin, n. 159. p. 568. n. 202. p. 841. Scales within the Mouth, n. 159. p. 580.
- Skeleton* of the *Tajacu* described, n. 153. p. 380.
- Scent-bags*, n. 144. p. 38.
- Scotia illustrata*. See Books.
- Sclerotis* in Fish and Fowl, a particular Cartilage, n. 199. p. 715.
- Sea-water* how made sweet, n. 156. p. 489. that it was probably the only Element of Water created at first, &c. p. 493. See Larks. See Ornithology. Seas pressure at great depth, n. 193. p. 504. n. 204. p. 908.
- Seeds* of Ash and other Plants microscopically examined, n. 199. p. 700. Of Cotton, Palm, &c. with Discourses of the Embrio Plant, n. 205. p. 949.
- Seeing* vide Vision.
- Self-moving* Liquor, n. 176. p. 1188.
- Self-opens*, or Cavities in the Earth, n. 157. p. 512.
- Seminal* Principle specifies new acquired Parts, n. 156. p. 497.
- Gaulish Sepulcher* found near the River Eure in France, n. 135. p. 221. Sepulchral Lamps. See Lamps.
- Serpents* 25 Foot long, n. 139. p. 978.
- De Sestertio* dissertatiuncula, n. 190. p. 384.
- Shell* Fish distinguisht into univalves livalves and turbinated, n. 156. p. 507.
- A *Shell* found in the *Kidney*, n. 171. p. 1018. *Odd East-Indian Shell Fish*, n. 203. p. 870. Of the *Entalis Dentalia* and *Blatta*, *Byzantina* and *purpura*, n. 187. p. 639. See *Purple*.
- Shells* found under Ground, n. 205. p. 941.
- Sipho Wurtembergicus* imitated by Mr. *Davis*, n. 167. p. 846. by Dr. *Papin*, p. 847. A Letter concerning it from Dr. *Reisellius*, n. 178. p. 1272.
- Skin*. See *Scales*, cause of its itching, n. 202. p. 843.
- Skulls* of Fowl described, n. 199. p. 713. n. 206. p. 194.
- Smelling*, the Reason of its delicacy, n. 139. p. 977. See *Nose*.
- Smoak* consuming Engine, n. 181. p. 78.
- Snake*, *Rattle-snake* Anatomized, n. 143. p. 25. *Snake-stone* its Vertue, n. 144. p. 50. See *Serpent*. *Snake-stones*. See *Stones*.
- Snails* of *Virginia*, n. 198. p. 671. Discourse of *Snails*, n. 139. p. 983.
- Snow* bloody or red, n. 139. p. 976.
- Soda* Salt of *English Soda* viewed microscopically, n. 173. p. 1087. and that from *Britany*, p. 1088. that from *Alicant*, p. 1089.
- Soil* of *Virginia* Discourse thereof, and the manner of cultivating it, n. 205. p. 941. and n. 206. p. 184.
- Solar Eclipses*. See *Eclipses*.
- Solid Problems* constructed, n. 188. p. 335.

- Sorbus pyriformis*, n. 139. p. 978.
- Sounds*. An Introductory Essay concerning the Doctrine of them, containing some Proposals for the Improvement of Acoustics; comparing that Science with Optics. Hearing with Vision. Each divided into direct refracted and reflexed. Three ingenious Problems to this purpose. Sonorous Bodies ought to be placed near a smooth Wall, Water, &c. n. 156. p. 471.
- Spaws* (Sulphur) of the same nature with Brine-Pits, n. 156. p. 491.
- Specific Gravity* of several Bodies. See Gravity.
- Speaking Trumpet* described, n. 141. p. 1027. used to discover the Leak of a Ship, n. 201. p. 783.
- Spleen morbid*, n. 194. p. 543. See *Stentero phonicon*.
- Spectacles* without Glasses by the help of short Tubes, n. 156. p. 474. with Glasses and the several sorts of them, n. 156. p. 481.
- Spiculum* Plane, Convex, Concave, n. 156. p. 484. See Optics.
- Sperma ceti*, what, n. 205. p. 974.
- Spiders*, n. 139. p. 982.
- Spirits Animal*, their disorder the cause of most Diseases, n. 199. p. 717.
- Spirit of Wine* grows warm upon the addition of Water, n. 168. p. 898. dissolves Chrystals of Silver and coagulates Milk, p. 902.
- Springs* (one salt another Medicinal) on the Banks of the River Weare in the Bishoprick of Durham, n. 163. p. 726.
- Cause of *Springs*, n. 192. p. 468.
- Stars* fixt their Longitudes, Latitudes, right Ascensions and Declinations, n. 159. p. 569.
- Statutes* how cast very thin, n. 186. p. 259.
- Stearns subterraneous*, Observations on them, n. 169. p. 922.
- Steel*. See Metals.
- Stentero phonicon*, or Speaking Trumpet, n. 156. p. 481. See Speaking Trumpet.
- Three *Stomachs* in the Tajacu, n. 153. p. 365.
- Stones* figured, n. 139. p. 985.
- Snake-stones* commonly found in Alum-Mines, n. 142. p. 1052.
- Stone-powder*. See Sand. *Formed stones* found at Hunton in Kent, thought to be of that sort call'd Conchites, a kind of Marble, such as is dug about Bluckley in the Wild of Kent, n. 155. p. 463. A *Stone* growing to an Iron Bodkin in the Bladder of a Boy, n. 168. p. 882. *Stones* voided by Seige, n. 170. p. 961. n. 181. p. 94. and n. 182. p. 140. A large *stone* taken out of the Bladder of a Man, n. 171. p. 1015. *Stones* voided *per penem*, n. 175. p. 1162. A large *Stone* voided by a Woman *per meatum urinarium*, n. 178. p. 1269. The means of extracting them so without cutting, n. 202. p. 817. See *Calculus humanus*. A Description of *Stones* supposed to be in Fieri, on the River Don, n. 175. p. 1157. A strange Tincture given to a *Stone* without Fire, n. 179. p. 22. Arms of *Stone* found buried in France, n. 185. p. 223. *Stone Pillars* of the *Giants Causeway* in the Country of Antrim in

- in Ireland, n. 199. p. 708. Description of several *figured Stones*, n. 200. p. 746. *Petrified Teeth* and Bone of a Whale, n. 205. p. 942. *Figured Stones* call'd *Brontix læves pellucidæ*, n. 201. p. 778. See *Rock Plants*.
- Storm of Thunder and Lightning* on the Coast of New-England, n. 157. p. 519. At *Portsmouth*, n. 177. p. 1212. At *Oundle* in Northamptonshire, n. 199. p. 710. in the *Bay of Biscay*, n. 204. p. 911. *Storm* of very large of *Hail*, n. 203. p. 858.
- Structure of the Nose and Smelling*, n. 139. p. 977. Of the *Structure* of the *Parts* of the Body for their several uses, n. 196. p. 614.
- Sugar* made of the Juice of the *Maple* in *Canada*, n. 171. p. 988.
- Sulphur* sublimed from the *Pyrites* in *Mount Ætna*, n. 169. p. 924. See *Brimstone*.
- Sun* an account of the *Spots* seen in it from the 25<sup>th</sup> of *April* to the 8<sup>th</sup> of *May*, 1684. n. 157. p. 535. Why the *Sun* appears so big near the *Horizon*, n. 187. p. 314.
- T
- Table* of the mean *Conjunctions* of *Saturn* and *Jupiter*, n. 149. p. 258. Of the mean *Motion* of the *Satellites* of *Saturn*, n. 145. p. 85. A *Tide Table* for the Year 83. n. 143. p. 10. *Tide Tables* in *Almanacks* false, p. 12. *Tide Tables* reducible to any parts in *England*, n. 143. p. 14. A *Tide Table* for the Year 1684. With *Directions* to apply it to any *Port* in *England*, n. 155. p. 458. Another for the Year 1685. n. 166. p. 822. Another for the Year 1686. n. 177. p. 232. Another for the Year 1687. n. 185. p. 232. Another for the Year 1688. n. 191. p. 428. A *Table* of the *Deaths* of *People*, with the *Values* of *Annuities* for *Lives*, n. 196. p. 596.
- Tajacu* and *Tiger* at *Enmity*, with the *Anatomy* of the former, n. 153. p. 363.
- Tanning* of *Buck-skins* in *Virginia* and *Carolina*, n. 194. p. 531.
- Tartar*, its *Salt* observed *microscopically*, n. 171. p. 1077.
- Poysonous Teeth* of the *Viper-kind* described, n. 144. p. 45.
- Observations* on the *Teeth* of *Animals* with the *Scurf* thereon. See *microscopical Observations*.
- Telescopes* *Borelli's* discoursed on, n. 140. p. 1005. Why one with four *Glasses* shews objects erect, n. 183. p. 169. See *Opticks* and *Perspective-Glasses*.
- Tempers* and *Dispositions* of *People* how guess'd at by the *Moderations* of the *Voice* in ordinary speaking, n. 140. p. 1010.
- Tendons* described, n. 194. p. 550.
- Test* of *Refiners* how made, n. 142. p. 1049.
- Testicles*. See *Anatomical Observations*.
- Thea*, the *Drink* made thereof. See *Books*.
- Theoria* *Telluris sacra*. See *Books*.
- Thermometers* how ascertained, n. 197. p. 650.
- Thunder*, its cause probably from the *Pyrites*, n. 157. p. 518.
- Thunder-storms*. See *Storms*.
- A *Man* kill'd by *Thunder*

stood in the same Posture dead as before, n. 201. p. 787.

*Tide Tables.* See Tables. Tides at Tonqueen. See Tonqueen.

*Tin* the manner of pulverizing it, n. 175. p. 1183.

*Tobacco* Observations on the Planting it, n. 205. p. 944. n. 206. p. 986. See Plants. It's Oil good for inveterate Sores, n. 205. p. 944.

*Tonqueen*, an account of the *Tides*, with a Theory of them, and Directions for coming over the Bar there, n. 162. p. 677.

*Tortoise*, a kind of Plant Animal, not being able to bury it self deep enough was kill'd by a great Frost, n. 159. p. 562. Its weight before and after Winter, n. 194. p. 533.

*Trade Winds.* See Winds.

*Trees* their Growth explained, n. 187. p. 307. See Plants.

*Truffles* found in Northamptonshire, n. 202. p. 817.

*Trumpet* speaking. See Speaking.

*Trumpet* Marine, its Musical Notes explained, n. 145. p. 559.

*Tunking.* See Tonqueen.

*Turkmans*, an account of their wand'ring sort of Life with their numerous Flocks and Herds, n. 155. p. 447.

*Turks*, their natural Temper, Manners, Zeal in War, Behaviour after Victory, &c. n. 155. 440. Unskilfulness in Sciences. See Mathematicks; as also in Husbandry and Gardening, p. 444. 447. Their Superstition, saluting their Emperors after the manner of the ancient Greeks and Romans, their Government perfectly Arbitrary, p.

449. Grand Signor's manner of giving Audience to Ambassadors of Christian Princes, p. 452.

*Turnep* Bread how made, n. 205. p. 970.

## U

*Valves* in the Vessels of Wood, n. 148. p. 201.

*Value* of Roman Monies compared with the English, n. 190. p. 385. Value of Annuities for Lives, n. 196. p. 602.

*Vapours*, signs when they rise, n. 171. p. 993. See Steams. How much Vapour raised by the Heat of the Sun, n. 189. p. 366.

*Variation* of the Magnetical Needle at Siam, n. 185. p. 252. in Leaotum to the North East of China, n. 180. p. 41. See Magnetical Observations. An Hypothesis of the Variation of the Variation, n. 195. p. 563.

*Vesica fellea* wanting in the Mexican Hog, n. 153. p. 368.

*Vesiculæ Seminales* of more sorts than one, n. 153. p. 370.

*Vessels.* See Antiquities.

*Vinegar* Salts therein. See Salts.

*Vipers* biting causes the Yellow Jaundice, n. 144. p. 49.

*Virginia* described, as to its Air, n. 201. p. 783. Sickneses, p. 784. subject to Thunder, p. 787. Of its Waters, p. 790. Number of its Rivers the cause of so few Towns, p. 792. Of its Earth and Soil, n. 205. p. 941. n. 206. p. 985. Of its Horses being work'd without shoeing, n. 205.

- n. 205. p. 941. Of its Plants, p. 942. n. 206. p. 981. Of its Birds, p. 888.
- Vision*, a Discourse thereon, in Reference to Brigg's, n. 147. p. 171.
- Vision*, two extraordinary Cases, 1. Of one seeing very well in the Day but quite blind in the Night, and of another that thro' some Distemper in the Head saw double, n. 159. p. 559.
- Vitriol* (Oil.) See Oil. A blew sort observed microscopically, n. 173. p. 1076.
- Vizir*. See Achmet and Mahomet.
- Ulcus* in Inguine dextro intestinorum faeces emittens, n. 176. p. 1204.
- Voice*, its Modulations in speaking indicates the Temper and Disposition, n. 140. p. 1010.
- Voyage* of the Emperor of China into Corea and East Tartary, n. 180. p. 39. into West Tartary, p. 52. Voyage into Persia by Tavernier, n. 137. p. 942.
- Ureters* inserted into the *Rectum*, n. 147. p. 189. *Ureters* obstructed by *Hydatides*, n. 188. p. 332.
- Vulcano's* in probability made up in great part of Pyrites, naturally kindled of themselves, n. 157. p. 516.
- W
- Wall* of China described, n. 180. p. 55.
- Water*, high Waters nearer to the Neaps, the least to the highest Spring-Tides, n. 143. p. 13.
- A new way of raising *Water*, n. 173. p. 1093. n. 178. p. 1274. n. 186. p. 263. Methods of examining Waters as to freshness and saltness, n. 197. p. 627. Expansion and Contraction of Fluids by heat and cold, n. 197. p. 650. The *Water* of Virginia requires more Malt, n. 201. p. 793. *Wells*. See Springs and Wells. *Water-Plants* why flat, n. 196. p. 611.
- Mineral-waters*, Queries whereby to examine them, n. 166. p. 802.
- Weather-cock*, whether one may not be contrived to whistle with an ordinary blast of Wind to be heard afar off, n. 156. p. 487. Observations on the Weather for a whole Year, n. 169. p. 932. A Discourse concerning the Weather, n. 171. p. 991.
- Wells*. See Spaws and Springs. A Well ebbing and flowing often in an Hour, n. 204. p. 909.
- Whales*, their several sorts, and Whalebone what, n. 205. p. 972.
- Wheat* said to have fall'n in Rain in Wiltshire, n. 186. p. 281.
- Wheeles*, a Discourse proving the larger they are the more easily are they drawn over Stones, &c. n. 167. p. 856.
- Whispering places* whence caused, n. 156. p. 477.
- Wind-pipe* of the Rattle-snake described, n. 143. p. 29. Of the Causes of several Winds, n. 175. p. 1148. *Winds* Tropic or Trade Winds, their probable material cause, n. 156. p. 489. Observations on the Winds for the Year 1684. n. 169. p. 932.

*Trade-winds* between the Tropicks considered, n. 183. p. 153. How blowing in the Atlantic and Ethiopic Oceans, p. 154. in the Pacific Sea, p. 161. Their Causes inquired, p. 164. The Variableness of the Winds the cause of the rising and sinking of the Barometer, n. 181. p. 111.

*Windgun* by Rarefaction of the Air, n. 179. p. 21.

*Wine*, its Salts examined. See Microscopical Observations and Salts.

*Winter*, what Damage the Fruit and other Trees received by the great Frost, Anno. 1683. n. 159. p. 559.

*Womb* of its Structure by Dr. Malpighius, n. 161. p. 630. Horns of a Bitches Womb stuffed with Bones, n. 147. p. 185.

*Women* amongst the Turks how they set off their Beauty, their chief Diversion, n. 155. p. 444.

*Of the Texture of Wood*, n. 202. p. 838. See Plants and Valves.

*World*, its last dissolution by Fire, n. 196. p. 617.

*Worms* seen in the Water of a Person ill of the Falling-sick-

ness, and how cured, n. 140. p. 1009. and n. 167. p. 839. The Conough Worm described, n. 168. p. 876. *Lumbrici lati*, n. 146. p. 113. *Teretes*, n. 147. p. 154. Hydropicus. See Hydatides. Powder of Worms not to be given, and why, n. 147. p. 159.

*Wormwood*, its Salt observed microscopically, n. 173. p. 1074.

*Wurtemberg Engine*. See *Sipho Wurtembergicus*.

## Y

*The Year* computed by the Turks according to the course of the Moon, yet they celebrate the *Neuruz*, i. e. begin each Year on the 21st. of March the Vernal æquinox in Constantines time, n. 155. p. 440.

## Z

*Zirknitzersee* described, n. 191. p. 411.

*Zodiaci obliquitas*. See Books.

A N

# Alphabetical Catalogue

OF THE

# BOOKS

Abbreviated in the

## PHILOSOPHICAL TRANSACTIONS.

From *Numb.* 137. to *Numb.* 206. inclusive.

A

**D**avid, *Abercrombij*, M. D.  
de Variatione ac varietate *Pulsus* Observationes,  
n. 171. p. 1023. Ejusdem tuta  
& Efficax Luis Venerea saepe  
absque Mercurio ac semper absque  
Salivatione Mercuriali curandæ  
Methodus, n. 160. p. 620.

The *Art* of Pruning Fruit-Trees,  
&c. n. 163. p. 733.

B

Th. *Baker's* Geometrical Key, or  
the Geometry of all Æquations,  
&c. n. 157. p. 549.  
Jacobus *Barnier* de Spiritu Vini sine  
acido, n. 145. p. 111.

Phar-

- Pharmacopœia *Bateana*, n. 206.  
p. 1000.
- Mr. John *Beaumont's* Considerations  
on Dr. Burnet's Theoria Telluris  
Sacra, n. 203. p. 888.
- Laurentij *Bellini* de Urinis, Pulsibus,  
&c. Opus, n. 154. p. 425.
- Belon's* Iteneraries, &c. n. 200. p.  
770.
- Edwardus *Bernard*, S. T. D. de  
Mensuris & Ponderibus, &c.  
n. 177. p. 1242.
- Systema *Bibliothecæ* Col. Paris.  
Soc. Jesu, n. 140. p. 1012.
- G. *Bidloo*, M. D. Anatomia hu-  
mani Corporis, n. 178. p. 1309.
- Joh. *Bobn* Epistola de Alkali &  
Acidi insufficientiâ, n. 145. p.  
110.
- Theoph. *Boneti*, M. D. Medicina  
Septentrionalis Collatitia, n. 167.  
p. 867.
- Job. Alph. Borelli* de Motu Ani-  
malium, n. 144. p. 62.
- Mr. *Boyle's* Memoirs for the Na-  
tural History of *Human Blood*,  
n. 154. p. 428.
- Experiments and Considera-  
tions of the Porosity of Bodies,  
&c. n. 162. p. 702.
- Essays of the great Effects of  
even languid and unheeded  
*Motion*, n. 170. p. 986.
- Short Memoirs for the Natu-  
ral Experimental History of  
Mineral Waters, n. 172. p.  
1063.
- Enquiry into the Vulgarly  
received Notion of *Nature*, &c.  
n. 181. p. 116.
- *Medicina Hydrostatica*, n. 192.  
p. 488.
- Benjamini *Brookbuysen* Oeconomia  
Animalis, n. 147. p. 194.
- Filippo *Buonanni*, Recreatione dell'  
occhio e della mente nell' Of-  
servazione delle Chiocciolè, &c.  
n. 156. p. 507.
- Tho. *Burnetij*, S. T. D. Archæo-  
logiæ Philosophicæ, &c. n. 201.  
p. 796.

## C

- Gualteri *Charltoni*, M. D. Inquisi-  
tio Physica de causis Catame-  
niorum & Uteri Rheumatismo,  
n. 171. p. 1020.
- Moses *Charra's* Royal Pharmacopœia,  
n. 138. p. 963.
- Steph. *Chauvini* Lexicon Reale  
sive Thesaurus Philosoph. n.  
199. p. 731.
- G. *Cole*, M. D. Novæ Hypothe-  
seos ad explicanda februm in-  
termittentium Symptomata &  
Typos, excygitatæ Hypotyposis,  
n. 197. p. 657.
- Confusius* sinanum Philosophus, sive  
scientia sinensis latinè exposita,  
n. 189. p. 376.
- Museo *Cospiano* annesso à quello  
del famoso Uliisse Aldrovandi,  
&c. n. 140. p. 1011.
- J. *Craige*, Methodus figurarum li-  
neis rectis & curvis comprehen-  
sarum quadraturas determinandi  
n. 183. p. 185.
- Dr. *Cudworth's* true intellectual Sy-  
stem of the Universe, part. I.  
n. 137. p. 936.
- R. *Cumberland*, D. D. An Essay  
towards the recovery of the  
Jewish Weights and Measures,  
n. 179. p. 33.

Caroli du Fresne Glossarum ad  
Scriptores Mediæ & infimæ La-  
tinitatis, n. 140. p. 1013.

## D

S. Dale, Pharmacologia seu Ma-  
nuctio ad Materiam Medi-  
cam, n. 204. p. 925.

Diogenes Laertius Græce & Latine,  
Edit. Wetstenij. n. 203. p. 886.

Joh. Dolæi, M. D. Encyclopedia  
Medicinæ Theoretico-practicæ,  
&c. n. 162. p. 704.

Car. Drelincurtij Experimenta A-  
natomica, n. 169. p. 945.

M. Duncan, Explication Nouvelle  
& Mechanique des actions A-  
nimales, &c. n. 140. p. 1013.

## E

G. Entij, M. D. Antidiatribe sive  
Animadversiones in M. Thursto-  
ni Diatribam de Respirationis  
usu Primario, n. 142. p. 1072.

Ejusdem Apologia pro circuitione  
sanguinis Edit. ult. n. 173. p.  
1105.

Epistola ad Reg. Soc. de nuperis  
Terræ motibus, &c. n. 203. p.  
893.

Ephemeris ad Annum, 1686. &  
Longit. Urb. Lond. n. 179.  
p. 35.

Lazarus Erckern, Translated by  
Sir William Petrus, n. 147. p. 189.

Mich. Esnulleri Opera omnia, n.  
174. p. 1140.

## F

Raph. Fabretti de Aquis & Aquæ-  
ductibus Veteris Romæ, Dis-  
sertationes tres, n. 155. p. 466.

## G

Johannes Goedartius of Insects En-  
glist by Dr. Lister, n. 143. p.  
22. n. 166. p. 833.

Davidis Gregorij, Exercitatio Geo-  
metrica de Dimensione figura-  
rum, n. 163. p. 730.

Nehem. Grew, M. D. his Anato-  
my of Plants, n. 150. p. 303.

## H

Edm. Halley, Catalogus stellarum  
Australium, &c. n. 141. p. 1032.

Clopton Havers, M. D. Osteolo-  
gia Nova, n. 194. p. 544.

Helvetiæ Historia. See Wagnerus.

Louis Hennepin, la Description de  
la *Louisiane* nouvellement de-  
couverte au sudouest de la Nou-  
velle France, n. 170. p. 980.

Excerpta ex Literis illustr. Viro-  
rum ad Joh. Hevelium, &c. n.  
150. p. 308.

Ejusdem Annus *Climactericus*, n.  
175. p. 1162.

Pb. de la Hire Tabularum astrono-  
micarum pars prior, n. 191.  
p. 443.

Th. Hobesij Decameron Physiolo-  
gicum, n. 138. p. 965.

Fred. Hofmanni Exercitatio de  
Cinnabari Antimonij, n. 176.  
p. 1208.

Rob. Hook, M. D. his Lectures  
and Collections, n. 139. p. 986.

*Horti Academici Argentinenſis*

Catal, See Spoor.

*Horti Indici Malabarici pars<sup>2</sup>,*

1a. 2a. & 3a. n. 145. p. 100.

4ta. 5ta. & 6ta. n. 198. p. 682.

7ma. 8va. & 9na. n. 200. p. 762.

*Chriſtiani Hugenij Afroſcopia*  
*Compendiaria, &c.* n. 161. p. 668.

## I

F. *Jeſſop* Propositiones Hydroſta-  
 ticæ ad illuſtrandum *Ariſtarchi*  
*Samij Syſtema* deſtinatæ, n. 191.  
 p. 440.

## K

Mr. J. *Kunckel's* Chymical Touch-  
 ſtone, n. 168. p. 896.

## L

*Laertius.* See *Diogenes.*

*Lectures* and Collections. See *Hook.*

Car. *Leigh,* M. D. *Phthiſiologia*  
*Lancaſtriensis,* n. 206. p. 1001.

*Lemery's* Chymiſtry, Edit. 5ta.  
 n. 175. p. 1183.

M. *Liſteri,* M. D. de fontibus Me-  
 dicatis Angliæ Exercitatio prior,  
 n. 144. p. 59. Exercitatio Al-  
 tera, n. 158. p. 579. his Editi-  
 tion of *Goedartius.* See *Goedart.*

Ejuſdem *Hiſtoria Animalium An-  
 gliæ. De Araneis Cochleis, &c.*  
 n. 139. p. 982.

## M

*Mallement de Meſſange* de la Qua-  
 drature du cercle, n. 185. p. 245.

Mr. *Mariotte.* Traitté du Mon-  
 vement des eaux, &c. n. 181.  
 p. 119. See *Perault.*

Joh. *Marij* *Caſtorologia,* auſta à Jo.  
*Franco,* n. 177. p. 1249.

Mr. *W. Molineux's* *Sciotericum Te-  
 leſcopicum,* or a new Contri-  
 vance of adapting a Teleſcope  
 to a Sun-dyal, &c. n. 184. p.  
 213.

Fr. *Moncæi* *Diſquiſitio de Magiâ,*  
 n. 162. p. 706.

Andr. *Morelij.* *Specimen Univerſæ.*  
*Rei Nummariæ,* n. 166. p. 825.

Observations on the *Dublin* Bills  
 of Mortality, n. 143. p. 21.

Ric. *Mortoni,* M. D. *Pyretologia,*  
 feu Exercitationes de morbis  
 Univerſalibus Acutis, n. 199.  
 p. 717.

Joſeph *Moxons* *Mechanick Exer-  
 ciſes,* n. 138. p. 967. n. 139.  
 p. 987.

*Muſeo Coſpiano.* See *Coſpiano.*

## N

Ant. *Nuck,* M. D. de Ductu Sa-  
 livali Novo, &c. n. 177. p.  
 1244.

II. *Newtoni* *Philoſophiæ naturalis*  
*Principia Mathematica,* n. 186.  
 p. 291.

## P

- Dennis *Papin's* Continuation of the new Digester of Bones, n. n. 187. p. 329.
- J. N. *Pecklini* de Potu Theæ Dialogus, n. 167. p. 871.
- Mr. *Perault* and *Mariotts* two Letters concerning Vision, n. 149. p. 265.
- Sir Will. *Perry's* Essays in Political Arithmetick, n. 183. p. 152.
- Jo. Con. *Peyer's* Merycologia, &c. n. 177. p. 1246.
- Mr. Alex. *Pitfield's* Translation of the Memoirs for a Natural History of Animals, n. 189. p. 371.
- Rob. *Plott*. L. L. D. De Origine Fontium, &c. n. 167. p. 862. Natural History of Staffordshire, n. 184. p. 207.
- Leonardi *Plucknerij* Phytographia, &c. pars 1ma. & 2da. n. 193. p. 528. pars 3a. n. 196. p. 618.
- Art of *Pruning* Fruit-Trees, n. 163. p. 733.
- Cl. *Ptolomæi* Harmonicorum, Lib. tres. n. 143. p. 20.

## R

- Jo. *Ray* Historia Plantarum Tom. 1. n. 186. p. 283.
- Wisdom of *God* manifested in the Creation, &c. n. 196. p. 611.
- Three Physico-Theological Discourses of the *Chaos*, the *Deluge* and *Dissolution* of the World, n. 196. p. 615.
- Ejusdem *Synopsis Methodica Animalium Quadrupedum & Serpentina* Generis, n. 202. p. 849.
- Leenhart *Rauwolff's* Itinerary, &c. n. 200. p. 768.
- Relazione de Ritrovamento dell' nuova di Chiocciola*, n. 152. p. 356.
- Tractè de Moyens rendre les *Riviers* Navigables, n. 203. p. 894.
- Willelmi ten *Ryne* dissertatio de Arthritide acupuncturâ & n. 148. p. 222.

## S

- Voyage de *Siam* des Peres *Jesuits*, n. 185. p. 249.
- Rob. *Sibbald*, M. D. *Scotia illustrata*, &c. n. 165. p. 795.
- Phalænologia nova*, sive *Observationes de rarioribus quibusdam Balænis in Scotiæ Litus nuper ejectis*, n. 205. p. 972.
- Mr. *Sommer's* Treatise of Roman Ports and Forts in Kent, n. 198. p. 688.
- Monfi. *Spons* *Recherches curieuses*, &c. n. 153. p. 386. n. 200. p. 762.
- Jo. Fred. *Spoor* *Catal. Plantarum Horti Academici Argentinenfis*, n. 199. p. 729.
- Jo. Christoph. *Sturmij* Collegij *experimentalis sive curiosi pars 2da*, n. 175. p. 1184. Eiusdem *Epistola* *invitatoria ad Observationes Magneticæ Variationis instituendas*, &c. p. 143. p. 23.
- R. *Sydenham*, M. D. *Tractatus de Podagrâ & Hydrope*, n. 150. p. 309.

## T

- J. Bapt. *Tavernier's* Six Voyages through Turkey into Persia, and the East-Indies, n. 137. p. 942.
- De nuperis *Terræ-motibus* *Epistola* ad Reg. Soc. n. 203. p. 893.
- Traité des moyens de rendre les Rivières Navigables*, n. 203. p. 894.
- Th. *Trapham*, of the State of Health in *Jamaica*, n. 141. p. 1030.
- Triachiasis* admodum rara, &c. n. 170. p. 986.

## U

- Mr. du *Verney* *Traité de l'Organ de l'Ouïe*, n. 149. p. 259.
- Fr. *Vernon's* Travels, n. 200. p. 768.
- Raymundi *Vieussens*, M. D. *Neurographia universalis*, n. 174. p. 1144.

## W

W

Waller's Translation of the Experiments made in the Academy del Cimento, n. 164. p. 757.

Joh. Wallis, S. T. D. Exercitationes tres de Rationum & Fractionum Reductione, de Periodo Julianâ, &c. n. 139. p. 980.

Historical and Practical Treatise of Algebra, n. 173. p. 1095.  
Fr. Willoughbeij Armig. de Historia Piscium Lib. quatuor, n. 178. p. 1301.

Z

Joh. Jac. Zimmermanni Cometscopia, n. 149. p. 270.

---

F I N I S.

---

PHILIPSON  
LAWSON  
The University of Toronto  
1882

PHILIPSON  
LAWSON

PHILIPSON  
LAWSON

PHILIPSON  
LAWSON

PHILIPSON  
LAWSON







